



CITY COUNCIL Staff Report

Meeting Date: Jan. 21, 2020

To: Mayor and City Council

From: Scott Chadwick, City Manager

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Subject: Climate Action Plan Update and Vehicle Miles Traveled calculations

Recommended Action

Receive an informational presentation on the Climate Action Plan (CAP) update and vehicle miles traveled (VMT) calculations.

Executive Summary

The City of Carlsbad's CAP was adopted by the City Council in September 2015. As part of the monitoring required by the plan, staff determined that the plan's calculation of VMT was based on an incorrect input, which resulted in a lower greenhouse gas (GHG) inventory and GHG targets. Staff currently estimates that the city will achieve the updated 2020 GHG target through existing CAP measures. However, it appears that the amended 2035 GHG target will require the addition of a substantial GHG reduction measure (or measures) to the CAP, such as community choice energy (CCE).

Due to the error in the VMT calculation, the city's CAP likely does not currently constitute a qualified GHG reduction plan (Qualified Plan) under California Environmental Quality Act (CEQA) Guidelines. Therefore, staff will not assess the GHG impacts of CEQA projects by using the CAP as a Qualified Plan until the error is addressed. Staff is working with consultants to undertake a focused CAP update to correct the data on VMT, incorporate the Regional Climate Action Planning Framework (ReCAP) Snapshot 2016 inventory data and add new GHG reduction measures, such as CCE, to meet the revised GHG reduction targets.

Discussion

In September 2015, the city adopted a CAP that outlines actions the city will undertake to achieve its proportionate share of state GHG emissions reductions. Implementation of the CAP serves as mitigation under CEQA for the city's General Plan update and as a Qualified Plan in accordance with CEQA Guidelines. Later development projects may use consistency with a Qualified Plan to streamline their CEQA GHG analyses.

The CAP contains a baseline inventory of GHG emissions for 2005, an updated baseline inventory for 2011, and a calculation of the city's targets based on a reduction from the 2005

baseline. Consistent with state law and policy, the CAP set a target to achieve a 15% reduction of GHG emissions from the 2005 baseline by 2020 and a target to reduce GHG emissions below the 2005 baseline by 49% by 2035. The CAP relies on ongoing monitoring of GHG reduction measures and updates to the GHG inventory. If an updated GHG inventory reveals that the CAP is not making adequate progress toward meeting the GHG targets, the city must adjust the CAP by modifying, adding or replacing reduction measures.

The San Diego Association of Governments (SANDAG) collaborates with local agency staff and climate planning experts to prepare a ReCAP that provides jurisdiction-specific GHG emissions data and a technical framework for regionally consistent climate action planning. On Nov. 22, 2019, SANDAG provided the City of Carlsbad with a ReCAP Snapshot that contains a 2016 GHG Inventory for assessing the city's CAP implementation efforts and for updating the city's CAP GHG inventory.

The CAP anticipated that its GHG inventory and targets would be revisited and possibly amended to account for more current data, such as the ReCAP Snapshot 2016 inventory. During ongoing CAP monitoring, staff determined that the CAP contains a calculation error that resulted in a lower GHG inventory and the CAP's GHG targets. Therefore, as part of staff's routine efforts to update the CAP with the 2016 inventory, staff will also address the apparent VMT calculation error.

The CAP was developed to be a Qualified Plan under CEQA Guidelines. CEQA does not require public agencies to develop a Qualified Plan; however, later development projects may use consistency with a Qualified Plan to streamline their CEQA GHG analyses. Due to the VMT error, the CAP likely fails to constitute as a Qualified Plan. The VMT error resulted in a lower CAP GHG inventory that affected the GHG reduction targets, which contradicts the requirements under CEQA Guidelines. As such, staff will not assess CEQA projects' GHG impacts using the CAP as a Qualified Plan until the VMT error is addressed.

Fiscal Analysis

This is an informational item explaining the CAP update and VMT calculations; therefore, there is no fiscal impact related to this item.

Next Steps

Staff is currently incorporating the ReCAP Snapshot data and the fiscal year 2018-19 CAP Annual Report into a CAP Progress Report presentation to City Council with an anticipated presentation date in April 2020.

To address the VMT error, in the short term, staff will develop supplementary data to assess CEQA projects' GHG impacts until the CAP is updated to meet CEQA Qualified Plan requirements. Additionally, the city will undertake a focused CAP update to correct the VMT data, incorporate the ReCAP Snapshot 2016 inventory data and add new GHG reduction measures, such as CCE, to meet the revised GHG reduction targets. Timelines for completion of these tasks will be provided at the April 2020 presentation.

In the longer term, by April 2021, staff will perform a comprehensive update to the CAP along with the city's Housing Element update. The Housing Element update will revise the city's residential density, which may increase the city's forecasted GHG emissions. This CAP update will determine whether the city remains on the trajectory to meet its GHG targets considering those land use changes.

Environmental Evaluation (CEQA)

Pursuant to Public Resources Code Section 21065, receiving an informational presentation on the CAP update and VMT calculations does not qualify as a "project" within the meaning of the CEQA. The informational presentation has no potential to cause either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment, and therefore does not require environmental review.

Public Notification and Outreach

This item was noticed in accordance with the Ralph M. Brown Act and was available for public viewing and review at least 72 hours prior to the scheduled meeting date.

Exhibit

1. Climate Action Plan Annual Reporting/Vehicle Miles Traveled (VMT) Calculations Memo dated Jan. 13, 2020



Memorandum

January 13, 2020

To: CITY MANAGER

From: CITY ATTORNEY *CB*

Subject: *CLIMATE ACTION PLAN ANNUAL REPORTING / VEHICLE MILES TRAVELED (VMT) CALCULATIONS*

Executive Summary

In April 2020, staff plan to present a CAP Progress Report to City Council that incorporates the City's Climate Action Plan (CAP) fiscal year (FY) 2018-19 Annual Report and ReCAP Snapshot data from the San Diego Association of Governments (SANDAG). That presentation will describe that the ReCAP Snapshot reflects an apparent error in the current CAP's vehicle miles traveled (VMT) calculation.

During CAP monitoring, staff determined that the CAP's VMT calculation is based on an incorrect input, which resulted in a materially understated greenhouse gas (GHG) inventory and GHG targets. Staff currently estimate that the City will achieve the updated 2020 GHG target through existing CAP measures. However, it appears that the amended 2035 GHG target will require the addition of a substantial GHG reduction measure (or measures) to the CAP, such as Community Choice Energy. Staff will provide a further update on these impacts as part of the CAP Progress Report presentation.

Due to the VMT error, the CAP likely does not currently constitute a qualified greenhouse reduction plan (Qualified Plan) under California Environmental Quality Act (CEQA) Guidelines Section 15183.5(b). Therefore, staff will not assess the GHG impacts of CEQA projects by using the CAP as a Qualified Plan until the VMT error is addressed.

To address the VMT error, staff plan to do the following: (1) in the short term, develop supplementary data to assess CEQA projects' GHG impacts until the CAP is updated to address section 15183.5(b) requirements; and (2) undertake a focused CAP update to address section

15183.5(b) requirements with the correct VMT figure¹. In the longer-term (by April 2021), staff will also update the CAP with the City's Housing Element update.²

I. Background

In September 2015, the City adopted a CAP that outlines actions that the City will undertake to achieve its proportionate share of state GHG emissions reductions. Implementation of the CAP serves as mitigation under CEQA for the City's General Plan update and as a Qualified Plan in accordance with CEQA Guidelines Section 15183.5(b).³ Compliance with section 15183.5(b) allows later development projects to use the CAP for their CEQA GHG analyses; projects above the CAP's screening threshold of 900 metric tons carbon dioxide equivalent (MTCO₂e) per year demonstrate consistency with the CAP under CEQA through a Consistency Checklist and/or a self-developed GHG emissions reduction program.

The CAP contains a baseline inventory of GHG emissions for 2005, an updated baseline inventory for 2011, and a calculation of the City's targets based on a reduction from the 2005 baseline. According to the CAP, the City emitted 630,310 MTCO₂e in 2005, 705,744 MTCO₂e in 2011 and is projected to emit 1,007,473 MTCO₂e in 2035. See CAP Section 2. Consistent with state law and policy, the CAP set a target to achieve a 15 percent reduction from the 2005 baseline by 2020 and a target to reduce emissions below the 2005 baseline by 49 percent by 2035. See CAP Section 3.1.

To meet these targets, the CAP states the City must implement strategies that reduce emissions to 535,763 MTCO₂e in 2020 and 321,458 MTCO₂e in 2035. *Id.* The CAP relies upon ongoing monitoring of GHG reduction measures and updates to the GHG inventory. See CAP Section 5.2. If an updated GHG inventory reveals that the CAP is not making adequate progress toward meeting the GHG targets, the City must adjust the CAP by modifying, adding, or replacing reduction measures.⁴

II. Regional Climate Action Planning Framework (ReCAP) and FY 2018-19 CAP Annual Report

SANDAG collaborates with local agency staff and climate planning experts to prepare a Regional Climate Action Planning Framework (ReCAP) that provides jurisdiction-specific GHG emissions data and a technical framework for regionally-consistent climate action planning. On November

¹ This update will revisit the CAP inventory and targets due to the VMT error, incorporate the ReCAP Snapshot 2016 inventory data, and add new or revised GHG reduction measures as necessary to meet the amended targets.

² The Housing Element update will revise the City's residential density, which may increase the City's forecasted GHG emissions. This CAP update will determine whether the City remains on the trajectory to meet its GHG targets considering those land use changes.

³ General Plan Sustainability Element, Policy 9-P.1 ("enforce the Climate Action Plan as the city's strategy to reduce greenhouse gas emissions") serves as CEQA mitigation for the General Plan update (see Table ES-3, impact 3.9-2, in the General Plan update EIR).

⁴ The CAP requires GHG inventory updates every three years. See p. 5-15 of CAP.

22, 2019, SANDAG provided the City of Carlsbad with a ReCAP Snapshot that contains a 2016 GHG Inventory for assessing the City's CAP implementation efforts and for updating the City's CAP GHG inventory. Staff is currently incorporating the ReCAP Snapshot data and the FY 2018-19 CAP Annual Report into a CAP Progress Report presentation to City Council, with an anticipated presentation date in April 2020.

The CAP anticipated that its GHG inventory and targets would be revisited and possibly amended to account for more current data, such as the ReCAP Snapshot 2016 inventory. However, that process assumed that the original CAP calculations did not contain material errors. As further described below, staff determined that the CAP contains a calculation error that resulted in materially lower figures for the CAP's GHG inventory and the CAP's GHG targets.⁵ Therefore, as part of staff's routine efforts to update the CAP with the 2016 inventory, staff will also address the apparent VMT calculation error.

III. CAP VMT Calculations

The City's CAP consultant intended to use the ICLEI Origin-Destination Method to calculate VMT.⁶ It is a regional travel demand model that captures trips that start (origin) or end (destination) within the boundary of the jurisdiction. This approach, which is endorsed by SANDAG and is used for the ReCAP, excludes consideration of pass-through trips and is believed to best capture where a local government can affect passenger vehicle emissions. The Origin-Destination Method calculates VMT by taking 100% of the VMT for internal-internal trips, 50% of the VMT associated with internal-external/external-internal trips, and 0% of the VMT associated with external-external trips (see Attachment 2).

During ongoing CAP monitoring, staff determined that the CAP used an incorrect figure for its internal-external/external-internal trips input in the Origin-Destination Method calculation.⁷ SANDAG provides local jurisdictions with spreadsheets that contain the VMT calculation inputs; from that spreadsheet, the City's CAP consultant selected an input for the internal-external/external-internal trips that was specific to Carlsbad when they should have selected the regionwide total input. The error resulted in 510,973,969 VMT compared to the correct 1,076,144,961 VMT.⁸

⁵ VMT is the largest contributor of community GHG emissions to the City's GHG inventory (39%). See p. 2-6 of CAP.

