City of Imperial Beach
Local Coastal Program
Resilient Imperial Beach Climate Action Plan

Final

July 17, 2019

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Acronyms & other abbreviations

Acronyms	Definition
AB	Assembly Bill
ARB	Air Resource Board
BAU	Business as Usual
CAP	Climate Action Plan
CARB	California Air Resources Board
CCE	Community Choice Energy
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CH_4	Methane
CSE	Center for Sustainable Energy
CO_2	Carbon Dioxide
CO_2e	Carbon dioxide equivalent
EMFAC	Emission Factors
EO	Executive Order
EPA	Environmental Protection Agency
EPIC	Energy Policy Initiatives Center of the University of San Diego
EV	Electric Vehicle
EVCS	Electric Vehicle Charging Stations
GHG	Greenhouse Gas
GWP	Global warming potential
HFCs	Hydrofluorocarbons
LCP	Local Coastal Program
LIDAR	Laser Identification Detection and Ranging
MMT CO_2e	Million metric tons of carbon dioxide equivalent
MPOs	Metropolitan Planning Organizations
MT	Metric Ton
MTS	Metropolitan Transit System
N_2O	Nitrous Oxide
NF_3	Nitrogen Trifluoride
PFCs	Perfluorocarbons
PHEVs	Plug-in Hybrid Electric Vehicles
PV	Photovoltaic
ROW	Right of Way
RPS	Renewable Portfolio Standard
RTP	Regional Transportation Plan
SANDAG	San Diego Association of Governments
SB	Senate Bill
SCS	Sustainable Communities Strategies
SDG&E	San Diego Gas and Electric
SDUPD	San Diego Unified Port District
SE	Supporting Effort
SF_6	Sulfur Hexafluoride

TIRCP	California's Transit and Intercity Rail Capital Program
TRNERR	Tijuana River National Estuarine Research Reserve
UC	University of California
U.S.	United States
USFWS	U.S. Fish and Wildlife Service
VMT	Vehicle Miles Traveled

1.0 Executive Summary

The City of Imperial Beach Climate Action Plan (CAP) includes the 2012 Greenhouse Gas (GHG) baseline inventory, forecasted emissions for 2020, 2030, and 2050, and measurable strategies and actions the City will strive to implement to achieve emission reductions. The CAP targets emission reductions below 2012 levels of 4% by 2020 and 42% by 2030, consistent with state guidance in support of state efforts under Assembly Bill (AB) 32 and Senate Bill (SB) 32. The CAP also serves to align the City's reduction efforts with Executive Order (EO) S-3-05 which sets a goal of reducing statewide emissions by 80% by 2050. This CAP establishes a roadmap to meet the 2030 reduction target but only represents the first step in the City's long-term efforts to meet and exceed state targets and goals. Following adoption, the City will identify and pursue resources to accelerate and expand implementation of existing measures and identify additional measures for inclusion in the next CAP update. The City is committed to climate action planning as a process through which it plans for and invests in progressively more aggressive GHG reductions and a more sustainable, adaptable, and resilient community.

While the core impetus behind a CAP is to reduce GHG emissions, it will also have a positive impact on multiple other important factors including the health of the Imperial Beach economy, people, and natural resources. These impacts, referred to hereafter as co-benefits include, but are not limited to, improved air and water quality, energy efficiency, water conservation, grant opportunities, and cost savings. In total this will position Imperial Beach to contribute to state and global efforts to reduce GHG emissions and become more resilient in the face of climate change impacts.

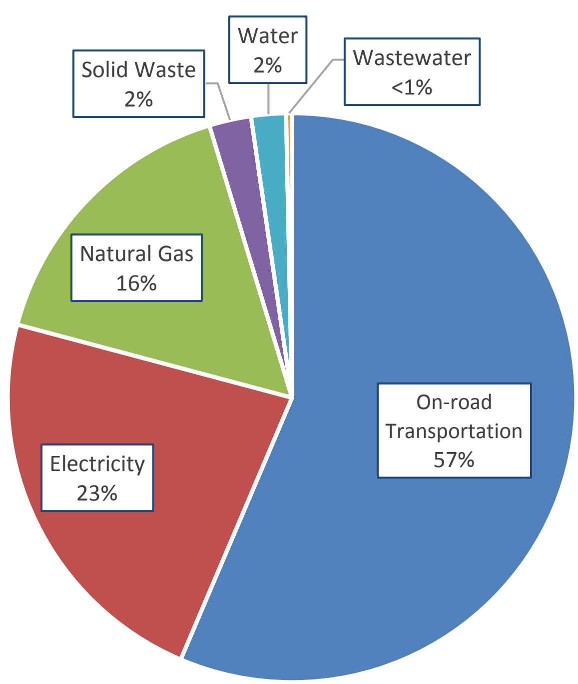
The CAP has been developed in parallel with an update of the City of Imperial Beach General Plan and Local Coastal Program (LCP). This update establishes the CAP as one of the components in the City's vision to become more sustainable, expand its eco-tourism and recreational economy, and support state goals to reduce emissions to 1990 levels by 2020 and 40% and 80% below 1990 levels by 2030 and 2050 respectively. It is also consistent with the City's broader emphasis on establishing policies and pursuing investments that preserve and enhance the economy, environment, and community character of Imperial Beach. In formulating the CAP, the City focused on reasonable targets and measures that are expected to be locally achievable.

1.1 Baseline Emissions and Reduction Strategies

This section provides an overview of the City's GHG emissions profile, 2012 GHG baseline inventory, selected reduction targets, and measures and strategies that have been identified to meet those targets. The 2012 inventory consists of 96,400 Metric Tons (MT) of carbon dioxide equivalent (CO_2e), with transportation, electricity, and natural gas emissions collectively accounting for approximately 96% of the total (Figure 1.1). To be consistent with AB 32 and SB 32 emissions reduction targets at the State level, the target emission levels for Imperial Beach are set at 4% below the 2012 emissions level by 2020 and 42% below the 2012 emissions level by 2030 (Table 1.1). These targets are consistent with State targets under AB 32 and SB 32. The methodology utilized in the target selection process is detailed more fully in Chapter 3 and the technical appendices. Emissions reductions that would be needed to meet the long-term goals set in EO S-3-05 are also included; however, the strategies and measures are geared towards achieving reductions through the CAP's 2030 horizon year (Table 1.2). The 2020 target will be met without the need for any local actions. As a result, the measures and strategies are only listed with their estimated contribution towards achieving the 2030 CAP target.

Of the 26,300 MT CO_2e reductions needed to meet the CAP's 2030 target, 6,454 MT CO_2e are estimated to come from local efforts included in the CAP strategies and measures. This amounts to approximately 25% of total reductions while the other 75%, 19,992 MT CO_2e, are estimated to result from federal and state actions.

Figure 1.1 Imperial Beach 2012 GHG Emissions Inventory by Category



Percentage may not add to totals due to rounding.
Energy Policy Initiatives Center, 2018

Table 1.1 Emissions Projection, Reduction Targets, and Emissions Reduction Needed

Year	Business-as-usual Projection (MT CO_2e)	Target Emission Level (% below baseline)	Target Emission Levels (MT CO_2e)	Emissions Reduction Needed to Meet Target (MT CO_2e)
2012	96,400	-	-	-
2020	81,100	-4%	92,700	-11,500
2030	82,200	-42%	55,900	26,300

*Emissions values are rounded.

*Energy Policy Initiatives Center, 2018

Table 1.2 Measures and Quantified Reductions to meet CAP 2030 GHG Emission Reduction Target

Emissions Category	Reduction Strategies and Measures		2030	
			MT CO_2e	% of Local Reductions
On-Road Transportation	Strategy: Clean and Efficient Transportation			
	T.1	Increase Citywide Electric Vehicle (EV) Charging Stations	751	11%
	T.2	Clean Municipal Fleet	48	1%
	Strategy: Reduce Vehicle Miles Traveled (VMT)			
	T.3	Increase Mass Transit Ridership	687	10%
	T.4	Improve Pedestrian and Bicycle Facilities	342	5%
	T.5	Reduce Municipal Employee VMT	13	<1%
Energy	Strategy: Increase Renewable Electricity			
	E.1	Increase Grid-Supply Renewables	1,204	17%
	E.2	Increase Commercial Solar Photovoltaic (PV)	59	1%
Waste	Strategy: Zero Waste			
	W.1	Divert Waste from Landfill	3,318	51%
Carbon Sequestration	Strategy: Carbon Sequestration			
	S.1	Tree Planting	31	<1%
Total GHG Reductions Needed to Reach 2030 Target				**6,454 MT CO_2e**
Total Potential GHG Reductions from Local Measures				**6,454 MT CO_2e**

*Percentages are rounded and may not sum.

1.2 CAP Structure

Including this Executive Summary the CAP has a total of five chapters and 4 appendices:

- Chapter 1 – Executive Summary
- Chapter 2 – Planning for Climate Change
- Chapter 3 – Greenhouse Gas Emissions
- Chapter 4 – Emission Reduction Measures
- Chapter 5 – CAP Monitoring and Updates
- Appendix A – Greenhouse Gas Emissions Inventory and Projections
- Appendix B – Methods for Estimating Greenhouse Gas Emissions Reductions in the Imperial Beach Climate Action Plan
- Appendix C – CAP Measure Cost Overview
- Appendix D – Consolidated Measure Implementation Action Matrix

2.0 Planning for Climate Change

Table 2.1 Imperial Beach Climate Action Plan Goals

1. Analyze Imperial Beach's 2012 baseline GHG emissions and 2020, 2030, and 2050 projected Business as Usual (BAU) Emissions.
2. Establish GHG emissions targets for 2020 and 2030 consistent with state goals identified in Assembly Bill (AB 32) and Senate Bill (SB 32).
3. Identify a set of quantifiable measures and supporting efforts to meet the established GHG emission reduction targets.
4. Outline a discrete set of tasks to implement the CAP measures.
5. Provide a framework for monitoring and verifying the effectiveness of CAP measures and making necessary changes to meet the established GHG emission reduction targets and maximize co-benefits.
6. Align with 2050 statewide GHG emission reduction goal set under EO S-3-05.