⁶ See p. 2-3 of CAP: "For transportation trips that originate or end in Carlsbad, emissions for half of the entire trip are included, and not just for the miles traveled within Carlsbad; however, trips that just pass through Carlsbad are excluded, as their emissions would be reflected at their trip ends." See also p. 5 of Aug. 23, 2013 D&B memorandum accompanying CAP: "The 2011 Inventory uses VMT excluding pass-through trips to capture transportation emissions from trips originating or ending within the City of Carlsbad...pass-through trips were excluded from this inventory."

⁷ This type of error occurred with other climate action plans developed in 2015 or earlier. The City of San Diego and City of La Mesa discovered and corrected this type of error prior to finalizing their climate action plans.

⁸ These figures reflect year 2012 data.

Staff is now updating the CAP to address the VMT error and to incorporate the ReCAP Snapshot 2016 inventory data. In the longer-term (by April 2021), staff will update the CAP as necessary in relation to the City's Housing Element update. Staff is also developing supplementary data to assess CEQA projects' GHG impacts until the CAP is updated to address CEQA Guidelines Section 15183.5(b) requirements (See Section VI below). Staff currently estimate that the City will achieve the updated 2020 GHG target through existing CAP measures. However, it appears that the amended 2035 GHG target will require the addition of substantial GHG reduction measure (or measures) to the CAP, such as Community Choice Energy. Staff will provide a further update on these impacts as part of the CAP Progress Report presentation to City Council.

IV. CAP as Qualified Greenhouse Gas Reduction Plan

The CAP was developed to be a Qualified Plan under CEQA Guidelines Section 15183.5(b). CEQA does not require public agencies to develop a Qualified Plan, however later development projects may use consistency with a Qualified Plan to streamline their CEQA GHG analyses. The use of a Qualified Plan is one of a few pathways that may be used to assess a CEQA project's GHG impacts. See *Center for Biological Diversity v. California Department of Fish and Wildlife and Newhall Land and Farming* (2015) 224 Cal. App. 4th 1105 (Newhall Ranch case).

A lead agency may determine that a project's incremental contribution to a cumulative effect is not cumulatively considerable (i.e., that the project's GHG impact is less than significant) if the project complies with a Qualified Plan. Section 15183.5(b) requires that a Qualified Plan do the following:

- (i) quantify greenhouse gas emissions, both existing and projected over a specified time period, resulting from activities within a defined geographic area;
- (ii) establish a level, based on substantial evidence, below which the contribution to greenhouse gas emissions from activities covered by the plan would not be cumulatively considerable;
- (iii) identify and analyze the greenhouse gas emissions resulting from specific actions or categories of actions anticipated within the geographic area;
- (iv) specify measures or a group of measures, including performance standards, that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level; and
- (v) establish a mechanism to monitor the plan's progress toward achieving the level and to require amendment if the plan is not achieving specified levels; and be adopted in a public process following environmental review.

Due to the VMT error, the CAP likely fails to constitute a Qualified Plan. The VMT error resulted in a materially understated CAP GHG inventory that affected the GHG reduction targets, which contradicts the requirements under CEQA Guidelines Sections 15183.5(b)(1)(A)-(B). A Qualified Plan must also develop measures or a group of measures that would meet the specified emissions level if implemented on a project-by-project basis. CEQA Guidelines § 15183.5(b)(1)(D). The VMT error requires the addition of new GHG reduction measure(s) to the

CAP to meet the corrected reduction targets, and it is currently unknown which measure(s) will be added to the CAP and how the CAP Checklist for development projects will be updated to reflect these changes. Considering these issues, staff will not assess CEQA projects' GHG impacts using the CAP as a Qualified Plan until the VMT error is addressed.

V. Next Steps

To address the VMT error, staff will do the following: (1) in the short term, develop supplementary data to assess CEQA projects' GHG impacts until the CAP is updated to address section 15183.5(b) requirements; and (2) undertake a focused CAP update to address section 15183.5(b) requirements with the correct VMT figure, which will also incorporate the ReCAP Snapshot 2016 inventory data. In the longer-term (by April 2021), staff will also update the CAP with the City's Housing Element update.

While the CAP is updated to fully meet Qualified Plan requirements, development projects could use the supplementary data described in (1) to tier from the EIR for the General Plan update and CAP. See CEQA Guidelines § 15183.5(a).⁹ In addition to tiering, the Newhall Ranch case provides some possible options for a sufficient GHG impact analysis in the absence of a Qualified Plan. The City Attorney's Office will continue to assist City staff in reviewing this matter and applying GHG analysis methods to development projects until the CAP is updated to address CEQA Guidelines Section 15183.5(b) requirements.


AMANDA GUY
Deputy City Attorney

Attachments

1. FY 2018-19 CAP Annual Report
2. SANDAG ReCap Excerpts

⁹ CEQA Guidelines § 15385. "Tiering" refers to the "coverage of general matters in broader EIRs...with subsequent narrower EIRs or ultimately site-specific EIRs incorporating by reference the general discussions and concentrating solely on the issues specific to the EIR subsequently prepared."

City of Carlsbad Climate Action Plan Annual Report

Reporting Year 3: July 1, 2018 - June 30, 2019
August 2019

City of Carlsbad
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Table of Contents

	<u>Page</u>
I. Introduction.....	1
II. Background on Climate Action Plan	1
III. CAP Measures and Actions	5
A. Energy Efficiency	5
B. Renewable Energy.....	5
C. Transportation	6
D. Water	7
E. Public Outreach and Education.....	7
IV. New Development Projects	8
V. Monitoring.....	8
A. Renewable Energy.....	8
B. Electric Vehicles	10
C. Transportation General Plan Policies.....	12
VI. GHG Emissions Inventory and Forecast.....	14
VII. Summary	15
Appendix A - FY 18-19 CAP Implementation Activities	

Tables and Figures

	<u>Page</u>
Figure 1 – 2011 Community GHG Emissions by Sector.....	2
Table 1 – 2011 Community GHG Emissions by Sector	2
Table 2 – CAP Measures and GHG Reductions	4
Table 3 - PV System Installations in Reporting Year 3 (FY 18-19).....	9
Figure 2 - Residential PV Installations and CAP Projections and Target	9
Figure 3 – Non-residential PV Installations and CAP Projections and Target	10
Figure 4 - CVRP Participation in Carlsbad 2011-2018.....	11
Table 4 - Electric Vehicle Charging Station Installations in Reporting Year 3 (FY 18-19).....	11
Figure 5 – Bikeways by Classification.....	13

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I. Introduction

The purpose of this document is to provide an update on the status of the Climate Action Plan (CAP) implementation that occurred during the current reporting period. The CAP requires that the city annually monitor and report on CAP implementation activities, and present this report to the City Council in a public meeting. Given that CAP implementation is tied to the budget cycle, staff chose the fiscal year calendar to be the reporting period. This Year 3 annual report covers the FY 18-19 reporting period (July 1, 2018 to June 30, 2019).

II. Background on Climate Action Plan

The City of Carlsbad's Climate Action Plan (CAP) was adopted on Sept. 22, 2015, along with the General Plan Update and associated Environmental Impact Report. The purpose of the CAP is to describe how greenhouse gas (GHG) emissions within Carlsbad will be reduced in accordance with statewide targets.

Chapter 2 of the CAP contains information about the 2011 GHG inventory conducted at the time of CAP development. A GHG inventory identifies the major sources and overall magnitude of GHG emissions in the city using standard modeling methods and protocols. Typical inputs include electricity consumed, natural gas consumed, vehicles miles traveled, solid waste disposed, wastewater treated and potable and recycled water used.

Chapter 3 of the CAP contains a discussion of the forecasting used to determine the city's GHG targets for 2020 and 2035, as well as the GHG reductions anticipated by state and federal policies and certain General Plan policies.

Chapter 4 of the CAP describes the additional Measures and Actions that the city must pursue to reach its GHG emissions reduction targets.

To implement these additional Measures and Actions, the city needed to identify and allocate appropriate funding. Therefore, subsequent to CAP adoption, staff contracted with University of San Diego's Energy Policy Initiatives Center (EPIC) to study incremental internal costs to the city for CAP implementation. All of the participating city departments and divisions were surveyed to quantify the resources needed to effectively implement the CAP. On Feb. 23, 2016, staff presented the findings of the study to City Council and noted that these costs would be included in subsequent departmental budget requests. CAP implementation is a team effort involving a number of city departments and divisions, coordinated by the CAP Administrator. The interdepartmental CAP implementation team consists of Public Works (PW) – General Services, PW – Traffic and Mobility, PW – Environmental Management, PW – Utilities, Community and Economic Development – Planning, Parks & Recreation, Finance, City Attorney

and City Manager - Communications. This team meets on an on-going basis to discuss CAP implementation activities and opportunities for collaboration.

The city conducted its first GHG inventory in 2005, which is attached to the CAP as Appendix A. As part of the CAP preparation, the city updated the 2005 inventory and prepared a 2011 inventory. Figure 1 and Table 1 below show the 2011 GHG emissions graphically and in tabular form for the entire city, including emissions from both municipal operations and the community. Municipal operations constituted approximately 1% of all GHG emissions in 2011. Since there are several different types of GHG, GHG emissions are typically expressed in metric tons of carbon dioxide equivalent (MTCO₂e) to allow for standardization and comparison.

Figure 1 – 2011 Community GHG Emissions by Sector

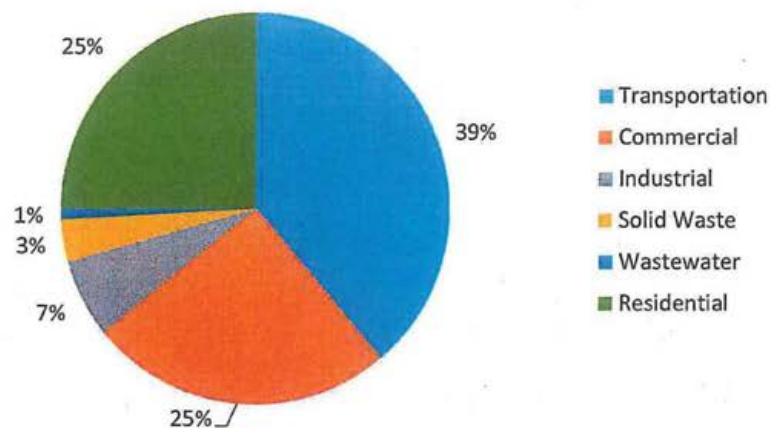


Table 1 – 2011 Community GHG Emissions by Sector

Sector	GHG Emissions (MTCO ₂ e)
Residential	176,405
Commercial	178,712
Industrial	46,248
Transportation	273,745
Solid Waste	21,719
Landfill	2,598
Wastewater	6,317
Total	705,744

Of the total emissions in 2011, 96% are attributed to the residential, commercial, industrial and transportation sectors (e.g. buildings and automobiles). This emissions profile by sector is typical of other cities; therefore, similar to most other CAPs, Carlsbad's CAP focuses primarily on GHG emissions reduction strategies on these sectors.

Forecasts for the Carlsbad CAP were conducted for 2020 and 2035 GHG emissions using the Statewide Energy Efficiency Collaborative (SEEC) model. The CAP used the 2005 inventory as the baseline. The first step in forecasting is to determine what is known as the "Business-As-Usual" (BAU) projection. This projection is the amount of GHG emissions increase anticipated over time due to population and job growth and vehicular traffic levels. The forecast then deducts the anticipated emissions reductions derived from state and federal policies, such as low carbon fuel standards, building energy code requirements and the state's requirement for utilities to provide electricity from renewable energy sources (known as the Renewable Portfolio Standard or RPS).

The Carlsbad CAP considered another category of anticipated GHG emissions reduction from the BAU projections: additional General Plan policies and actions. These policies and actions deal with the transportation sector and include bikeway and pedestrian system improvements, traffic calming, parking facilities and policies, and transportation improvements. After deducting these anticipated GHG emissions reductions from the BAU projection, the model then calculates the amount of additional GHG emissions reductions needed to reach the 2020 and 2035 targets.

The statewide targets used for the CAP are taken from Executive Order S-3-05 (EO S-3-05) and the Global Warming Solutions Act of 2006, Assembly Bill (AB) 32. EO S-3-05 calls for a reduction to 1990 levels by 2020 and 80% below 1990 levels by 2050. For Carlsbad, the targets are 15% below the 2005 baseline by 2020 and 49% below the 2005 baseline by 2035.

The additional GHG emissions reductions necessary to reach the targets are known as the CAP Measures; these measures are noted in Table 2. Each Measure has Actions, which once implemented by the city, will result in the modeled GHG emissions reductions also shown in Table 2.

Table 2 – CAP Measures and GHG Reductions

Measure Letter	GHG Reduction Measures	GHG Reduction in 2020 (MTCO ₂ e)	GHG Reduction in 2035 (MTCO ₂ e)
A	Install residential photovoltaic (PV) systems	2,896	10,136
B	Install commercial and industrial PV systems	3,810	13,336
C	Promote building cogeneration for large commercial and industrial facilities	305	1,067
D	Encourage single-family residential efficiency retrofits	323	1,132
E	Encourage multi-family residential efficiency retrofits	100	351
F	Encourage commercial and city facility efficiency retrofits	5,251	18,377
G	Promote commercial and city facility commissioning, or improving building operations	5,251	18,377
H	Implementation of Green Building Code	51	179
I	Replace Incandescent bulbs with LED bulbs	6,257	21,900
J	New construction residential and commercial solar water heater/heat pump installation and retrofit of existing residential	3,315	11,604
K	Promote Transportation Demand Management	6,728	23,549
L	Increase zero-emissions vehicle travel	15,474	54,158
M	Develop more citywide renewable energy projects	1,309	4,580
N	Reduce the GHG intensity of water supply conveyance, treatment and delivery	1,705	5,968
O	Encourage the installation of greywater and rainwater systems	344	1,205
Total GHG Reductions		53,199	185,919

III. CAP Measures and Actions

The CAP Measures listed in Table 2 can be grouped into four strategy areas: Energy Efficiency, Renewable Energy, Transportation and Water. For each of the Measures, there are detailed Actions that, taken together, should result in the anticipated GHG emissions reductions. Each of the Actions has an implementation timeframe. Short-term Actions should be completed within the first two years of CAP implementation; mid-term Actions should be completed within five years; and, long-term Actions begin implementation in the first two to five years but will not be completed within that timeframe.

The following section describes the progress made by the city in implementing the CAP measures and actions, organized by the different strategy areas. A more detailed description of activities conducted for each CAP Action, along with the 2035 performance goals for each Measure, is contained in Appendix A of this report. The activities involving public outreach and education are described in a separate section, since those efforts cross over all strategy areas.

A. Energy Efficiency

Energy efficiency is an important component to reducing energy consumption and lowering GHG emissions. The State of California's Energy Commission (CEC) has adopted a "loading order," a prioritized list of actions needed to reduce energy use, and energy efficiency is at the top of the list. For Carlsbad, energy efficiency CAP Measures account for almost a third of the planned GHG emissions reductions.

Measures D, E, F, G, H and I all deal with energy efficiency, both in the community and municipal operations. These Measures call for ordinances mandating energy efficiency improvements in residential and non-residential construction, commissioning of commercial and city facilities, implementation of energy conservation measures in city facilities, and promotion of energy efficiency rebate and incentive programs.

During the reporting period, staff continued to make progress in implementing the energy efficiency related Measures. On March 12, 2019, City Council adopted energy efficiency ordinances for major renovations of existing residential and non-residential buildings. PW – General Services upgraded seven heating, ventilation and air conditioning (HVAC) units at the Faraday Center. LED lighting was installed at the Carlsbad City Library, Safety Training Center and Oak Avenue paint shop area. West facing windows at the Safety Training Center were tinted.

B. Renewable Energy

The provision of energy through distributed renewable sources can significantly reduce the need for electricity from the grid and, therefore, lower GHG emissions. The CEC's loading order prioritization of energy efficiency is to lessen the amount of energy used, thereby minimizing

the size and cost of the renewable energy system needed to power the building. According to the CAP, renewable energy Measures will account for about one-fifth of the planned GHG emissions reductions.

Measures A, B, C, J and M relate to community and city renewable energy improvements. These Measures include ordinances requiring PV systems in new residential and non-residential construction and existing commercial buildings, cogeneration in larger non-residential buildings, alternative energy water heating systems, citywide renewable energy projects, and promotion of renewable energy rebate and incentive programs. Cogeneration involves the generation of electricity and another form of energy, such as using steam to provide heating for a building.

On March 12, 2019, City Council adopted ordinances requiring installation of solar photovoltaic (PV panels) for all new non-residential development and major renovations of existing non-residential buildings, as well as alternative energy water heating for all new residential and non-residential development

C. Transportation

There are two primary facets of GHG emissions reductions related to transportation. The first is to reduce the number of miles a vehicle is driven. Each mile driven represents an emission of GHG. Reducing the length of trips, or the need to use a motorized vehicle, can significantly reduce GHG emissions. The second facet of transportation-related GHG emissions is to reduce or eliminate the GHG emissions coming from vehicles. Known as low- or zero-emissions vehicles, these automobiles include alternative-fueled vehicles, hybrids and electric vehicles. Taken together, reduction of vehicle miles traveled and tailpipe emissions represents the largest single GHG emissions reduction strategy area. In the Carlsbad CAP, transportation-related Measures total over 40% of the planned GHG emissions reductions.

Measures K and L address the transportation related GHG emissions reductions. Measure K relates to reducing vehicle miles traveled and is closely tied to the policies contained in the General Plan Mobility Element. On Feb. 26, 2019, the City Council approved a Transportation Demand Management (TDM) plan and ordinance. Staff released a Request for Proposals in March 2019 to solicit TDM consulting services.

Measure L involves reducing tailpipe emissions through an increase in the proportion of low- and zero-emission vehicles on the road. On March 12, 2019, City Council adopted an ordinance requiring installation of electric vehicle (EV) charging infrastructure for all new residential and non-residential development and major renovations of existing residential buildings. Other activities during the reporting period included the purchase of ten plug-in hybrid city fleet vehicles and installation of 20 fleet and employee EV charging stations, 10 at the Faraday Center and 10 at the Carlsbad City Library.

D. Water

Water conservation can lower GHG emissions because movement of water and wastewater requires energy. Measures N and O promote increasing energy efficiency in the potable water, recycled water and wastewater conveyance systems and using greywater and rainwater collection systems.

The Carlsbad Municipal Water District (CMWD) analyzes energy usage of their pumps and endeavors to increase energy efficiency of equipment whenever it is replaced. During the reporting period, a sewer pump stations was removed and the Automated Metering Infrastructure system was optimized and commissioned. Implementation of the Actions associated with Measures N and O will continue in the mid- to long-term timeframe.

E. Public Outreach and Education

In addition to the provision of energy-efficient buildings or the availability of PV systems and electric vehicles, a critical component to reducing GHG emissions is encouraging members of the public to engage in behaviors that reduce GHG emissions. Bike lanes, pedestrian improvements and transit expansion only reduce GHG emissions if people use them.

Measures C, D, E, F, G, and I all contain Actions related to public outreach and education. During the reporting period, staff continued work on a multi-year, research-based strategy to achieve measurable changes in public behavior, resulting in reduced GHG emissions. Concurrent with the long-term strategy, staff implemented several short-term public outreach and education tactics, including:

- Article in Carlsbad Business Journal
- News releases promoting GHG reduction measures and environmental events in local media
- Mailed advisory letter to over 180 building owners regarding AB 802 energy benchmarking and reporting requirements
- Informational materials available at city facilities.
- A website with information and resources
- Participation in the Carlsbad Chamber of Commerce Green Business Expo.
- Presentations at local, regional and statewide meetings, including the City of Carlsbad Planning Commission and City Council, Southwestern HOAs, Carlsbad Sustainability Coalition, Building Industry of America (BIA) North County Legislative Committee, San Diego Association of Governments (SANDAG) Regional Planning Committee, and the SEEC Forum.

IV. New Development Projects

The CAP serves as an environmental review tiering document pursuant to Section 15183.5 of the California Environmental Quality Act (CEQA) Guidelines. According to the CAP, any discretionary project that will have GHG emissions greater than 900 MTCO₂e must either demonstrate consistency with the CAP or submit a project-specific GHG analysis for review and approval.

During the reporting period, the Planning Division continued to implement the Climate Action Plan Consistency Checklist and accompanying Guidance for Demonstrating Consistency with the Climate Action Plan – For Discretionary Projects Subject to CEQA. The Checklist and Guidelines are available at: <http://www.carlsbadca.gov/services/building/forms/default.asp>.

The CAP states that new projects demonstrated to emit less than 900 MTCO₂e would not contribute considerably to cumulative climate change impacts, and therefore do not need to demonstrate consistency with the CAP. No development projects approved during the reporting period met or exceeded the 900 MTCO₂e threshold.

V. Monitoring

Monitoring of CAP implementation can be divided into three general areas: 1) progress on implementing the CAP Actions; 2) progress on reaching the CAP Measures' performance goals; and, 3) progress in reaching the CAP GHG emissions reductions targets for 2020 and 2035.

A detailed description of the activities undertaken to implement the CAP Actions is contained in Appendix A. Regarding the CAP Measures and their corresponding performance goals, there is variability in the monitoring data sources. For example, monitoring for Measures D, E, F and G require San Diego Gas and Electric (SDG&E) electric and natural gas energy usage. Monitoring for Measure L requires vehicle miles traveled (VMT) model output data. The energy usage and VMT data will be collected during the biannual GHG inventory process, conducted by SANDAG, and reported in the corresponding CAP Annual Report.

A. Renewable Energy

Measures A and B involve increasing the amount of residential and non-residential solar PV systems in Carlsbad. Data for the reporting period were obtained from the permit activity in the city's EnerGov system. Table 3 shows the number and capacity in kilowatts (kW) of PV system installations in the residential and non-residential sectors during the reporting period.

Table 3 – PV System Installations in Reporting Year 3 (FY 18-19)

Sector	Total Finaled Permits	Total Capacity (kW)	Highest Capacity Project (kW)	Lowest Capacity Project (kW)	Median Project Capacity (kW)
Residential	966	6,183.0	21.6	1.3	6.0
Non-residential	23	5,384.4	1,000.0	8.4	133.2

Figures 2 and 3 show the residential and non-residential PV installations as they relate to the CAP projections and target. The data were obtained from SDG&E grid interconnections and the city's EnerGov system. The residential PV installations far exceed the CAP projections and are greater than the 2035 target of 25 megawatts (MW) of capacity. Beginning in January 2020, California building code will require PV in new residential construction, which will contribute to the continuing increase in residential PV. The non-residential installations currently meet the trend line amount for reaching the CAP target. The significant increase in non-residential PV during the reporting period is mostly due to three large installations, which were required to include PV through the discretionary permit review process. The city's newly adopted non-residential PV ordinance will require all new non-residential construction and major renovations to include PV, thereby increasing the projects subject to the PV requirement.