Imperial Beach is the most southwesterly city in the continental United States. The City is almost entirely built out and very little vacant developable land remains that has not been permanently preserved. As a result, future growth is expected to occur as property redevelops in accordance with the existing land uses.

The City has experienced relatively little population growth since 1990, effectively adding less than 1,000 people for a total population of 27,418 as of 2016. The City also does not have a large employment base. Instead it is primarily a residential and visitor-serving community that offers residents and visitors access to the classic Southern California small beach town lifestyle and an abundance of natural resources to enjoy. As a result, there is no meaningful industrial or heavy commercial activity in Imperial Beach or emissions from those sources. According to the San Diego Association of Governments (SANDAG) and the United States (U.S.) Census, the education, healthcare, and retail/leisure sectors comprise more than two-thirds of the employment base within the City. Approximately 95% of the Imperial Beach workforce commutes to jobs outside of the City. Overall, 75% of employed residents drive alone to work, 11% carpool, 4% use public transportation, 4% walk or bike, and 4% work at home. The combined lack of energy intensive industrial activities, high commute rate outside of the City, and single occupancy commute rate results in an emissions profile that is heavily skewed towards transportation and residential energy sources, with transportation emissions forming the largest portion.

Transportation

Imperial Beach has already taken numerous steps to address transportation emissions. The City has continued to expand its network of bicycle routes and improve the safety and condition of its sidewalks and streets to promote more active methods of transportation. The City has taken additional efforts to expand its eco-tourism, recreational, and visitor-serving economy that are expanding the local employment base, effectively providing more residents the opportunity to work in their own community and avoid longer commutes.

Despite these efforts, Imperial Beach has limited authority and fiscal capacity to significantly reduce transportation emissions. There are four primary methods to reduce transportation emissions:

- Deploy clean vehicles and support clean transportation infrastructure
- Reduce driving and shorten commutes through mixed use development and smart growth
- Increase public transit ridership
- Increase biking, walking, and other first mile/last mile modes

While the City can and does play a role in each of these, regional, state, and federal policies, plans, and investments are the core drivers of large-scale transportation sector GHG reductions. Adoption of clean vehicles is largely driven by macroeconomic trends, policies, and funding at the national and state levels. Public transit planning is handled at the regional level through SANDAG and the Metropolitan Transit System (MTS), and while Imperial Beach is served by two bus lines with strong ridership, with an additional line in the planning stages, dramatic increases in transit ridership are not likely given the City's limited employment and population density. The CAP includes measures intended to improve connections to transit, continue efforts to make the City more walkable and bikeable, and expand clean vehicle infrastructure, such as EV charging stations.

Energy and Energy Efficiency

GHG emissions from electricity and natural gas use in buildings comprise the bulk of the remaining emissions in the City. Imperial Beach currently receives its energy from San Diego Gas and Electric (SDG&E), 33% of which is required to consist of renewables by 2020, 60% by 2030, and 100% by 2045. To achieve its emissions reductions targets, the community will need to reach higher shares of renewables and become more energy efficient. The two main mechanisms for increasing the renewable content of the community's electricity supply are to ensure grid-supplied electricity contains more renewable energy or to increase the generation of renewable power within the City. Community Choice Energy (CCE) or changes to SDG&E's energy portfolio are the most likely frameworks for increasing grid-supplied renewable energy. Additional solar systems on buildings within the community and distributed energy storage systems provide the second avenue to increase the quantity of local renewable energy used in the community. Beginning in 2020, the California Energy Commission (CEC) will require new residential units to include solar with limited exceptions. The CAP complements this residential requirement with a measure to install solar on new and remodeled commercial development. Finally, while there is no measure directed at energy efficiency, the City is committed to ensuring that available resources and funding from SDG&E and state programs are invested in residential and commercial energy efficiency projects in the community.

Waste and Carbon Sequestration

Reduction of solid waste is the primary mechanism that is included in the CAP to decrease GHGs from this category. The State has aggressive targets for diverting waste and reducing greenhouse gas emissions from landfills. The City's current franchise waste hauler is EDCO. The City, EDCO, and local community must be active participants to achieve waste reductions, especially since the included waste reduction measure is anticipated to account for over half of all CAP measure emission reductions to meet the 2030 target.

Carbon sequestration is also an important strategy included in the CAP. Compared to the regional average, Imperial Beach has fewer trees and a lower proportion of the City covered by tree canopies. Trees are effective at sequestering GHG emissions and provide a range of additional benefits that include reducing temperature and energy use and improving air and water quality, aesthetics, and general quality of life. The City is also surrounded on three sides by valuable natural resources that can be enhanced or restored to sequester carbon. The Imperial Beach coastal shoreline, the San Diego Bayfront, and the Tijuana Estuary present future opportunities to sequester carbon through habitat conservation, restoration, and/or enhancement. Additional work is necessary to quantify the carbon sequestration benefits of these natural areas, however, the potential sequestration benefit could be substantial. Because of this potential it is included in the CAP as a supporting effort rather than a quantified measure.

Sequestration is recognized as an important part of the State's climate change approach. Governor Brown's Executive Order (EO) B-55-18 set a goal of carbon neutrality by 2045 which can likely only be achieved with a major expansion of carbon sequestration efforts. Given it is likely that that this EO will be codified into law within the next several years, Imperial Beach will play a small but important role in meeting this objective through expansion of its urban forest and enhancement and conservation of habitat both within its boundaries and adjacent to the City.

2.1 The Purpose of Imperial Beach's Climate Action Plan

The purpose of the CAP is to establish a roadmap for the City to meet the 2020 and 2030 GHG reduction targets and become more sustainable, adaptable, and resilient. While the core impetus behind a CAP is to reduce GHG emissions, it will also have a positive impact on multiple other important factors including the health of the Imperial Beach economy, people, and natural resources. These impacts, referred to hereafter as co-benefits include, but are not limited to, improved air and water quality, energy efficiency, water conservation, grant opportunities, and cost savings. In total this will position Imperial Beach to contribute to state and global efforts to reduce GHG emissions and become more resilient in the face of climate change impacts. While the City of Imperial Beach CAP is intended to be a strategy for reducing emissions, it is not currently intended to be used as a California Environmental Quality Act (CEQA) mitigation document. As in other communities throughout the state, the Imperial Beach CAP is a mechanism to support the State's climate protection efforts. The City does however, as part of its ongoing implementation process, commit to identifying and pursuing the resources necessary to adapt the CAP into a CEQA mitigation document by 2025. Potential sources of funding to achieve this include grants and funding from the City's FY22-23 and FY23-24 municipal budgeting and CIP process, or a combination of both.

The 2019 CAP has been developed in parallel with a targeted update of the City's General Plan and LCP. It is the result of a collaborative process between City of Imperial Beach staff, the City Council and various commissions, the community, SANDAG, the Energy Policy Initiatives Center of the University of San Diego (EPIC), and the Resilient Imperial Beach LCP and General Plan Update Steering and Stakeholder Committees.

Outreach to the public was conducted through a series of public meetings and workshops and a community survey.

The CAP contains:

- A summary of the City of Imperial Beach 2012 GHG baseline missions Inventory, which identifies the major sources and quantities of GHG emissions attributable to the City and forecasts how these emissions may change over time
- The identified emissions gap the City will need to close through CAP measures in order the meet its targets consistent with AB 32 and SB 32 and related legislation, and in alignment with the long-term goal identified in EO S-3-05
- CAP GHG reduction measures, implementing actions, and a recommended monitoring and update framework to verify the effectiveness of CAP measures and make adjustments and changes moving forward, if necessary

In addition to reducing emissions, the CAP will result in a range of additional co-benefits such as those listed in Table 2.2. Many of these potential co-benefits will also ensure that the City is better able to adapt to current and future climate change impacts such as increasing temperatures and sea level rise that manifest themselves in the form of more frequent and severe flooding, more intense heat waves and exacerbated urban heat island effects, severe droughts, and deteriorating air quality among others. The City of Imperial Beach completed its Sea Level Rise Assessment in 2016 to identify future sea level rise scenarios and associated impacts that could occur without additional adaptation strategies. The City's General Plan and Local Coastal Program Update includes policies and a framework for the City to identify and select the most appropriate strategies to adapt to sea level rise, as well as policies to adapt to other climate change impacts. The City intends to address climate adaptation more robustly in the first update to the CAP.

Table 2.2 Potential Co-benefits from CAP Implementation

Improved/increased natural habitat	Improved water quality
Improved air quality	Reduced traffic congestion
Reduced energy use	Reduced water run-off
Reduced urban heat island effect	Reduced waste
Improved public health	More local jobs
Improved safety	Improved mobility

2.2 California Climate Protection Efforts and Actions

In 2006, the State passed AB 32, the California Global Warming Solutions Act of 2006, which laid the foundation for future efforts. Since that time a number of key pieces of legislation and executive actions, including SB 32 and EO S-3-05, have reinforced and accelerated state efforts to reduce GHG emissions. SB 32, adopted in 2016, effectively requires a 40% reduction of statewide GHG emissions below 1990 levels by 2030. These and other important cornerstones of California climate policy that are most applicable to the City's CAP are included in Table 2.3 along with an explanation of their importance.