Figure 2 - Residential PV Installations and CAP Projections and Target

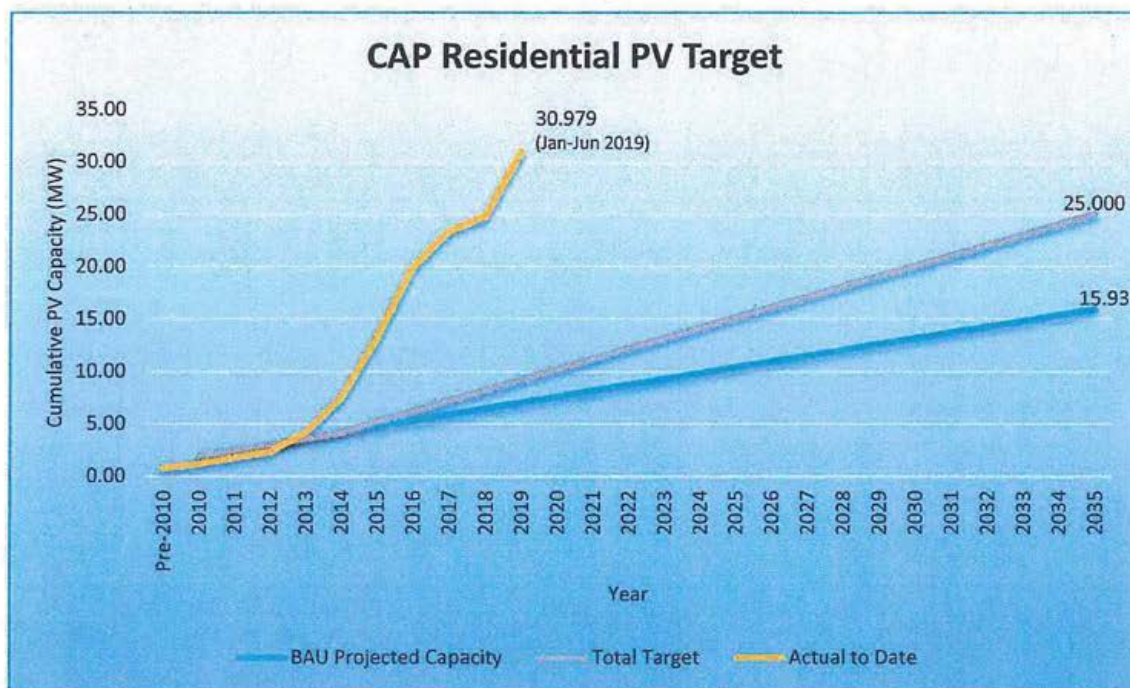
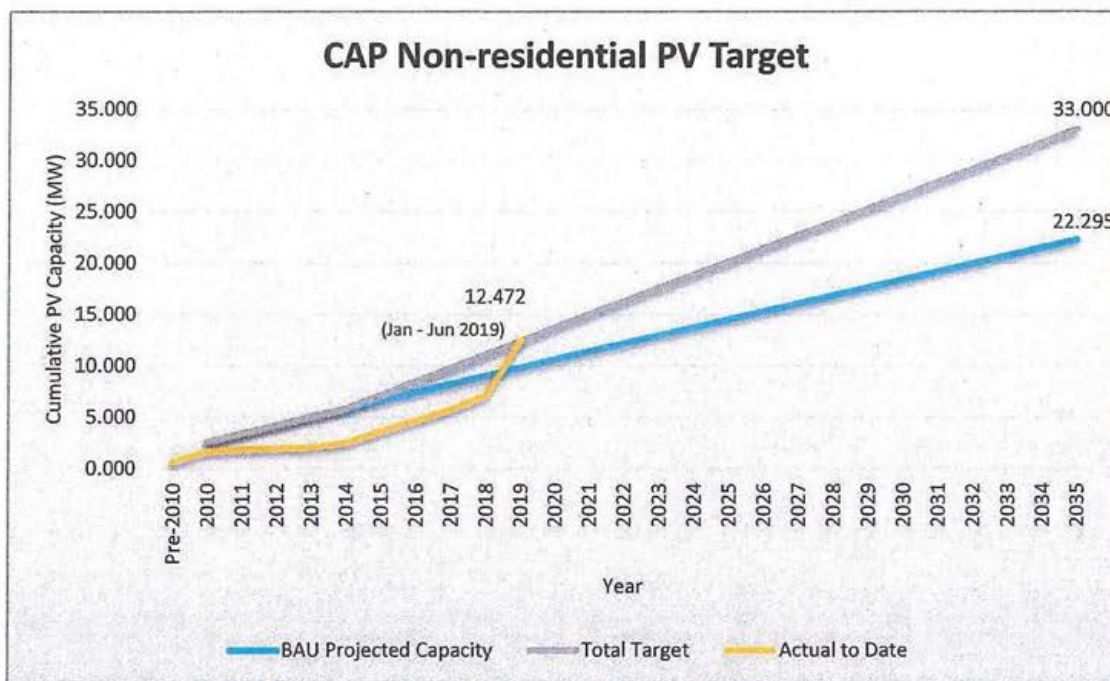


Figure 3 – Non-residential PV Installations and CAP Projections and Target

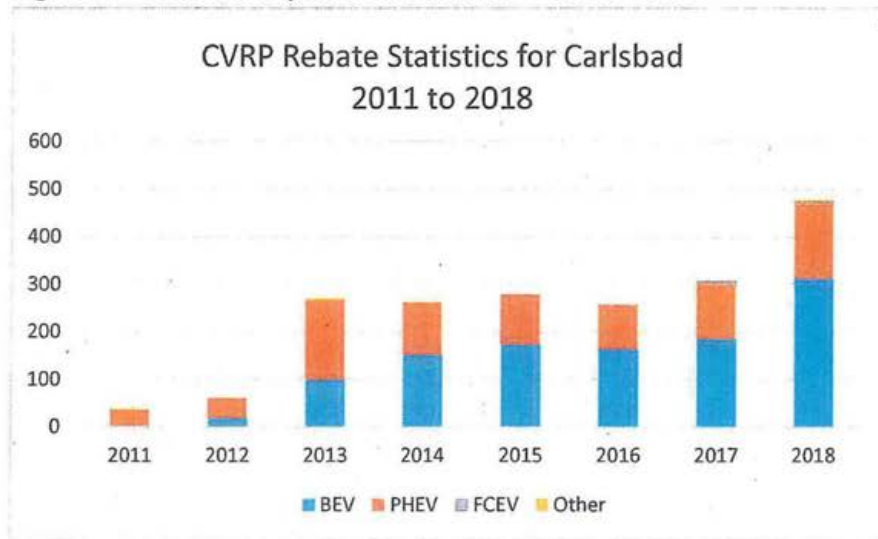


B. Electric Vehicles

CAP Measure L involves promoting an increase in the proportion of zero-emission vehicle (ZEV) miles traveled, specifically EV, of the total VMT. One way to promote an increase in EV ownership and use is to increase the number and locations of publicly available EV charging stations.

The California Air Resources Board (CARB) administers the Air Quality Improvement Program (AQIP), intended to fund clean vehicle and equipment projects, air quality research, and workforce training. One of the AQIP programs is the Clean Vehicle Rebate Program (CVRP). Administered by the Center for Sustainable Energy (CSE), CVRP provides rebates for the purchase or lease of clean vehicles. CVRP participation statistics can be used to gauge EV ownership. Figure shows the annual CVRP participation within Carlsbad from program inception to 2018.

Figure 4 – CVRP Participation in Carlsbad – 2011 to 2018



BEV = battery-electric vehicle; PHEV = plug-in hybrid electric vehicle; FCEV = fuel-cell electric vehicle; other = non-highway, motorcycle & commercial BEV.

Data for the reporting period is available from July 1, 2018 to March 31, 2019. CVRP participation was as follows: BEV = 253; PHEV = 115; FCEV = 3; Other = 1. The city is also acquiring clean vehicles are part of fleet conversion strategy. During the reporting period, the city purchased 10 plug-in hybrid electric vehicles, which replaced existing combustion engine vehicles.

The CAP Annual Report for Reporting Year 2 (FY 17-18) contained a locational analysis of existing and future public EV charging stations. Several public (unrestricted access) and workplace/fleet (restricted access) EV charging stations were added to the inventory during the reporting period, as shown in Table 4.

Table 4 – Electric Vehicle Charging Station Installations in Reporting Year 3 (FY 18-19)

Location	EV Service Provider	Access	Number/Type of Ports
Ralph's Supermarket	Volta	Unrestricted	Two L2
The Square at Bressi Ranch	ChargePoint	Unrestricted	15 L2
LiFT Business Park	ChargePoint	Unrestricted	Seven L2
Nemko	ChargePoint	Restricted	6 L2
St. Patrick's Parish Center	Greenlots	Restricted	Eight L2
Carlsbad Supercharger	Tesla	Tesla only	20 DCFC
Legoland Castle Hotel	Non-networked	Guests only	14 L2
Pacific Vista Commerce Center	ChargePoint	Restricted	24 L2

Location	EV Service Provider	Access	Number/Type of Ports
Laurel Tree Apartments	ChargePoint	Unrestricted	6 L2
ThermoFisher	ChargePoint	Restricted	20 L2
2051 Palomar	ChargePoint	Restricted	20 L2
City of Carlsbad Faraday Center	Greenlots	Restricted	10 L2
Carlsbad City Library	Greenlots	Restricted	10 L2

L2 = Level 2 chargers; DFCF = DC fast chargers

With the exception of the ThermoFisher and City of Carlsbad charging stations, all other workplace/fleet installations were constructed through SDG&E's Power Your Drive program. The installations at the two city facility sites were constructed through the Electrify America program.

C. Transportation General Plan Policies

In addition to the CAP Measures and Actions described in Section III, the CAP also relies upon implementation of some transportation related General Plan policies for GHG reductions. These policies involve bikeway system improvements, pedestrian improvements and increased connectivity, traffic calming, parking facilities and policies, and transportation improvements. While the overall GHG reduction of these General Plan policies is relatively small (less than 4.5% of 2035 reductions) it is important to track progress in completing these improvements because they contribute increased and multimodal mobility within the city.

Bikeway and Pedestrian System Improvements

There were several improvements to the bikeway and pedestrian system during the reporting period. In addition to the installation of a rectangular rapid flashing beacon for pedestrian crossing at the intersection of Alicante Road and Lapis Road, major projects included:

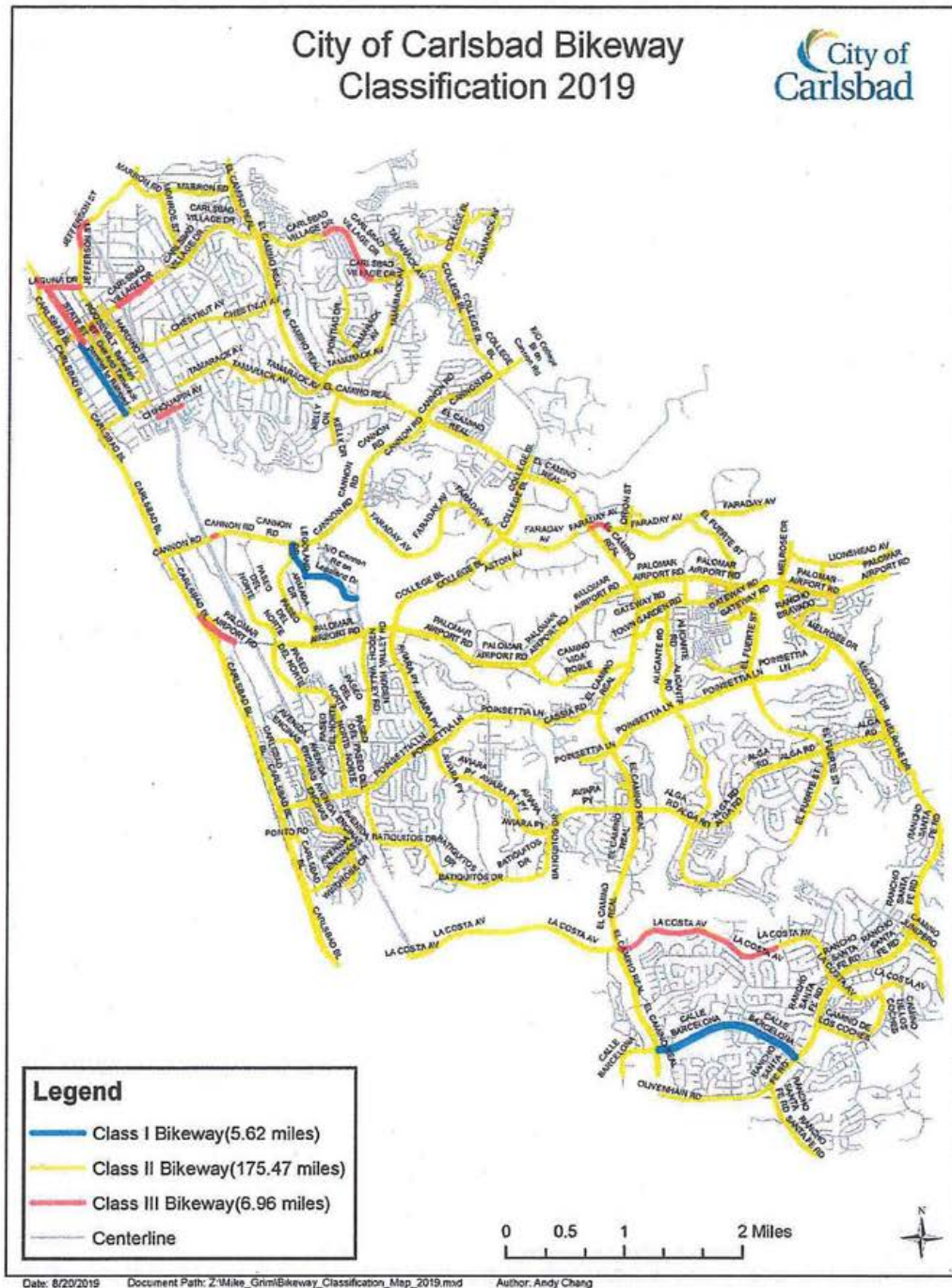
2018-19 Slurry Seal – Added a four-foot buffer to existing bike lanes on both sides along Poinsettia Lane, from El Camino Real to Melrose Drive.