The state established an initial Scoping Plan in 2008 and undertook two updates in 2014 and 2017. These documents function as the road maps for meeting the State's emission reduction targets. The original 2008 Scoping Plan recognized the important role of local governments in meeting these targets and recommended a reduction in communitywide and municipal operations to levels that would parallel the State's AB 32 target.

Table 2.3 Key California Climate Change Regulations and Legislation

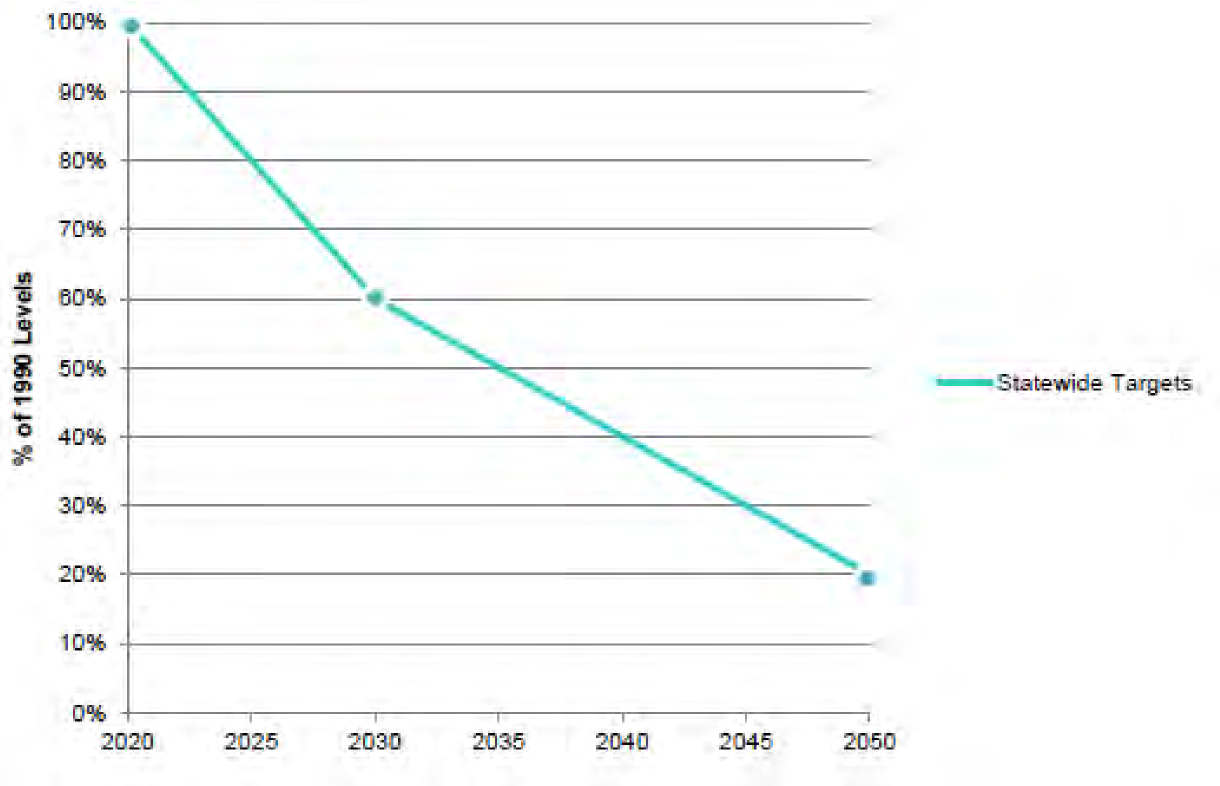
Regulation/Legislation	Title/Issue	Description
AB 32	Global Warming Solutions Act of 2006	Requires the state to reduce emissions to 1990 levels by 2020 and led to other companion legislation and regulations
SB 32	Amends the Global Warming Solutions Act of 2006	Requires the state to reduce emissions to 40% below 1990 levels by 2030
EO S-3-05	Executive Order	Establishes a goal of reducing statewide emissions to 80% below 1990 levels by 2050
EO B-55-18	Executive Order to Achieve Carbon Neutrality	Establishes a goal of achieving carbon neutrality as soon as possible and no later than 2045
SB 375	Sustainable Communities and Climate Protection Act of 2008	Requires regional targets for GHG reductions from passenger vehicles through better land use and transportation planning and a Sustainable Communities Strategy
SB 535 and AB 1550	Greenhouse Gas Reduction Fund Investments in Disadvantaged and Low-Income Communities	Requires the identification of disadvantaged and low-income communities throughout the state and sets minimum targets for overall investments
SB 350	Clean Energy and Pollution Reduction Act	Set 2030 targets for increasing the state renewable energy mix to 50%, doubling of energy efficiency in existing buildings, and a modernized electric grid
SB 100	California Renewables Portfolio Standard Program	Increased 2030 targets for increasing the state renewable energy mix to 60% by 2030 and 100% by 2045
Executive Order S-01-07	Low Carbon Fuel Standard	Established a target to reduce the amount of carbon in transportation fuels by 10% by 2020
Advanced Clean Cars Program	Passenger Vehicle GHG Emissions	Set emission standards for vehicles and targets for deployment of zero-emissions vehicles
SB 379	Climate Adaptation and Resiliency Planning	Requires cities and counties to incorporate climate adaptation and resiliency into core local planning documents and processes
California Energy Commission	2019 Building Energy Efficiency Standards	Requires solar PV on new residential units with limited exceptions

The 2017 Climate Change Scoping Plan Update adopted by the California Air Resources Board (CARB) outlines strategies for achieving these target reductions and encourages local jurisdictions to develop their own targets to reduce communitywide emission by 40% and 80% below 1990 levels by 2030 and 2050 respectively. It should be noted however that the State's 2050 goal is driven by EO S-3-05, which is not codified law, and that establishing specific measures to achieve such a goal is highly speculative and not realistic given the changes in public policy, technology, and demographics that are expected to occur. As a result, CAPs generally focus on achieving interim reductions consistent with SB 32's 2030 target or through 2035 in alignment with progression towards the 2050 goal.

2.3 State of California Climate Emissions Targets

Statewide emissions targets and associated trajectories needed to meet those targets in are shown in Figure 2.1. Imperial Beach selected its own CAP reduction targets to be consistent with the reductions in this graphic. Again, as noted earlier Imperial Beach does not have a 1990 emissions inventory so reductions below 2012 levels that would be equivalent with achieving 1990 emissions levels by 2020 per AB 32 and a 40% reduction by 2030 per SB 32 were calculated. To do this, statewide reductions needed to achieve AB 32 and SB 32 targets using 2012 as the baseline year were calculated. This requires a 4% reduction in statewide emissions by 2020 to comply with AB 32 and a 42% reduction to comply with SB 32. The application of these targets to the CAP establishes consistency with the statewide targets.

Figure 2.1 Statewide GHG Reduction Targets



Source: CARB

2.4 Regional Efforts

There are a variety of regional efforts to reduce emissions. Through SB 375, the Sustainable Communities and Climate Protection Act of 2008, regional targets for GHG emissions reductions from passenger vehicle use were established. This requires Metropolitan Planning Organizations (MPOs), including SANDAG, to adopt Sustainable Communities Strategies (SCS) as part of their regional transportation plans (RTP). This includes identifying land use, housing, and transportation strategies that will achieve the regional GHG reduction targets through a reduction in per-capita emissions.

The most recent SANDAG RTP/SCS, San Diego Forward: The Regional Plan, was adopted in October of 2015 and establishes the regional strategy to exceed SB 375 targets by achieving per-capita reductions of 15% and 19% respectively by 2020 and 2035 compared to a 2005 baseline. The two components for achieving this reduction are reducing per-capita VMT in combination with cleaner vehicles.[1] There are no local government requirements resulting from SB 375. Instead the planning process itself is intended to result in a prioritization of land use and transportation projects, investments, and policies that would put the region on a path to achieve these targets. Improved and expanded public transit, biking and walking infrastructure, mixed use transit-oriented development and communities, and related programs and projects all form part

[1] ARB's EMFAC model provides vehicle emissions factors for California by county that are multiplied by per-capita VMT to estimate progress towards SB 375 targets.

of the regional SB 375 toolbox. While there are no concrete penalties for falling short of these targets, projects that are consistent with an approved SCS that are also categorized as transit priority projects receive incentives under CEQA.

In addition to the SANDAG RTP/SCS, there are several other regional climate programs and coordination frameworks that intersect with the Imperial Beach CAP. These include multiple SANDAG resources such as the Regional Climate Action Strategy, Regional Climate Action Planning Framework, Energy Roadmap Program, and Regional Plug-In Electric Vehicle Readiness Plan. Other resources and frameworks include the San Diego Regional Clean Cities Coalition, the San Diego Regional Climate Collaborative, and tools and technical assistance offered by the San Diego Foundation. Collectively these provide Imperial Beach with resources and avenues for coordination and collaboration that can help the City achieve its own emission reduction targets, contribute to regional GHG targets, and ensure that regional efforts benefit the City. Table 2.4 includes descriptions of several of these programs and frameworks.

Table 2.4 Regional Climate Frameworks and Efforts

Frameworks/Efforts	Description
SANDAG	
Regional Climate Action Strategy	Guidance document that includes potential climate policies for local governments to inform updates to long range planning documents such as general plans
Regional Climate Action Planning Framework	Identifies best practices and guidance for preparing CAPs and monitoring their implementation over time
Energy Roadmap	Local government partnership with SDG&E. Development of Roadmaps to identify energy savings, cost savings, and GHG reductions for municipal buildings and parks
Regional Plug-In EV Readiness Plan	Addresses barriers to EV adoption through best practices, resources, and recommendations.
San Diego Regional Clean Cities Coalition	Targets reduced petroleum use in transportation through increased use of alternative fuel and alternative fuel vehicles, and other measures that improve fuel economy. Focus is primarily on planning, education, and outreach
San Diego Regional Climate Collaborative	Network to share expertise, leverage resources, and advance solutions to facilitate climate planning
Tijuana River National Estuarine Research Reserve (TRNERR)	Preserves, protects, and manages the natural and cultural resources of the Tijuana River Estuary by focusing on research and education with compatible recreation and resource use.
Center for Climate Change Impacts and Adaptation	Provides research, education, and collaboration opportunities on climate change impacts and adaptation, including partnering with Imperial Beach to monitor sea level rise.

3.0 Greenhouse Gas Emissions

The state of California defines GHGs as being any of seven compounds. Table 3.1 details the approximate atmospheric lifetime and global warming potential (GWP) value of each compound. GWPs are used to convert emission values into carbon dioxide equivalents (CO_2e) units.

Table 3.1 Defined GHG Compounds

	Atmospheric Lifetime (years)	Global Warming Potential
Carbon Dioxide (CO_2)	5 to 200	1
Methane (CH_4)	12	25
Nitrous Oxide (N_2O)	114	298
Hydrofluorocarbons (HFCs)	1 to 270	124 to 14,800
Perfluorocarbons (PFCs)	2,600 to 50,000	7,390 to 12,200
Sulfur Hexafluoride (SF_6)	3,200	22,800
Nitrogen Trifluoride (NF_3)	740	17,200

Source: California Health and Safety Code Section 38505(g).
*Listed in the 2009 U.S. Environmental Protection Agency (EPA) Proposed Endangerment and Cause or Contribute Findings for GHGs under the Clean Air Act (Endangerment Finding) in the Federal Register.

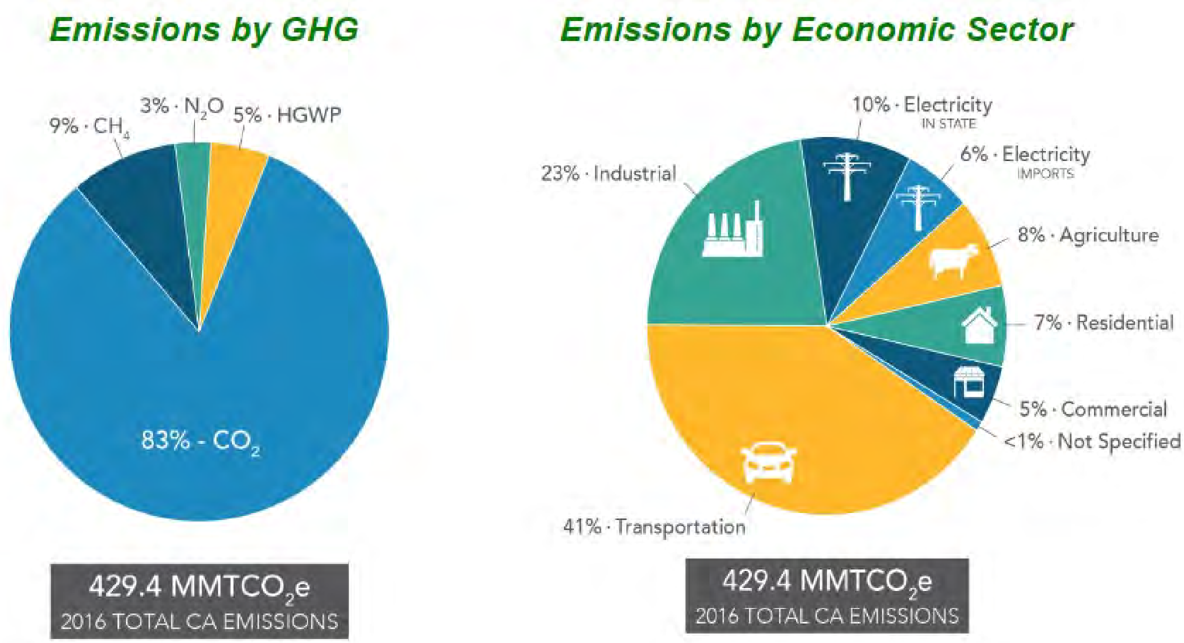
California groups the shaded rows into one category called High Global Warming Potential Gases, nearly all of which is comprised of HFCs.[2]

Figure 3.1 illustrates the breakdown of California emissions by GHG type as estimated in the State's 2018 Edition of the GHG Emission Inventory Report (released July 11th, 2018) and the emissions by economic sector. At a statewide level, transportation emissions account for the largest portion of overall GHG emissions by economic sector (41%) followed by

[2] California Air Resources Board. High Global Warming Potential Gases. https://www.arb.ca.gov/cc/inventory/background/hgwp.htm

industrial (23%) and electricity (16%). The proportion of emissions by economic sector varies considerably by community depending on the mix of uses and economic activities that occur within them.

Figure 3.1. California Emissions by GHG Type and by Economic Sector



Source: CARB

Cities such as Imperial Beach that do not have industrial, heavy commercial, or agriculturally oriented economies generally have little or no emissions from these sectors and consequently generally low per capita emissions. This results in other sectors and activities such as transportation and electricity and natural gas use accounting for the vast majority of GHG inventory emissions. In order to meet their GHG reduction targets, cities like Imperial Beach must develop realistic, achievable, local CAP measures. The development of these measures begins with a thorough understanding of baseline and future estimated community-wide emissions levels. This chapter includes a detailed breakdown of the source and quantity of emissions generated by activities associated with emissions categories within Imperial Beach, and expected emissions levels through the CAP target years of 2020 and 2030 as well as the 2050 alignment year. This information forms the foundation for developing local CAP measures that can be implemented and have achievable GHG reduction targets.

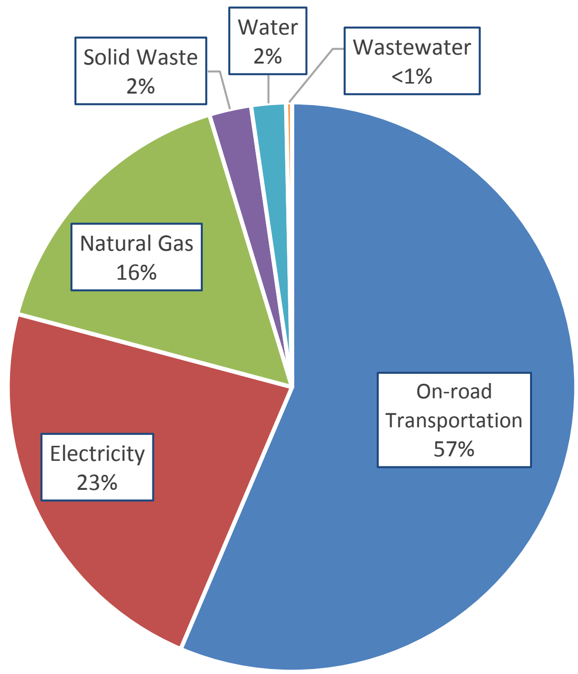
3.1 Imperial Beach GHG Inventory and BAU Projections

A baseline GHG inventory for 2012 was calculated to provide a snapshot in time of community-wide quantity and sources of emissions. BAU emissions projections were then calculated for 2020, 2030, and 2050. BAU projections estimate future communitywide emissions growth absent any new policies or programs or future impacts of already adopted federal and State of California policies. The impacts of already adopted federal and State policies are then incorporated into these projections and referred to as the Legislatively Adjusted BAU emissions projections.

Emissions Sectors and Baseline Inventory

The baseline inventory is comprised of six emissions categories (Figure 3.2). The on-road transportation sector alone accounts for the majority of emissions (57%), followed by electricity (23%), and natural gas (16%). Emissions from the transportation sector in particular form a much larger portion of the City's inventory than the state as a whole. Again, this is a result of the lack of industrial and heavy commercial economic activities in Imperial Beach.

Figure 3.2 % of Imperial Beach GHG Emissions by Emissions Category (2012)



Percentage may not add to totals due to rounding.
Energy Policy Initiatives Center, 2018

Table 3.2 MT CO_2e GHG Emissions by Emissions Category*

Emissions Category	2012 GHG Emissions (MT CO_2e)
On-Road Transportation**	54,400
Electricity ***	21,900
Natural Gas***	15,600
Solid Waste	2,300
Water	1,900
Wastewater	300
Total	**96,400**

*Sums may not add up to totals due to rounding. GHG emissions for each category are rounded to the nearest hundreds. Values are not rounded in the intermediary steps in the calculation.
**Based on SANDAG Series 13 VMT estimates. 2012 is the Series 13 Base Year.
Energy Policy Initiatives Center, 2018.
*** Electricity and Natural Gas have been consolidated into an Energy category in Chapter 4. Emission reduction Measures.

The following list includes the six categories and the associated activities that contribute to their emissions (note that electricity and natural gas are listed jointly since they are both utilized in buildings and in similar activities):

- Transportation: Passenger cars; light-, medium-, and heavy-duty trucks; buses; mobile homes; and motorcycles
- Electricity and Natural Gas: Buildings and infrastructure
- Solid Waste: Disposed organic and mixed waste from City residences and businesses
- Water: Treatment, transport, and distribution of water
- Wastewater: Treatment and transportation of wastewater

Transportation sector emissions were developed using SANDAG VMT estimates for Imperial Beach and then quantified based on the CARB Emission Factors (EMFAC) 2014 model, which incorporates statewide transportation sector GHG reduction programs. In order to estimate an emission factor per mile, it was assumed that Imperial Beach has the same EMFAC distribution of vehicle class types as the San Diego Region. This was then multiplied by the annual VMT forecast to estimate annual GHG emissions.