2018 Concrete Replacement:

- Replaced 14 non-compliant and damaged curb ramps
- Replaced over 5,000 linear feet of broken or uplifted sidewalk (approximately 25,000 square feet)
- Relocated light pole, removed tree and installed missing piece of sidewalk on La Costa Avenue to complete pedestrian path.

The city currently has 188.05 miles of bikeways, as shown in Figure 5. A total of 6.02 miles of bikeways were added to the system during the reporting period.

Figure 5 – Bikeways by Classification



Parking Facilities and Policies

On Sept. 26, 2017, the City Council accepted a Parking Management Plan (PMP) for the Carlsbad Village, Barrio and Beach Area, which contains many of the parking policies described in the CAP. Implementation of the plan will occur through the Carlsbad Village and Barrio Master Plan (adopted by City Council on July 24, 2018). The recommendations in the PMP include hiring a parking program management program manager, incentivizing shared and leased parking, reducing parking requirements, allowing bicycle parking as a replacement for required parking, and installing digital parking locator infrastructure and wayfinding signs.

Transportation Improvements

During the reporting period, staff continued coordination with North County Transit District (NCTD) in the finalization of the city's Trolley Feasibility Study and the development of the Carlsbad Connector, a first mile/last mile service connecting the Poinsettia Commuter Rail Station to the employment centers in the city's industrial parks.

VI. GHG Emissions Inventory and Forecast

As stated in the CAP Annual Report 2, dated August 2018, the city is participating in SANDAG's Climate Planning Services GHG inventory program and will receive a no-cost GHG inventory every two to three years. As of June 30, 2019, the 2016 inventory was not received and, therefore, it is not included in this annual report for Reporting Year 3 (July 1, 2018 – June 30, 2019).

The SANDAG-prepared 2016 inventory will differ from the GHG inventory contained in the CAP in several ways. It will include emissions from energy used for water conveyance and treatment. It will also include the electricity-related emissions from the Claude "Bud" Lewis Desalination Plant, which was not operational in 2011 when the CAP emissions were calculated. Lastly, the methodology for deriving transportation-related emissions, or VMT, used in the 2016 inventory is different from that used in the CAP.

In addition to the changes in GHG inventory components and derivation, the CARB issued new guidance on GHG emissions target setting and forecasting through their 2017 Climate Change Scoping Plan. Issued in November 2017, the Scoping Plan aligns the forecasting and target setting protocols in accordance with California's 2030 GHG emissions targets. The city contracted with EPIC to use the 2016 GHG inventory to forecast GHG emissions, derive targets, and evaluate the city's progress in reaching its targets. EPIC will use the Scoping Plan guidance to derive the updated targets and forecasts. Once the 2016 inventory is received, and the targets and forecast are established, staff will present the findings to the City Council and make recommendations on updating CAP Measures and Actions if needed.

VII. Summary

During the third year of CAP implementation, staff continued to make progress in carrying out the CAP Measures and Actions. During the next fiscal and reporting year, staff will continue to work and coordinate with consultants, SANDAG, SDG&E and other regional and business partners to further CAP implementation and continue to lower GHG emissions.

Appendix A

FY 18-19 CAP Implementation Activities by Measures and Actions

CAP Measures and Actions 2035 Performance Goals for Measures		FY 18-19 CAP Implementation Activities by Measures and Actions
Timeframes in CAP: <i>Short-term = 1 - 2 years</i> <i>Mid-term = 2 - 5 years</i> <i>Short to Long-term & Mid-Long-term = begun but not completed in 5 years</i>		
A - Promote installation of residential photovoltaic systems Promote installation of residential PV systems to produce an additional 9.1 MW above already projected amounts, or the equivalent of 2,682 more homes with PV systems, by 2035.		
A-1	Temporarily - for a period of one year - suspend residential and commercial PV system permit fees, together with a publicity campaign to promote PV systems installation. <i>(Short-term)</i>	This action was deemed unnecessary due to the already increasing volume of residential and commercial PV permits. Permit fees for Carlsbad are proportionate or lower than fees in other San Diego region jurisdictions. In 2015, City Council adopted Ord. CS-285, which streamlined the permitting process for small residential rooftop solar energy systems.
A-2	On a continuing basis, ensure that regulatory provisions - such as complying with regulations for zoning, structure height, permit submittal and review, etc. - do not hinder residential and commercial PV system installation. <i>(Short to Long-term)</i>	Staff will continue to evaluate the zoning regulations and permitting process to ensure there is no hindrance of PV installations.
A-3	Adopt an ordinance, similar to those passed by Lancaster and Sebastopol, which requires new homes to install PV panels to offset a portion of their energy use. <i>(Short-term)</i>	In December 2018, the California Building Standards Commission added a requirement to the 2019 statewide building codes that all new low-rise residential buildings in California will be equipped with solar systems. The requirement will take effect on Jan. 1, 2020. In February 2019, city staff recommended that the City Council adopt the statewide residential PV requirement rather than develop a local PV ordinance for residential buildings. In making the recommendation, staff noted that the CAP's 2035 goal for 25 megawatts of installed residential PV was reached in 2018.
B - Promote installation of commercial and industrial photovoltaic systems Promote installation of commercial and industrial PV systems to produce an additional 10.7 MW above projected amounts, or roughly 15% of projected commercial and industrial electricity use.		

B-1	Adopt a commercial energy conservation ordinance requiring all new nonresidential developments with more than 50 cars surface parked or on roofs of parking structures to use PV panels over at least half of the surface/roof-parked cars or provide equivalent energy conservation/generation by other means (over and above other requirements). <i>(Short-term)</i>	On March 12, 2019, City Council adopted Ordinance No. CS-347, which requires all new nonresidential buildings to install solar PV systems to offset a portion of their electricity requirements. The ordinance was submitted to the California Energy Commission for review on March 14, 2019 and will be enforceable once it is approved by the Commission. As of June 30, 2019, the ordinance was scheduled for approval at the Commission's Aug. 14, 2019, business meeting.
B-2	Adopt an ordinance requiring existing nonresidential developments to install PV panels to offset a portion of their energy use. <i>(Mid-term)</i>	On March 12, 2019, City Council adopted Ordinance No. CS-347, which requires existing nonresidential buildings that undergo major renovations or additions to install solar PV systems to offset a portion of their electricity requirements. The ordinance was submitted to the California Energy Commission for review on March 14, 2019 and will be enforceable once it is approved by the Commission. As of June 30, 2019, the ordinance was scheduled for approval at the Commission's Aug. 14, 2019, business meeting.
C - Promote building cogeneration for large commercial and industrial facilities Promote building cogeneration for large commercial and industrial facilities, with the goal of producing 6.9 MW by 2035.		
C-1	Promote cogeneration by publicizing grant opportunities and financial incentives, such as the Self-Generation Incentive Program and feed in tariffs for cogeneration systems, for renovations of existing buildings by posting these on the city's website and by other means. <i>(Short-term)</i>	Staff maintained a website to promote existing programs such as the Self-Generation Incentive Program.
C-2	Install cogeneration systems on all city facilities that can benefit from the installation of these systems and apply for funding through the Energy Efficiency Financing for Public Sector Projects program, or other similar funding sources. <i>(Mid to Long-term)</i>	Staff evaluated the effectiveness of cogeneration systems on city facilities and no facilities met the minimum criteria needed for useful cogeneration.
C-3	Require cogeneration systems for large commercial and industrial facilities that have on-site electricity production, both for new construction and retrofits. <i>(Mid-term)</i>	Staff is assessing the types of projects that could be subject to this Action, both existing and in the future.
D - Encourage single-family residential efficiency retrofits Encourage single-family retrofits with the goal of 50% energy reduction compared to baseline in 30% of the total single-family homes citywide (approximately 10,000 single-family homes out of total of 35,000.)		

D-1	Publicize available incentive and rebate programs, such as SDG&E's Residential Energy Efficiency Program, on the city's website and by other means. <i>(Short-term)</i>	Staff maintained a website, made community presentations, and published articles in newsletters and newspapers.
D-2	Create a citywide "Energy Challenge," similar to the Department of Energy's Better Buildings Challenge, to promote cost-effective energy improvements, while having residents and building owners commit to reducing energy consumption. <i>(Short-term)</i>	Staff continued work on a multi-year, research-based strategy to achieve measurable changes in public behavior, resulting in reduced GHG emissions. A program such as this could become part of that strategy, based on the findings of research being conducted.
D-3	Adopt a residential energy conservation ordinance, which requires residential property owners to conduct and disclose an energy audit at the time of major renovations (as defined by the ordinance,) to ensure that homes and residential developments meet specified low cost energy efficiency measures - such as requisite ceiling insulation, insulated pipes, water heater blankets and exterior door stripping. <i>(Short-term)</i>	On March 12, 2019, City Council adopted Ordinance No. CS-347, which requires specified energy efficiency measures in all major residential renovations. The ordinance was submitted to the California Energy Commission for review on March 14, 2019 and will be enforceable once it is approved by the Commission. As of June 30, 2019, the ordinance was scheduled for approval at the Commission's Aug. 14, 2019, Business Meeting.
E - Encourage multi-family residential efficiency retrofits Encourage multi-family retrofits with the goal of 50% energy reduction compared to baseline in 30% of the total multi-family homes citywide (approximately 5,000 single-family homes out of total of 17,000.)		
E-1	See D-1 above	See D-1 above
E-2	See D-2 above	See D-2 above
E-3	See D-3 above	See D-3 above
F - Encourage commercial and city facility efficiency retrofits Encourage commercial and city facility efficiency retrofits with the goal equivalent to a 40% energy reduction in 30% of commercial square footage citywide and in city-owned buildings by 2035.		