Emissions from electricity use and natural gas in Imperial Beach were estimated using the Built Environment (BE.2) and Built Environment (BE.1) methods from the U.S. Community Protocol. Similar to transportation, electricity emissions were calculated by multiplying a city-specific electricity emission factor by the adjusted net energy for load (electricity sales + transmission losses). The electricity emissions factor is derived from the mix of bundled power supplied from SDG&E. Natural gas emissions estimates were calculated by multiplying annual natural gas use by a natural gas emission factor based on CARB data. The detailed methodologies for estimating emissions from all six emissions sectors are included in Appendix A.

Emissions from solid waste were estimated using method Solid Waste (SW.4) from the U.S. Community Protocol. To estimate emissions, the amount of waste disposed in a given year is multiplied by an emission factor for mixed solid waste.

Emissions from water use were estimated using the Wastewater and Water (WW.14) method from the U.S. Community Protocol. California American Water Company (CalAm) Southern Division, a privately owned utility company provides potable water to the City. The energy and emissions used to supply potable water to the City varies by the source of the water and were calculated based on the percentage of potable water supplied from each source and then aggregated.

The emissions from wastewater generated by Imperial Beach were estimated by multiplying the total amount of wastewater generated annually by the emission factor of the wastewater treatment process. The City's Public Works Department operates and maintains the wastewater collection system within the City. The wastewater is delivered to the City of San Diego Metropolitan Sewerage System and treated at its wastewater treatment plants.

While the CAP is a critical vehicle for reducing GHG emissions, it should only be viewed as a foundation for reducing overall community-wide emissions. Separate and complementary actions by residents and businesses in addition to CAP strategies and measures would result in additional reductions. For example, residents can make behavior changes such as biking, walking, taking transit, and altering their consumption patterns. Businesses can make many similar changes to reduce their own emissions. The CAP measures are intended to facilitate and support these changes through investments in biking, walking, and transit infrastructure and programs, and other actions such as publicizing information on rebates and incentives, but there are many additive actions that residents and businesses can take. Such actions can further reduce community wide emissions.

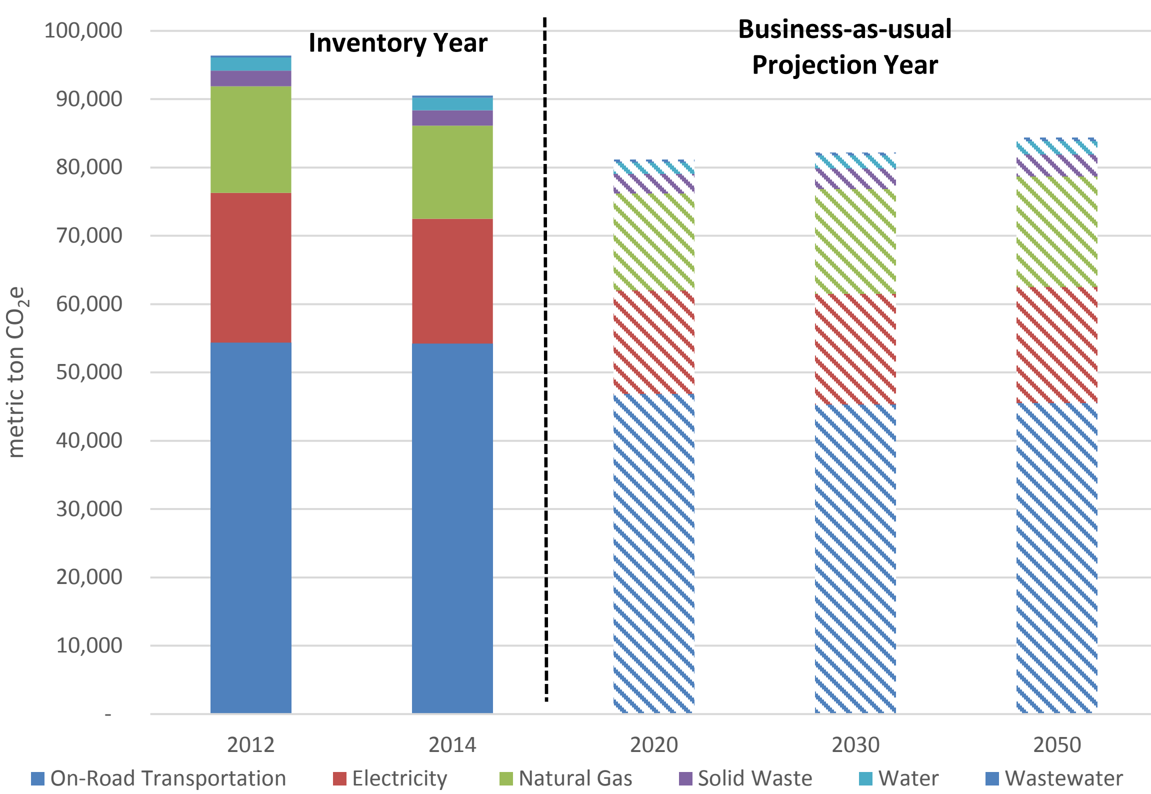
3.2 BAU Projections, Targets, and Local Gap

BAU Projections

With the baseline inventory established, community-wide BAU and Legislatively Adjusted BAU emissions forecasts were completed to estimate the quantity of emissions that would need to be reduced through local actions to meet the City's emissions targets consistent with AB 32 in 2020 and SB 32 in 2030.

BAU projections were first completed to demonstrate emissions growth in the absence of any new policies and programs that would be expected to further reduce emissions (Figure 3.3 and Table 3.3). With no additional actions emissions are estimated to decrease through 2020 due to federal and state actions and then begin increasing thereafter. The gradual increase through 2050 is estimated to be attributable to factors such as population growth and full impact of existing federal and state policies occurring earlier. The Legislatively Adjusted BAU projections, are included in the Local Emissions Gap section and include estimated future emissions reductions from existing legislation and regulations.

Figure 3.3 Imperial Beach BAU Projections



Source: Energy Policy Initiatives Center, 2018

Table 3.3. Imperial Beach BAU Projections*

Year	On-Road Transportation	Electricity	Natural Gas	Solid Waste	Water	Wastewater	Total
	MT CO_2e						
2012	54,400	21,900	15,600	2,300	1,900	300	96,400
2020	46,900	15,100	14,200	2,800	1,700	400	81,100
2030	45,300	16,200	15,400	3,100	1,900	400	82,200
2050	45,600	17,000	16,200	3,200	2,000	400	84,400

*GHG emissions have been rounded to hundreds. CO_2e; Inventory years: 2012 and 2014; business-as-usual projection years without policy change: *2020, 2030 and 2035*.

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Source: Energy Policy Initiatives Center

Selecting CAP 2020 and 2030 Targets and 2050 Goal

There are many options for cities to consider in selecting reduction targets that are consistent with State objectives. There is no State guidance however that directs cities to choose specific targets. The Imperial Beach CAP targets have been selected to be consistent with State targets. Since Imperial Beach does not have a 1990 inventory the State targets need to be recalculated using a 2012 baseline to correspond to the City's baseline inventory. This allows the setting of local targets that are consistent with State GHG targets (Table 3.4 and Figure 3.4). Based on this recalculation, statewide reductions of 4%, 42%, and 81% below 2012 levels are needed to meet 2020 and 2030 targets and align with the 2050 goal.

Table 3.4 Statewide Reduction Targets Adjusted for a 2012 Baseline

Year	Statewide Inventory (MMT CO_2e)	Statewide 2020 Target (AB 32)		Statewide 2030 Target (SB 32)		Statewide 2050 Goal (EO S-3-05)	
		Emissions Level = 1990 (MMT CO_2e)	% Reduction from Inventory Year	Emissions Level = 40% < 1990 (MMT CO_2e)	% Reduction from Inventory Year	Emissions Level = 80% < 1990 (MMT CO_2e)	% Reduction from Inventory Year
2012	448	431	**-4%**	260	**-42%**	86	**-81%**