F-1	Undertake a program of energy efficiency retrofits for city-owned buildings, with the goal of 40% reduction in energy use, beginning with retrofits that would result in most substantial energy savings. <i>(Short-term)</i>	Staff installed replacement LED lighting at the Carlsbad City Library, Safety Training Center and the Oak Avenue paint shop area. The west facing windows at the Safety Training Center were tinted. Staff replaced seven HVAC units at the Faraday Center.
F-2	Promote available incentive and rebate programs, such as SDG&E's Energy Efficiency Business Rebates and Incentives Program, on the city's website and by other means. <i>(Short-term)</i>	Staff maintained a website and published an article in the Carlsbad Business Journal.
F-3	Adopt a commercial energy conservation ordinance, which requires property owners to ensure that commercial buildings meet specified energy efficiency measures - such as requisite heating, ventilation, and air conditioning improvements, service water system requirements, and improved refrigeration equipment, at time of conducting major renovations (as defined by the ordinance). <i>(Short-term)</i>	On March 12, 2019, City Council adopted Ordinance No. CS-347, which requires specified energy efficiency measures in all new and certain existing nonresidential buildings undergoing major renovations. The ordinance was submitted to the California Energy Commission for review on March 14, 2019 and will be enforceable once it is approved by the Commission. As of June 30, 2019, the ordinance was scheduled for approval at the Commission's Aug. 14, 2019, Business Meeting.
G - Promote commercial and city facility commissioning Encourage commercial and city facility commissioning, or improving existing and new building operations, with the goal equivalent to a 40% energy reduction in 30% of commercial square footage citywide and in city-owned buildings by 2035.		
G-1	Promote commercial commissioning programs on the city's website such as San Diego RCx, and similar programs for commercial buildings. <i>(Short-term)</i>	Staff maintained a website to promote these programs.
G-2	Commission city facilities to improve building operations and reduce energy costs, with a goal of 40% energy reduction in 30% of city facility square footage. <i>(Mid-term)</i>	The city is participating in SANDAG's Energy Roadmap program, which provides energy audits of city facilities and recommends possible energy conservation measures. During the reporting period, energy audits were conducted at the Calavera Hills and Stagecoach Community Centers.
H - Implement green building measures Implementation of a 5% improvement in energy efficiency above the City of Carlsbad residential green building code (based on CALGreen, the statewide green building code), for new construction.		

H-1	Adopt residential and commercial energy conservation ordinances requiring a 5% improvement in energy efficiency for residential and nonresidential new construction, above the existing City or Carlsbad green building code. <i>(Short-term)</i>	At the time of CAP adoption, the City of Carlsbad was requiring compliance with 2013 version of CalGreen. On June 27, 2017, the city adopted the 2016 version of CalGreen, which significantly increases energy efficiency of newly constructed buildings, far beyond the 5% called for in Action H-1. For example, single family homes constructed under the 2016 standards will use about 28% less energy for lighting, heating, cooling, ventilation, and water heating than those built to the 2013 standards
I - Promote replacement of incandescent and halogen bulbs with LED or other energy efficient lamps Replace 50% of incandescent and halogen light bulbs citywide with LED or similarly efficient lighting by 2035.		
I-1	Replace 50% of incandescent or halogen light bulbs in city facilities with LED or similarly efficient lighting, or follow SANDAG Energy Roadmap recommendations for lighting in city facilities, whichever results in greater energy savings. <i>(Short-term)</i>	Staff installed replacement LED lighting at the Carlsbad City Library, Safety Training Center and the Oak Avenue paint shop area.
I-2	Promote the use of LED or other energy efficient lamps by publicizing rebate programs and information from SDG&E on the benefits of the use of LED or other energy efficient lighting on the city's webpage. <i>(Short-term)</i>	Staff maintained a website, made community presentations, and published articles in newsletters and newspapers.
I-3.i	Evaluate the feasibility of adopting a minimum natural lighting and ventilation standard, developed based on local conditions. <i>(Mid-term)</i>	In 2018, the CSE performed a qualitative feasibility evaluation for natural lighting and ventilation. CSE determined that it would be difficult to provide a cost-effective natural ventilation requirement that goes beyond the 2019 Building Energy Efficiency Standards. The primary reason is that, while natural ventilation could meet some of a nonresidential building's cooling load due to Carlsbad's moderate climate, the 2019 California state building code nevertheless requires that a building's mechanical ventilation system be sized to meet the full cooling load to ensure that safe indoor air quality is maintained. As such, the cost of providing natural ventilation would not be offset by a reduced mechanical ventilation system. With regards to natural lighting, CSE noted that nonresidential natural lighting is well-governed in state codes, reducing the need for additional local standards. Cost-effectiveness analysis typically

a-v

		includes recommendations to alter building geometry to allow more daylight into the space. Daylighting requirements that may impact the architectural design and layout are challenging to enforce and are susceptible to heightened industry resistance. Daylight dimming plus off lighting control is a simple, cost-effective measure provided in the 2019 Building Energy Efficiency Standards, as it does not require architectural geometry or design changes. Daylighting in residential spaces is less likely to be cost-effective than in nonresidential spaces because the code assumes occupants are not typically present in residential spaces during the day to take advantage of daylighting; therefore, the cost of these controls may not be offset by the savings. There are no known reach codes that include natural lighting and/or natural ventilation requirements that go beyond current code requirements. The feasibility assessment also concluded that there are no known reach codes that include natural lighting and/or natural ventilation requirements that go beyond current code requirements.
I-3.ii	Demonstrate natural lighting and ventilation features in future facility upgrade or new construction. <i>(Mid-term)</i>	Staff is evaluating potential future city projects to demonstrate natural lighting and ventilation.
J - New construction residential and commercial solar water heater/heat pump installation & retrofit of existing residential Install solar water heaters or heat pumps on all new residential and commercial construction. Retrofit up to 30% of existing homes and commercial buildings to include solar water heaters or heat pumps.		
J-1	Promote the installation of residential solar water heaters and heat pumps by publicizing incentive, rebate and financing programs, such as PACE programs and the California Solar Initiative for renovations of existing buildings by posting this information on the city's website and by other means. <i>(Short-term)</i>	Staff maintained a website, made community presentations, and published articles in newsletters and newspapers.
J-2	Adopt residential and commercial energy conservation ordinances requiring new residential and commercial buildings to install solar water heaters or heat pumps, or use alternative energy (such as PV-generated electricity) for water heating needs. <i>(Short-term)</i>	On March 12, 2019, City Council adopted Ordinance Nos. CS-347 and CS-348, which require new residential and nonresidential buildings to install solar thermal water heating or electric heat pump water heaters for water heating needs. The ordinances were submitted to the California Energy Commission for review on March 14, 2019. The ordinances will be enforceable once they are approved by the Commission. As of June 30, 2019, the ordinances were scheduled for approval at the Commission's Aug. 14, 2019, business meeting.

K - Promote transportation demand management strategies Promote Transportation Demand Management Strategies with a goal of achieving a 10% increase in alternative mode use by workers in Carlsbad, for a total of 32% alternative mode use.		
K-1	Adopt a citywide TDM plan, as described in the General Plan Mobility Element, detailing a mix of strategies to reduce travel demand, specifically of single occupancy vehicles. SANDAG's 2012 "Integrating Transportation Demand Management Into the Planning and Development Process" provides a guide to designing and implementing a TDM plan and will be used as a reference document to develop the city's TDM plan. TDM strategies evaluated in the plan include parking ordinances, subsidized or discounted transit programs, transit marketing and promotion, carsharing, parking pricing, and bike parking. (Short-term)	On Feb. 26, 2019, City Council adopted Resolution No. 2019-024, establishing a TDM plan, which provides an implementation framework for TDM throughout the city, including infrastructure, regulations and policies, guiding resources, and a TDM program for existing businesses. Also, through Resolution No. 2019-024, City Council authorized staff to issue a Request for Proposal (RFP) for TDM program consulting services. As of June 30, 2019, the consultant had been selected but not awarded the contract. The TDM consultant will develop a program evaluation framework, review development plans, monitor approved TDM plans, conduct outreach to existing businesses to develop voluntary TDM programs, and assess the feasibility of expanding the TDM program to HOAs, schools, etc. The consultant will also utilize best management practices to position Carlsbad as a regional TDM employment hub and expand the reach of TDM beyond the TDM ordinance and new development alone.
K-2	Adopt a TDM ordinance, defining a minimum trip generation threshold for nonresidential development projects. The city will set performance requirements for minimum alternative mode use based on project type. All projects above the threshold shall submit a TDM plan, which includes a description of how the minimum alternative mode use will be achieved and maintained over the life of the project. Potential TDM trip reduction measures can include carpool and vanpool ridesharing services; designated employees as contacts for trip reduction programs; providing a direct route to transit in coordination with NCTD; developing public-private transit partnerships; passenger loading zones; pedestrian connections; showers and clothes lockers; long-term bicycle parking and shuttle programs. (Mid-term)	On March 12, 2019, City Council adopted Ordinance No. CS-350, which requires all nonresidential develop with a minimum trip generation to prepare and implement a TDM, including the provision of TDM amenities. The ordinance became effective on April 11, 2019.
L - Promote an increase in the amount of zero-emissions vehicle travel Promote an increase in the amount of ZEV miles traveled from a projected 15% to 25% of total VMT by 2035.		

L-1	Working with industry partners, construct a "PV to EV" pilot project to install a PV charging station at a city facility (such as Faraday Center) to charge city ZEVs. The purpose of the pilot project would be to evaluate the feasibility of incorporating more ZEV into the city's fleet. <i>(Short-term)</i>	Staff continues to assess the feasibility of a direct "PV to EV" pilot project(s). During the reporting period, staff received estimates for a transportable PV to EV unit and worked with local trade organizations to develop a Request for Information (RFI). The RFI will seek information on all forms of PV to EV projects.
L-2	Prepare a community-wide charging station siting plan, which evaluates site visibility and exposure, EV driving ranges, high volume destinations, locations with high ownership or interest in EVs, and cost of construction. <i>(Short-term)</i>	Staff prepared a mapping and travel distance analysis of existing and future EV charging sites and identified gaps in service areas. The locations of city-owned public properties and commercial centers that do not currently have EV charging infrastructure were then evaluated as to their ability to fill those gaps. The results of that mapping analysis is contained in Section V of the annual report.
L-3	Construct ZEV charging stations based on the community-wide charging station siting plan described in L-2 above. The ZEV charging stations will be funded by grant funds when available, and the city will post signage directing ZEVs to charging stations. <i>(Mid-term)</i>	On Dec. 18, 2018, City Council authorized city participation in the Electrify America program, which provided 20 staff/fleet charging stations; 10 at the Faraday Center and 10 at Carlsbad City Library. The charging stations were activated in May and June of 2019.
L-4	Offer dedicated ZEV parking, and provide charging stations adjacent to ZEV parking as identified in the community-wide charging station siting plan. <i>(Mid-term)</i>	On March 12, 2019, City Council adopted Ordinance No. CS-349, which requires new residential and nonresidential buildings to install EV charging infrastructure. New one and two-family homes, and townhouses with attached private garages must have a complete circuit installed and ready for EV charging supply equipment (EVSE). Multifamily residential and nonresidential buildings must provide EVSE for up to 10% of its parking. The EV charging requirements also apply to certain major renovations of existing residential sites and buildings. The ordinance became effective on April 11, 2019.
L-5	Adopt requirements for ZEV parking for new developments. <i>(Short-term)</i>	On March 12, 2019, City Council adopted Ordinance No. CS-349, which requires new residential and nonresidential buildings to install EV charging infrastructure. New one and two-family homes, and townhouses with attached private garages must have a complete circuit installed and ready for EVSE. Multifamily residential and nonresidential buildings must provide EVSE for up to 10% of its parking. The EV charging requirements also apply to certain major renovations of existing residential sites and buildings. The ordinance became effective on April 11, 2019.
L-6	Adopt a residential energy conservation ordinance, similar to Palo Alto, requiring the installation of EV chargers or pre-wiring in new residential construction and major renovations. <i>(Short-term)</i>	On March 12, 2019, City Council adopted Ordinance No. CS-349, which requires new one and two-family homes, and townhouses with attached private garages to have a complete circuit installed and ready for EVSE. Multifamily residential buildings must provide EVSE for up to 10% of its parking. The EV charging requirements also apply to major renovations of existing residential sites and buildings, as defined in the ordinance. The ordinance became effective on April 11, 2019.