MMT CO_2e: million metric ton CO_2e

Figure 3.4 Statewide Reductions Adjusted for a 2012 Baseline*

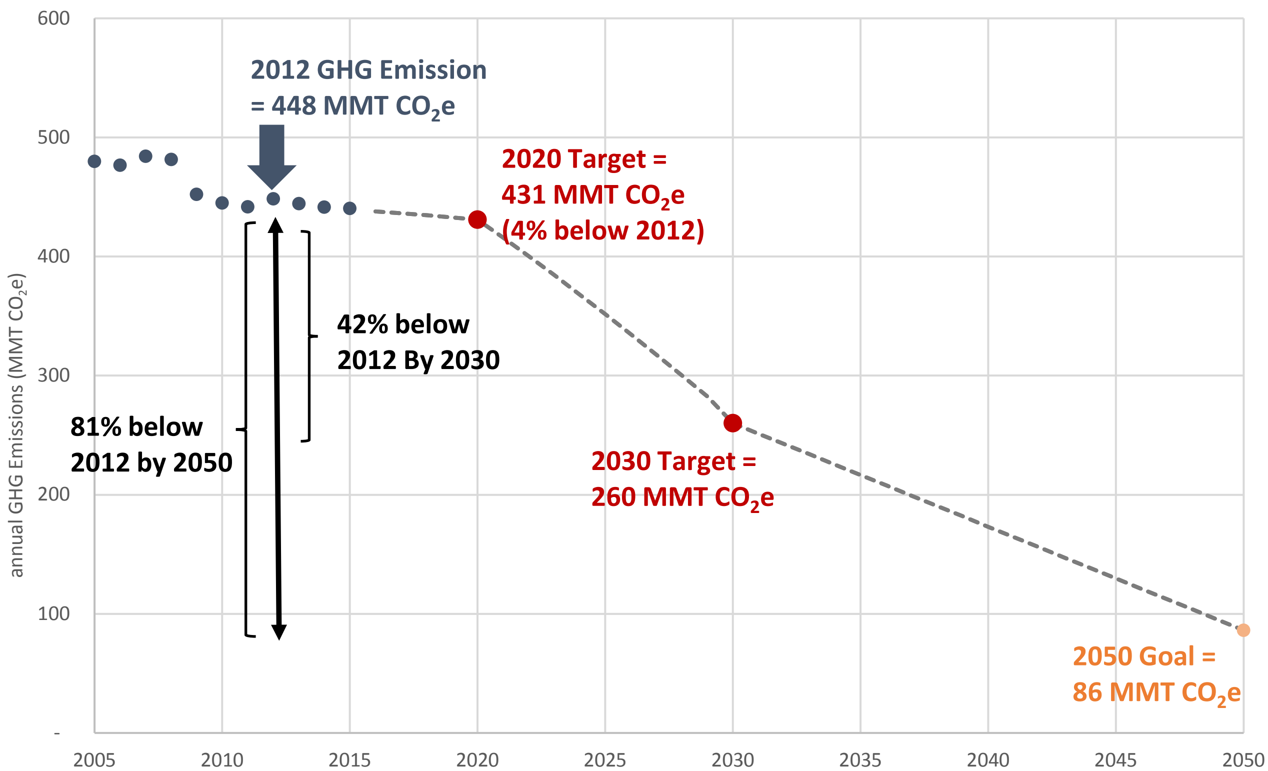


*Figure adapted from California's 2017 Climate Change Scoping Plan Figure 6 that shows a linear, straight-line path to the 2030 target. The 2050 goal is calculated based on 80% below 1990 level (80% below 431 MMT CO_2e).
Source: CARB Greenhouse Gas Emission Inventory (2017 Edition) and 2017 Climate Change Scoping Plan

These percentages were then applied to the Imperial Beach BAU Projections to calculate local emissions targets. Table 3.5 shows the emissions levels that would need to be achieved for the respective target and goal timeframes. The reductions correspond to each time period. No local actions are needed for the City to reach its 2020 target. In 2030, a reduction of 26,300 MT CO_2e is needed for the City to meet its 2030 target.

Table 3.5 Emissions Projection, Reduction Targets, and Emissions Reduction Needed

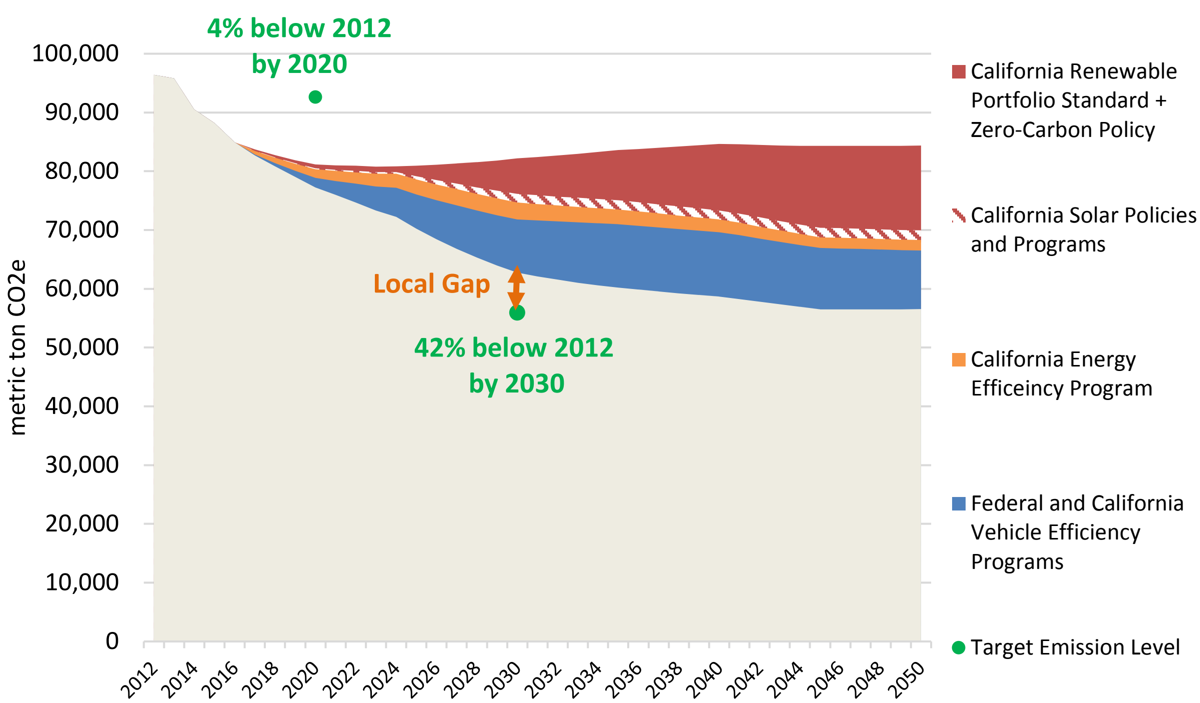
Year	Business-as-usual Projection (MT CO_2e)	Target Emission Level (% below baseline)	Target Emission Levels (MT CO_2e)	Emissions Reduction Needed to Meet Target (MT CO_2e)
2012	96,400	-	-	-
2020	81,100	-4%	92,700	-11,500
2030	82,200	-42%	55,900	26,300

*Emissions values are rounded.
Source: Energy Policy Initiatives Center 2018

Local Emissions Gap

With the targets selected, the local emissions gap to be met through CAP measures was then estimated. In order to do this, Legislatively Adjusted BAU Projections were first estimated. These projections account for the anticipated impact of federal and state regulations and are represented in Figure 3.5 by the various colored bands. The remaining quantity of emissions that need to be addressed through the CAP is referred to as the Local Gap. Without any local actions Imperial Beach would meet and exceed its 2020 reduction target of 4% below 2012 levels. To meet the 2030 target of 42% below 2012 levels, the CAP would need to achieve reductions of 6,454 MT of CO_2e. The CAP measures are designed to achieve these reductions.

Figure 3.5 Imperial Beach GHG Reduction Local Gap



Energy Policy Initiatives Center, 2018

2050 Emissions Planning

As noted previously, EO S-3-05 set a long-term GHG reduction goal of 80% below 1990 levels by 2050; however, this has not been codified as state law and remains a goal rather than a target. Estimating the reduction potential from federal, statewide, and local actions through 2050 is highly speculative. A number of variables that cannot reliably be assessed through 2050 will have a substantial impact on emissions levels over the coming decades, including new technology, changing market dynamics, population growth, and other demographic changes. Additionally, state GHG reduction actions and strategies are expected to continue to evolve substantially. The current Scoping Plan Update for example, only provides an outline for actions through 2030. As the 2030 target year approaches, the State is expected to prepare additional Scoping Plan updates that outline actions beyond 2030. Also, it is likely that additional legislation will be passed that would have additional impacts on emissions through 2050.

As a result, it will be important that the Imperial Beach CAP be a living document that is monitored and updated periodically to respond effectively to the changing landscape. Regular monitoring and implementation reports are recommended beginning in 2020. These reports will include updated inventories and projections, assessment of the effectiveness of the individual measures, and eventually development of forecasts, measures, and targets beyond 2030.

3.3 Relationship to the California Environmental Quality Act (CEQA)

The Imperial Beach CAP is a mechanism to reduce GHGs and not currently set up to be used for CEQA review of plans and projects. As noted in section 2.1, the City will pursue adapting it into a CEQA mitigation document by 2025.

4.0 Emissions Reduction Measures

The IB CAP emission reduction strategies, measures, targets, and actions are presented in this chapter. As detailed in Chapter 3, the City has adopted targets to reduce emissions 4% below 2012 levels by 2020 and 42% below 2012 levels by 2030 (55,900 $MTCO_2e$). Each measure includes the estimated GHG reductions, co-benefits, general description and background information, and identified implementation actions.

The measures represent actions and issues with direct City influence and are intended to achieve emissions reductions within the community. Progress towards implementing each of the CAP measures and their correspondent emission reductions targets will be assessed on an ongoing basis. If necessary, modifications will be proposed to achieve reduction targets.