L-7	Update the city's Fleet Management Program to include a low and zero-emissions vehicle replacement/purchasing policy. Increase the proportion of city fleet low and zero-emissions VMT to 25% of all city-related VMT by 2035. <i>(Short-term)</i>	The fleet conversion program replaced 12 internal combustion engine vehicles with plug-in hybrids. Currently, the city's fleet includes 31 hybrid vehicles.
M - Develop more citywide renewable energy projects Produce an equivalent amount of energy to power 2,000 homes (roughly equivalent to a 5% reduction) by 2035 from renewable energy projects.		
M-1	Conduct a feasibility study to evaluate citywide renewable energy projects and prioritize accordingly. <i>(Short-term)</i>	Leveraging SANDAG's Energy Engineering contract with TRC, a Microgrid Feasibility Study for the Carlsbad Safety and Service Center on Orion Way was completed and presented to City Council on June 12, 2018. If implemented, the microgrid would include enough renewable energy generation and energy storage to power the entire complex in case of a blackout.
M-2	Incorporate renewable energy measures such as PV system installation on city buildings and parking lots, or microturbine installation on city facilities, with the goal of producing approximately 12,000 megawatt-hours per year. <i>(Mid to Long-term)</i>	In accordance with the city's solar PV ordinance, future city facilities will be required to incorporate renewable energy. The potential for retrofitting PV on existing buildings is evaluated when other improvements and/or renovations are planned.
M-3	Pursue available funding sources for the construction of renewable energy projects by the city, such as Energy Efficiency Financing for Public Sector Projects and SGIP. <i>(Mid to Long-term)</i>	City staff continually monitors potential funding sources to support CAP implementation, including renewable energy projects.
N - Reduce the GHG intensity of water supply conveyance, treatment and distribution Reduce the intensity of GHG emissions from water utilities (including water supply, wastewater, and recycled water) conveyance, treatment and distribution by 8% by 2035.		
N-1	Improve water utilities (including water supply, wastewater, and recycled water) conveyance, treatment and distribution, and other system improvements. <i>(Mid to Long-term)</i>	Incorporating energy efficiency into system improvements is standard practice for Carlsbad Utilities. During this reporting period, energy savings have been realized through the removal of the Simsbury Sewer Lift Station by constructing a short extension to the service area gravity sewer system. In addition, the emergency generators at Knots Lane and North Batiquitos Lift Stations are being replaced with Tier 4 rated generators that will reduce nitrogen oxides emissions. Lastly, the full optimization and commissioning of the Automated Metering Infrastructure (AMI) allows for remote reading of 96% of CMWD's meter inventory. The deployment of AMI has significantly reduced the amount of internal combustion engine emissions due to reduction in monthly vehicle trips to generate data for a billing cycle.

a-ix

O - Encourage the installation of greywater and rainwater systems Encourage the installation of greywater and rainwater collections systems with a goal of 15% of homes by 2035.		
O-1	Host workshops on greywater and rainwater collection systems through the Carlsbad Municipal Water District, or partner with existing workshop providers, for homeowners interested in installing systems suitable for their property. <i>(Mid-term)</i>	CMWD participated in a rain barrel rebate program with other north San Diego County water districts to encourage and provide financial incentive for rainwater collections systems. Details on the program can be found at: https://www.rainwatersolutions.com/products/northcounty
O-2	Create a greywater design reference manual, or provide links to an existing one, for the design of greywater and rainwater collection systems. <i>(Mid-term)</i>	This is a mid-term action, planned for Years 3 - 5. There was no activity on this action during the reporting period.
O-3	Evaluate the feasibility of offering a rebate for residential greywater systems that require a permit to cover the cost of obtaining a permit. <i>(Mid-term)</i>	This is a mid-term action, planned for Years 3 - 5. There was no activity on this action during the reporting period.

a-x



REGIONAL CLIMATE ACTION PLANNING FRAMEWORK



TECHNICAL APPENDIX I

GHG Inventories, Projections, and Target Selection

MAY 2018

PREPARED BY  EPIC
ENERGY POLICY INITIATIVES CENTER
UNIVERSITY OF SAN DIEGO SCHOOL OF LAW

PREPARED FOR



3.4.4 Limitations of method used to calculate emissions from the natural gas category

Natural gas for electricity generation

As discussed in the activity data collection section, the natural gas delivered to power plants and co-generation plants primarily used for grid electricity supply is not included in this category. However, the co-generation plants may use or sell the excess heat output (the by-product of electricity generation) or use the electricity generated for other on-site facilities. Limited information is available to determine how much natural gas or excess heat output are consumed on-site. Some of the co-generation plants in the San Diego region are subject to the EPA or CARB mandatory GHG reporting program, but only the total GHG emissions at the facility-level are available. More detailed analysis is needed to develop a more accurate assessment of the emissions from these facilities.

Out-of-boundary jurisdiction-owned facilities

Similar to the limitations in collecting electricity use data, the natural gas data are limited to the customer addresses located within the jurisdiction's boundary. The data do not include natural gas at out-of-boundary jurisdiction-owned facilities, unless they have been identified and specially added to the energy data request.

Emission factor updates

The natural gas heat content is based on the characteristics of natural gas delivered to California customers. U.S. Energy Information Administration (EIA) updates the heat content monthly, including the historic value. The historic value used may not match the latest update of historic value or the latest updates of the CARB statewide inventory. The latest natural gas heat content from CARB statewide inventory is used for the emission factor calculation.

3.5 GHG emissions from the on-road transportation category

The GHG emissions from on-road transportation include the tailpipe emissions associated with VMT in the San Diego region from all vehicles, including passenger cars, light-duty trucks, heavy-duty trucks, buses, motorcycles, etc. The emissions calculation method is based on 'TR.1 Emissions from Passenger Vehicles' and 'TR.2 Emissions from Freight and Service Trucks' of the U.S. Community Protocol using activity data (VMT) from SANDAG's travel demand model and an emission factor (grams CO₂e/VMT) based on the CARB mobile source emissions factor model (EMFAC).

3.5.1 Activity – vehicle miles traveled

In contrast with the activity data used for electricity and natural gas categories, activity data for the transportation category is modeled (not measured) based on the best available information regarding travel demand. The U.S. Community Protocol recommends jurisdictions use a regional travel demand model to capture trips that start (origin) or end (destination) within the boundary of the jurisdiction, as it recognizes that "local government cannot influence all passenger vehicle's GHG emissions within city boundaries. As such, the recommended origin-destination method (using an assignment-based travel demand model) better captures a local government's ability to affect passenger vehicles emissions" (ICLEI 2013, Appx. D p.8).

In the San Diego region, SANDAG uses an activity-based model (ABM) to support development of the Regional Transportation Plan (RTP) and generate outputs related to the transportation system performance. Every three to five years, SANDAG produces the Regional Growth Forecast, a long-range forecast of population, housing, and employment growth for the San Diego region. SANDAG updates the ABM with inputs from the Regional Growth Forecast and performs various model calibrations with updated model inputs, parameters and software updates in between the model update years (SANDAG, 2016). Each Regional Growth Forecast is named a new Series. The most recent forecast is the Series 13, 2050 Regional Growth Forecast with a base year of 2012.

SANDAG's estimated Origin-Destination VMT (O-D VMT) are further separated into three types: Internal-Internal (trips starting and ending in the jurisdiction boundary), Internal-External or External-Internal (trips either starting or ending in the jurisdiction boundary), and External-External (trips neither starting nor ending in the jurisdiction boundary). The method to allocate total VMT to each type is described in the SANDAG technical white paper, *Vehicle Miles Traveled Calculations Using the SANDAG Regional Travel Demand Model*, vetted and published by the Institute of Transportation Engineers. The method to allocate VMT described in the SANDAG technical white paper is consistent with the ICLEI-recommended method and is the recommended method for allocating VMT from SB375 Regional Target Advisory Committee (RTAC) to CARB (SANDAG, 2013).

To determine VMT for inventories and projections, SANDAG provides jurisdiction-specific O-D VMT data for the base year and requested horizon year(s) depending upon the jurisdiction's planning milestone years. In addition to the 2012 base year, the current forecast includes the horizon years of 2014, 2020, 2025, 2030, 2035, 2040, 2045, and 2050. The base year VMT data most closely represent actual conditions. An example of the data provided by SANDAG for a jurisdiction is provided in Table 10. The VMT are provided in miles per weekday and captures all vehicle types.

Table 10 Example of a jurisdiction's VMT by O-D

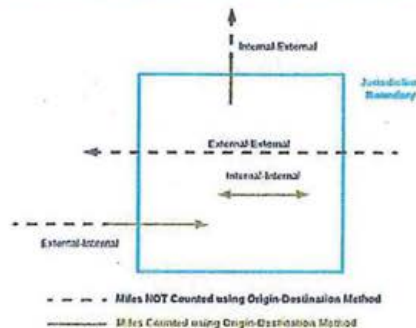
SANDAG series 13 O-D VMT (mile/weekday)			
Trip type	2012	2014	2020
Internal-Internal	241,151	249,320	241,621
Internal-External/External-Internal	3,056,636	3,151,243	3,171,670
External-External	596,264	627,807	620,610

For Internal-Internal trips, all VMT are within the jurisdictional boundary. For Internal-External/External-Internal trips, fifty (50) percent of the total VMT associated with the full trip lengths is allocated to a jurisdiction. All VMT associated with External-External trips are excluded as they represent the miles of pass-through trips. The trip types and VMT allocation method are provided Table 11 and illustrated in Figure 5.

Table 11 O-D VMT allocation method

Trip Type	Definition	VMT Allocation Method
Internal-Internal	Trips that start AND end within jurisdiction boundary	ALL VMT included in jurisdiction's total VMT
Internal-External/ External-Internal	Trips that start OR end within jurisdiction boundary	50% VMT included in jurisdiction's total VMT
External-External	Trips that neither start nor end within jurisdiction boundary	No VMT included in jurisdiction's total VMT

Figure 5 Illustration of O-D trip types and VMT allocation method



As shown in Figure 5, the blue lines indicate the jurisdictional boundary, the green lines represent the miles counted, and the black dashed lines are the miles not counted. Using the O-D VMT method, half of the total VMT from internal-external or external-internal trips are included.

The origin-destination VMT allocation method, illustrated using an original data table as provided by SANDAG, are given in Figure 6.

Figure 6 Illustration of O-D VMT allocation method with SANDAG data table¹

JURISDICTION	2012 Base Year (573)				
	TOTAL VMT	TOTAL JURISDICTION19 VMT	Two Trip End JURISDICTION19 VMT	One Trip End JURISDICTION19 VMT	NON-JURISDICTION19 VMT
		I-I, I-E and E-I	I-I	I-E and E-I	E-E
JURISDICTION1 TOTAL	3,112,142	310,083	-	310,083	2,802,059
JURISDICTION2 TOTAL	3,516,776	3,339	-	3,339	3,513,437
JURISDICTION3 TOTAL	369,620	220	-	220	368,800
JURISDICTION4 TOTAL	77,409	645	-	645	76,764
JURISDICTION5 TOTAL	1,895,376	1,540	-	1,540	1,893,836
JURISDICTION6 TOTAL	1,798,598	62,382	-	62,382	1,736,206
JURISDICTION7 TOTAL	2,644,337	127,718	-	127,718	2,516,619
External TOTAL	173,565	1,815	-	1,815	171,750
JURISDICTION8 TOTAL	92,294	19	-	19	92,275
JURISDICTION9 TOTAL	1,529,817	1,153	-	1,153	1,528,664
JURISDICTION10 TOTAL	790,901	163	-	163	790,638
JURISDICTION11 TOTAL	1,545,818	2,253	-	2,253	1,543,565
JURISDICTION12 TOTAL	2,675,295	410,084	-	410,084	2,265,211
JURISDICTION13 TOTAL	863,613	4,683	-	4,683	863,330
JURISDICTION14 TOTAL	36,928,734	272,985	-	272,985	36,655,749
JURISDICTION15 TOTAL	1,839,733	371,904	-	371,904	1,466,369
JURISDICTION16 TOTAL	947,193	3,230	-	3,230	943,963
JURISDICTION17 TOTAL	603,982	15,397	-	15,397	588,585
JURISDICTION18 TOTAL	16,372,819	693,838	-	693,838	15,678,981
JURISDICTION19 TOTAL	1,010,600	1,014,236	241,151	773,185	596,204
REGIONWIDE TOTAL	79,390,852	3,297,787	241,151	3,056,635	76,093,605

As shown in Figure 6, all internal-internal trip miles are included in VMT calculations. For the internal-external/external-internal trips, half of the entire trip miles within the San Diego region are included in VMT calculations, not just the portion of the trip miles within the jurisdictional boundary. None of the external-external trips are included in VMT calculations. Using the example above, the VMT calculation would be 241,151 (or 100% of internal-internal) plus 1,528,318 (or 50% of internal-external/external-internal), equaling 1,769,469.