The strategies and measures are organized under four categories:

- On-Road Transportation
- Energy
- Waste
- Carbon Sequestration

4.1 Emission Reduction Strategies

A total of five reduction strategies and 9 measures fall under these categories. The strategies include:

- **Clean and Efficient Transportation:** Requires expansion of electric vehicle charging infrastructure and cleaner municipal vehicles
- **Reduce Vehicle Miles Traveled (VMT):** Requires continued investments in biking and walking infrastructure and public transit. Also includes City investment in a fleet of electric bicycles for staff use for official City business

- **Increase Renewable Electricity:** Requires the City to explore options to increase grid-supplied renewable electricity which could include joining a regional CCE program. Also requires new solar PV on new and redeveloped commercial projects and consideration of solar PV at existing public facilities
- **Zero Waste:** Requires the adoption of a "Zero Waste" policy to be achieved by 2050 and collaboration with the City's waste service provider to achieve statewide waste diversion targets
- **Carbon Sequestration:** Requires planting of new trees as part of new development and redevelopment, increased tree planting along streets, parking lots, other public places, and tracking of tree planting and tree canopy coverage. This also requires the City to explore habitat enhancement and conservation opportunities

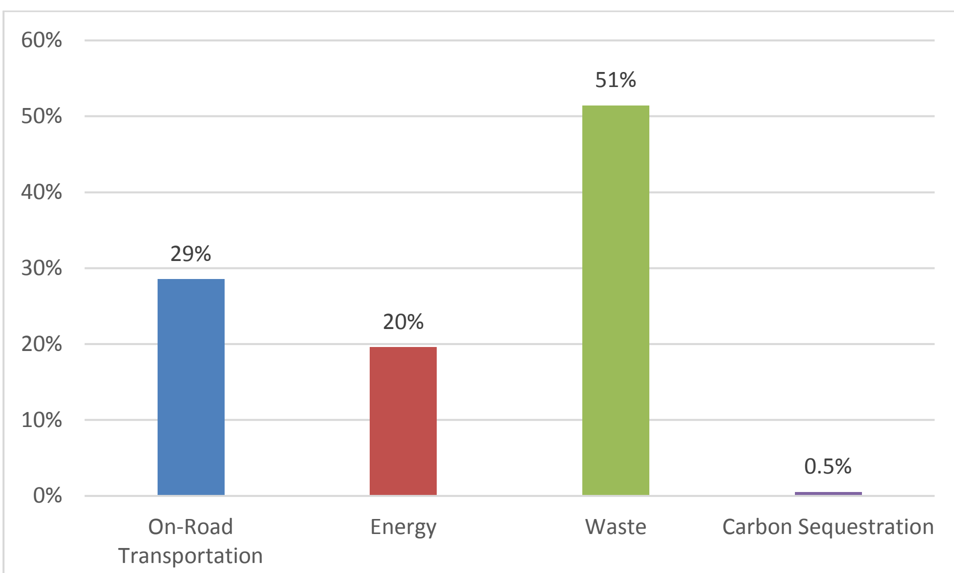
4.2 Reduction Measures

The reduction measures selected for inclusion in the CAP were developed with community input, a review of actions taken in other comparable jurisdictions, incorporation of State and regional laws, guidelines, and recommendations, and identification of corresponding emission reduction activities in the community. Anticipated emission reductions have been calculated for each of the measures and then compared to the 2030 target. Comparisons to the City's 2020 target have not been included since no actions are necessary to meet it.

Some measure components do not have quantified emission reductions associated with them. These are indicated as supporting efforts. In future updates they may be quantified as part of existing or stand-alone measures.

Figure 4.1 illustrates the percentage of CAP emissions reductions by categories. Reductions from diverting waste account for approximately 51% of measure reductions, while On-Road Transportation and Energy would account for 29% and 20% respectively. Table 4.1 shows the anticipated GHG reductions by measure that collectively add up to the 6,454 MT CO_2e needed to meet the 2030 target.

Figure 4.1 % of CAP Reductions by Emissions Category to Meet 2030 Target



Source: AECOM, 2018

Table 4.1 Measures and Quantified Reductions to meet CAP 2030 GHG Emission Reduction Target

Emissions Category	Reduction Strategies and Measures		2030	
			MT CO_2e	% of Local Reductions
On-Road Transportation	Strategy: Clean and Efficient Transportation			
	T.1	Increase Citywide Electric Vehicle (EV) Charging Stations	751	11%
	T.2	Clean Municipal Fleet	48	1%
	Strategy: Reduce Vehicle Miles Traveled (VMT)			
	T.3	Increase Mass Transit Ridership	687	10%
	T.4	Improve Pedestrian and Bicycle Facilities	342	5%
	T.5	Reduce Municipal Employee VMT	13	<1%
Energy	Strategy: Increase Renewable Electricity			
	E.1	Increase Grid-Supply Renewables	1,204	17%
	E.2	Increase Commercial Solar Photovoltaic (PV)	59	1%
Waste	Strategy: Zero Waste			
	W.1	Divert Waste from Landfill	3,318	51%
Carbon Sequestration	Strategy: Carbon Sequestration			
	S.1	Tree Planting	31	<1%
Total GHG Reductions Needed to Reach 2030 Target				**6,454 MT CO_2e**
Total Potential GHG Reductions from Local Measures				**6,454 MT CO_2e**

*Percentages are rounded and may not sum.
Source: Energy Policy Initiatives Center

4.3 The On-Road Transportation Emissions Category

The On-Road Transportation Sector accounts for approximately 57% of the 2012 baseline inventory. These emissions are a combination of vehicle fuel-efficiency, fuel carbon content, vehicle operations, and the quantity of VMT. State and federal fuel efficiency and technology standards will spur a large reduction in transportation sector emissions. They will not be enough alone however to meet the State's 2030 target and the EO S-3-05 2050 goal. Sustained and significant reductions in per capita VMT will also be needed to achieve the State's 2030 reduction target and put it on track to meet the 2050 goal. Planning and investment decisions to achieve VMT reductions fall primarily to the regional and local level and can be achieved by increased multi-modal transportation options and travel and closer proximity between travel origins and destinations.

The CAP has two strategies and five transportation emission reduction measures that focus on clean transportation and VMT reductions.

Table 4.2 On-Road Transportation Category Strategies and Measures

Strategy	Measures	Description
Clean and Efficient Transportation	T.1 Increase Citywide EV Charging Stations (EVCSs)	Increase the number of stations at public and private facilities citywide
	T.2 Clean Municipal Fleet	Gradually replace the City municipal fleet with EVs
Reduce VMT	T.3 Increase Mass Transit Ridership	Achieve increased transit ridership through the planned MTS Rapid Bus 925
	T.4 Improve Pedestrian and Bicycle Facilities	Expand and improve the City's active transportation network
	T.5 Reduce Municipal Employee VMT	Purchase electric bicycles for City staff to utilize for City business
% of Total 2030 Emission Reductions from Local Measures		**29%**
Total 2030 Emission Reductions from Category		**1,841**

These CAP measures are anticipated to achieve around one-quarter of total CAP emission reductions from local measures by 2030.

Clean and Efficient Transportation Strategy

CAP measures included in this strategy are focused on increasing the number of EV charging stations (EVCSs) throughout the City and replacing older City municipal vehicles with EVs over time. EVCSs at both public and private facilities and developments will support the deployment of EVs as more options come to market. The City will examine options to install them at its own facilities and collaborate with other agencies such as the San Diego Unified Port District (SDUPD) and local schools to increase the number at public facilities. It will also identify ways to work with developers to install EVCSs at new and redeveloped multifamily residential and commercial developments. Gradual replacement of the City municipal fleet will also result in meaningful reductions and result in savings from reduced fuel, operations, and maintenance costs.

Table 4.3 Clean and Efficient Transportation Strategy Emissions Reduction Potential

Target Year	Total Emissions Reduction Potential (MT CO_2e)	Percentage of Total Local Reduction Potential
2030	799	12%

Source: Energy Policy Initiatives Center, 2018

T.1: Increase Citywide Electric Vehicle Charging Stations (EVCSs)

Support, encourage, and incentivize the installation of 100 EVCSs at private and public facilities throughout the City by 2030.

2030 GHG Reduction Potential: 751 MT CO_2e
Co-benefits: Improved Air Quality, Energy Savings
Methodology: See Appendix B, pages 20 – 22

In regions with cleaner electric grids such as California EVs produce fewer GHGs than traditional fossil-fueled vehicles. As technologies continue to advance they are becoming increasingly popular options to reduce fuel costs and emissions. Even as the number of EV options increases however, there is a need for accompanying charging infrastructure to support EV charging. The lack of sufficient charging infrastructure is often one of the primary concerns cited by consumers that deters them from purchasing EVs. Local governments can play a role in the expansion of the EV charging network by supporting cost-effective opportunities to install EVCSs at public and private facilities.

According to a range of studies, the majority of EV charging takes place at home. As such, one focus of this measure is to increase home charging availability at multifamily developments. The City intends to work with developers through its development review process to encourage installation of charging stations in multifamily developments. As EVs become adopted more broadly there will also be an increased need for stations at commercial developments. The City will work to encourage an increased number of charging stations at new and redeveloped commercial developments as well. The CAP includes a target to install stations in 5% of parking spaces at new and redeveloped multifamily and commercial development by 2030.

Installations at public facilities that have high concentrations of employment, recreational, and civic activity will be another focus of this measure. Potential locations could include City Hall, the Imperial Beach Library, schools, parks, and other similar facilities.

Implementation Table T.1:

Action	Description	Responsibility	Timeline
1	Encourage and incentivize EVCSs at new and redeveloped multifamily and commercial developments through the development review process	City	Near-term
2	Identify a list of priority public facility installation sites on City sites and in collaboration with relevant partner agencies	City	Near-term
3.	Identify and pursue funding and financing resources to support EVCS installation	City	Near- and Mid-term

T.2: Clean Municipal Fleet

Replace fossil fuel vehicles with Plug-in Hybrid Electric Vehicles (PHEVs) and EVs by 2030, when feasible.

2030 GHG Reduction Potential: 48 MT CO_2e
Co-benefits: Improved Air Quality, Energy Savings
Methodology: See Appendix B, pages 22 – 24

Municipal fleets are increasingly transitioning to cleaner fleets as a mechanism to meet long-term sustainability goals and reduce operations and maintenance costs. An initial consultation through the Plug-in San Diego EV Expert, a partnership between SANDAG and the Center for Sustainable Energy (CSE), was conducted to estimated potential reductions associated with transitioning municipal fleet vehicles to EVs by 2030.