This method of allocation is recommended in the U.S. Community Protocol, from the SB375 RTAC to CARB, and recognized in the SANDAG technical white paper, as discussed earlier. The previous version of the ICLEI community-wide protocol presented an alternative method to calculate VMT for a jurisdiction: the in-boundary method, or the "clipped" VMT method. This method was used by ICLEI to develop 2005 GHG inventories for most jurisdictions in the San Diego region. This method is discussed in Section 4.3.

¹ SANDAG's original VMT data table was modified to remove the jurisdiction names.

The SANDAG VMT data are provided in miles per weekday, and the last steps to calculate total VMT for a community are to convert average weekday VMT to average daily VMT, then calculate annual VMT. The weekday to annual conversion factor is based on the conversion factor from average weekday to annual (347 weekdays to 365 days per year) described in the CARB statewide inventory technical support document (CARB, 2016).

The annual VMT is calculated using Equation 4.

Equation 4 Annual VMT calculation

$$\text{Annual VMT} = \sum_{\text{trip type}} (\text{VMT}_{\text{trip type}} * \text{Allocation Factor}_{\text{trip type}}) * 347$$

Where,

Annual VMT

= annual VMT of a jurisdiction (miles/year)

$\text{VMT}_{\text{trip type}}$

= VMT for a given trip type (miles/weekday)

$\text{Allocation Factor}_{\text{trip type}}$

= allocation factor using O-D Method of a given trip type (%)

347

= conversion factor, weekday to annual

With,

trip type

= [Internal-Internal, Internal-External/External-Internal, External-External]

For example, using the VMT by trip type given in Table 10, the 2012 annual VMT for a sample jurisdiction are 614,005,743 miles, as calculated in Equation 5.

Equation 5 Example of a jurisdiction's annual VMT calculation

$$\begin{aligned} \text{Annual VMT} &= \sum_{\text{trip type}} (\text{VMT}_{\text{trip type}} * \text{Allocation Factor}_{\text{trip type}}) * 347 \\ &= \left(241,151 \frac{\text{miles}}{\text{weekday}} * 100\% + 3,056,636 \frac{\text{miles}}{\text{weekday}} * 50\% + 594,264 \frac{\text{miles}}{\text{weekday}} * 0\% \right) * 347 \\ &= 614,005,743 \frac{\text{miles}}{\text{year}} \end{aligned}$$

3.5.2 Average vehicle emission rate

The average vehicle CO₂ emission rate is derived from the statewide EMFAC mobile source emissions model developed by CARB and converted to CO₂e using a conversion rate derived from the EPA.

EMFAC CO₂ emission rate

The current version of EMFAC is EMFAC2014, adopted by CARB in 2015. The EMFAC model has undergone methodology and data source updates since its previous versions, EMFAC2007 and EMFAC2011. EMFAC2007 and EMFAC2011 are the vehicle emission rate sources for most of the existing GHG inventories used by jurisdictions in the San Diego region.

Table 12 represents the selections used to download emission rates output files from the EMFAC2014 web database. The smallest geographic area selection in the database is the Metropolitan Planning Organization (MPO) or county level; therefore, EPIC uses the emission rate in the San Diego region for all jurisdictions in the region.

Table 12 EMFAC2014 web database (v1.0.7) default mode selection for emission rate output

Category	Selection
Data type	Emission rates
Region	MPO: SANDAG County: San Diego
Calendar year	Inventory year
Season	Annual
Vehicle category	EMFAC2011 categories (All)
Model year	Aggregated or all model years
Speed	Aggregated
Fuel	All (gas, diesel, electric)

The EMFAC2014 emissions rate output file includes running, start, and idling exhaust emissions rates for the criteria pollutants and CO₂. To calculate the average vehicle CO₂ emission rate, it is necessary to use the VMT distribution (also provided in the EMFAC output file) and the CO₂ running exhaust emission rate (emissions from vehicle tailpipe while traveling on roads) for each type of vehicle category with each fuel type.

CARB released the next model version, EMFAC2017, in December 2017 and is expected to get approval from EPA in 2018. EMFAC2017 includes a GHG module that provides GHG emission estimates directly, including CO₂, CH₄ and N₂O, assuming complete combustion of the fuel (all carbon content of the fuel is converted to CO₂) and CH₄ and N₂O emission rates based on CARB vehicle testing data. No off-model CO₂ to CO₂e conversion (discussed in the following Section 3.5.2.2) will be needed once EMFAC2017 is approved and used for estimating emissions from on-road transportation.

EPIC is developing a Technical Working Paper, "Estimating a Greenhouse Gas Emission Rate for Miles Driven: A Method for Climate Action Planning," which will include comparisons of the model versions and more details on estimating the average vehicle emission rate for GHG inventories and projections.

EPA CO₂ to CO₂e conversion factor

On-road transportation also produces CH₄ and N₂O emissions. EMFAC2014 does not provide CH₄ and N₂O exhaust emissions. Therefore, the CO₂ emission rate is converted to a CO₂e emission rate that includes both CH₄ and N₂O emissions. The conversion factor is based on the EPA GHG Emissions Inventory. The latest EPA GHG Inventory provides CH₄ and N₂O emissions for fossil fuel combustion in on-road vehicles and off-road equipment. Only the on-road CH₄ and N₂O emissions are used, and all fuel types (gasoline, diesel, and alternative fuels) are included. The CH₄ and N₂O emissions are converted to CO₂e using the associated GWPs given in Table 4. Sources and methods are updated in each iteration of the U.S. GHG Emission Inventory. The CO₂, CH₄, and N₂O emissions of the same year vary slightly in each updated version. EPIC uses an average of the CO₂e to CO₂ emissions ratio from the most recent three years as the conversion factor. This conversion factor is currently 1.01.

Table 13 CO₂, CH₄, and N₂O emissions from on-road mobile combustion in U.S. (2012-2014)

Calendar year	CO ₂ emissions (MMT CO ₂ e)	CH ₄ emissions (MMT CO ₂ e)	N ₂ O emissions (MMT CO ₂ e)	Total emissions (MMT CO ₂ e)	CO ₂ e to CO ₂ ratio
2012	1,613	1.6	14.5	1,629	1.01
2013	1,628	1.6	14.5	1,645	1.01
2014	1,656	1.4	12.6	1,671	1.01
Average					1.01
MMT – million metric tons Source: EPA 2016					

Average vehicle CO₂e emission rate for the San Diego region

The average vehicle GHG emissions rate, or the combination of the conversion factor and the average vehicle CO₂ emission rate, can be calculated in terms of CO₂e according to Equation 6.

Equation 6 Average vehicle CO₂e emission rate calculation (San Diego region)

$$CO_2e\ ER_{ave} = \sum_{class, fuel} (VMT\ Distr_{category, fuel} * CO_2\ RUNEX_{category, fuel}) * 1.01$$

Where,

$CO_2e\ ER_{ave}$	= average vehicle CO ₂ emission rate of all vehicle classes and fuel types in the region (grams CO ₂ e per mile)
$VMT\ Distr_{category\ fuel}$	= VMT of a given vehicle class with a given fuel out of total VMT in the San Diego region (%)
$CO_2\ RUNEX_{category\ fuel}$	= CO ₂ running exhaust emissions of a given vehicle with a given fuel (grams CO ₂ per mile)
1.01	= Conversion factor from CO ₂ to CO ₂ e

With,

<i>Class</i>	= [EMFAC2011 Categories, EMFAC2014 Technical Documentation Table 6.1]
<i>Fuel</i>	= [Gas, Diesel, Electric]

Using Equation 6 above, the San Diego region's average vehicle emission rates from 2012 to 2015 are given in Table 14.

Table 14 Average vehicle emission rate (2012-2015) for the San Diego region

Year	Average vehicle emission factor (gram CO ₂ e/mile)
2012	483
2013	476
2014	468
2015	457
Source: CARB, EPIC 2016	

3.5.3 Emissions calculation for on-road transportation category

Total emissions from the on-road transportation category are estimated by multiplying the average vehicle emission rate in the San Diego region with the jurisdiction's annual VMT in a given year, as shown in Equation 7.

Equation 7 Emission calculation for on-road transportation category

$$GHG\ Emissions_{transp} = annual\ VMT * CO_2e\ ER_{ave} * 10^{-6}$$

Where,

$GHG\ Emissions_{transp}$	= emissions from on-road transportation category in a given year (MT CO ₂ e)
$annual\ VMT$	= annual VMT of a jurisdiction (miles/year)
$CO_2e\ ER_{ave}$	= average vehicle CO ₂ e emission rate of all vehicle classes and fuel types in the region (grams CO ₂ e per mile)
10^{-6}	= conversion factor, MT per gram CO ₂ e

Using the example of the annual VMT from Equation 5, the annual on-road transportation emissions are 260,127 MT CO₂e as calculated in Equation 8.

Equation 8 Example of annual on-road transportation emission calculation

$$GHG\ Emissions_{transp} = annual\ VMT * CO_2e\ ER_{ave} * 10^{-6}$$

$$= 614,005,743 \frac{miles}{year} * 483 \frac{g\ CO_2e}{mile} * 10^{-6} \frac{MT\ CO_2e}{g\ CO_2e} = 296,565\ MT\ CO_2e$$

3.5.4 Limitations of method used to calculate emissions from on-road transportation**Travel demand model updates**

As discussed in the activity data collection (Section 3.5.1), SANDAG updates the regional travel demand model for each RTP update approximately every four years.

Due to the model and data sources updates, it is not feasible to re-calibrate VMT data for years prior to a newer version's base year. For example, for jurisdictions in the region using 2005 or 2010 as the CAP baseline year, the VMT data for the CAP baseline years are from previous versions of the travel demand model. Additionally, due to the model and data sources updates, VMT data cannot be compared across versions for the same year. SANDAG has switched from four-step transportation model to activity-based model starting with Series 13. The projected 2012 VMT data from Series 12 cannot be compared with the 2012 VMT data from Series 13. More discussion on VMT comparison is in Section 4.3.

Use of state model for the San Diego region

While the VMT data are specifically tailored to each jurisdiction in the San Diego region, the average vehicle emission rate for the San Diego region is used for all jurisdictions. This value includes the embedded assumptions in the EMFAC model, such as the regional VMT distribution of each vehicle class and alternative-fueled vehicle (AFV) sales in the region. The assumptions in EMFAC may not match the actual conditions in the region or in a particular jurisdiction. For example, if a jurisdiction has more AFV sales, including electric vehicle sales, than the EMFAC model assumptions for the whole region, the regional emission factor may be an overestimate for the jurisdiction.

Additionally, the average vehicle emission rate used in this Appendix is based on the VMT distribution of each vehicle category in the EMFAC model for the San Diego region and the emission factor for each vehicle category. In the EMFAC2011 model, the VMT inputs for the San Diego region were provided by SANDAG to CARB, so that the original source of VMT and emission factor were consistent. In EMFAC2014, the VMT inputs were estimates by CARB based on fuel sale data from the State Board of Equalization, vehicle populations, and odometer data from the Department of Motor Vehicles. Depending on the difference between the models and inputs, the VMT distribution in the EMFAC model may not be consistent with the VMT data in SANDAG's travel demand model. In addition, VMT data for the San Diego region from versions of the EMFAC model also show differences.

3.6 GHG emissions from the water category

Emissions from water use in a jurisdiction arise from the energy required to move water from origin sources to end-use customers, including upstream supply and conveyance, water treatment, and water distribution, as shown in Figure 7. The energy required to move water is primarily electricity but may include natural gas or other fuels.