In order to implement this measure the City will continue working with the EV Expert to develop a comprehensive fleet assessment and implement a fleet conversion plan. Measure T.1 will complement these efforts through the expansion of EV charging infrastructure. The City will also track vehicle performance, usage, and characteristics such as mileage, fuel consumption, operations and maintenance costs, and any additional information that is deemed relevant

Implementation Table T.2:

Action	Description	Responsibility	Timeline
1	Work with CSE's EV Expert to develop a municipal fleet assessment and conversion plan	City	Medium-term
2	Utilize fleet assessment and conversion plan to decide when to replace vehicles	City	Medium-term
3	Work with other agencies and jurisdictions to identify potential joint EV procurement options	City	Near- and Mid-term

Reduce VMT Strategy

CAP measures T.3 – T.5 reduce VMT by targeting an increase in transit usage and biking and walking and a reduction in single-occupancy vehicle use. As previously noted, Imperial Beach is not an employment center. As a result, the majority of the City's workforce commutes to other cities in the region for their jobs and well over nine out of every 10 do so in their personal vehicles. The addition of a new San Diego Metropolitan Transit System (MTS) Rapid Bus Route will provide the community with additional transit connectivity, and the City's continued efforts to expand and improve its active transportation network will enhance connections to transit service and community destinations.

Table 4.4 Reduce VMT Strategy Emissions Reduction Potential

Target Year	Total Emissions Reduction Potential (MT CO_2e)	Percentage of Total Local Reduction Potential
2030	1,042	16%

T.3: Increase Mass Transit Ridership

Reduce VMT through new MTS 925 Rapid Bus Route.

2030 GHG Reduction Potential: 687 MT CO_2e
Co-benefits: Improved Air Quality, Energy Savings, Reduced Traffic Congestion, Improved Mobility
Methodology: See Appendix B, pages 24 – 25

In spring of 2018 MTS received a $40.9 million grant from California's Transit and Intercity Rail Capital Program (TIRCP) for its planned Rapid 925 line. TIRCP is funded by proceeds from the cap-and-trade program and SB 1. The Rapid 925 will consist of a 25-mile round trip route between the Otay Mesa Transit Center and Imperial Beach with a direct connection to the University of California (UC) San Diego Blue Line. It will also be operated using zero-emission buses, effectively combining clean vehicles and reducing VMT. The City will not be responsible for providing any direct funding to support the purchase of the zero-emission buses or the operations of the route. While the City does not have a core planning or design role, it is in a position to help ensure the new route is implemented successfully. This includes coordination with MTS to ensure that its own circulation network provides excellent transit connectivity, especially for car-lite and transit-dependent households, vulnerable user groups, and active transportation users.

Implementation Table T.3:

Action	Description	Responsibility	Timeline
1	Coordinate with MTS to identify transit connectivity opportunities that improve transit access and mobility	City	Near-term
2	Work with MTS to increase awareness of the Rapid 925 and existing bus routes as a means to increase ridership	City	Near-term
Supporting Effort			
1	Collaborate with SANDAG to ensure that the RTP includes transit investments that improve transit service and connectivity	City	Near-term

T.4: IMPROVE BICYCLE AND PEDESTRIAN FACILITIES

Install 11 miles of Class II or better bicycle lane miles.

2030 GHG Reduction Potential: 342MT CO_2e
Co-benefits: Improved Public Health, Improved Safety, Improved Air Quality, Reduced Traffic Congestion, Improved Mobility
Methodology: See Appendix B, pages 25 – 27

The City has continued to expand its active transportation network to support its efforts to support health, safety, overall quality of life, and economic development vision. Its current network consists of the Bayshore Bikeway, a portion of the California Coastal Trail, an internal bicycle lane network, and an extensive network of sidewalks and trails for pedestrians. The City's topography, weather, and bevvy of natural and recreational resources make active transportation an ideal way for residents and visitors alike to enjoy the community in a safe, health, and fun manner. The City plans to add at least 11 miles of bicycle lanes by 2030. The City also plans to improve pedestrian infrastructure as part of Measure T.4, though the GHG emissions reductions for these improvements are not quantified because majority of the improvements include sidewalk widening and improvements to landscape, lighting, and benches.

While these plans were in place before the City elected to establish a CAP, they would also result in meaningful GHG reductions. The most significant projects, Palm Avenue Master Plan and Imperial Beach Boulevard Enhancement Project, would substantially improve two of the City's most prominent thoroughfares and focus on multimodal circulation.

Implementation Table T.4:

Action	Description	Responsibility	Timeline
1	Complete the suite of planned bicycle and pedestrian projects by 2030	City	Medium-term
2	Work to expand the number of bike parking facilities at commercial establishments throughout the City	City	Medium-term
3	Work with scooter and bikeshare and other emerging companies to analyze data and better understand active transportation patterns and needs throughout the City	City	Medium-term

T.5: Reduce Municipal Employee VMT

Obtain 10 electric bicycles for short-intracity trips.

2030 GHG Reduction Potential: 13 MT CO_2e
Co-benefits: Improved Public Health, Improved Air Quality, Reduced Traffic Congestion, Improved Mobility
Methodology: See Appendix B, pages 27

Due to its relatively small size and flat topography Imperial Beach bicyclists can navigate from one side of the city to the other in a relatively short amount of time. The continued expansion of the bicycle network and related improvements are expected to enhance bicycle mobility and improve safety. In conjunction with the expanding network it is increasingly feasible for City staff to shift some of its trips from single-occupancy vehicles to electric bicycles. Trips could include inspections and community meetings and events among others. In addition to the GHG reductions from this shift, the City would be taking an additional leadership role in setting the stage for long-term adoption of bicycling, walking, and other related forms of transportation

Implementation Table T.5:

Action	Description	Responsibility	Timeline
1	Purchase 10 electric bicycles	City	Near-term
2	Track the number of trips and VMT avoided through usage of the bicycles	City	Medium-term

4.4 The Energy Emissions Category

The Energy category, consisting of electricity and natural gas emissions resulting from use in buildings, accounts for approximately 39% of the 2012 baseline inventory. State efforts to reduce emissions from this category have focused on increasing grid-supplied renewable energy through the Renewable Portfolio Standard (RPS), incentives and requirements to increase distributed behind the meter renewables such as Solar PV, and energy efficiency for existing and new buildings. As noted in Table 2.3, the passage of SB 100 recently increased RPS requirements to 60% by 2030 and 100% by 2045. The California Energy Commission also adopted a requirement for new residential developments to include solar PV beginning in 2020 as part of its 2019 Building Energy Efficiency Standards. Additionally, they require a variety of energy efficiency measures for new residential and non-residential buildings that will reduce building energy use. As a result, new residential units built in 2020 and after will be highly energy efficient, demand less energy, and are likely to meet a considerable amount of their remaining demand through electricity generated by on-site solar.

It should not be overlooked however that Imperial Beach is built out and much of its building stock was built before 1978 prior to the adoption of California's energy code, Title 24 Part 6. This includes the vast majority of residential buildings, approximately 75% of which were built before 1980 according to the U.S. Census. While there are no industrial or heavy commercial land uses within Imperial Beach, there is a variety of light commercial uses such as retail and office that represent opportunities to increase commercial energy efficiency. Subsidies and rebates are available through SDG&E and other state funding sources to increase energy efficiency and reduce emissions from the existing Imperial Beach building stock. The City is committed to connecting its residents and businesses to these resources to improve energy efficiency in existing residential units and commercial uses.

The CAP measures in this cateogry are focused on increasing grid-supplied and behind-the-meter renewable energy and includes two measures.

Table 4.5 Energy Category Strategy and Measures

Strategy	Measures	Description
Increase Renewable Electricity	E.1 Increase Grid-Supply of Renewable and Zero Carbon Electricity	75% of grid-supplied electricity is renewable by 2030
	E.2 Increase Commercial Behind-the-Meter PV	Increase Solar PV at new and redeveloped commercial developments
% of Total 2030 Emission Reductions from Local Measures		20%
Total 2030 Emission Reductions from Category		1,263

Before the passage of SB 100, SDG&E was on track to meet the previous RPS target of 50% renewables by 2030 and is expected to meet the increased 60% standard. It has not yet however indicated that it will exceed it by 2030. As a result, the City will need to explore alternative mechanisms to meet measure E.1's 75% by 2030 target, which could be done through CCE or a similar alternative structure. Measure E.2 focuses on solar PV installation at new and redeveloped commercial developments would be complement the state's requirement that all new residential units include solar PV beginning in 2020.

CAP measures E.1 and E.2 are anticipated to achieve around 20% of total CAP emission reductions from local measures by 2030.

E.1: INCREASE GRID-SUPPLY OF RENEWABLE AND ZERO-CARBON ELECTRICITY

Partner with neighboring jurisdictions to evaluate the potential to join a regional CCE program and increase the share of renewables of grid-supplied renewable power to 75% by 2030, while striving for 100%.

2030 GHG Reduction Potential: 1,204MT CO_2e
Co-benefits: Improved Air Quality, Energy Savings
Methodology: See Appendix B, pages 27 – 28

Many jurisdictions that have recently adopted CAPs in California have included measures targeting a higher percentage of grid-supplied renewable energy than what is required under SB 100. In many cases achieving these targets will require the establishment of a CCE or similar structure. Under a CCE jurisdictions purchase power from suppliers or even own generation facilities, although the former is more common. The utility, in this case SDG&E, still owns the transmission and distribution infrastructure. Residents and businesses would be automatically enrolled in the program but would have the option to opt out and continue their existing relationship with SDG&E.

CCEs can range in size from just one jurisdiction to multiple jurisdictions in a regional framework. A number of other jurisdictions within San Diego County are either studying the establishment of a CCE or are in the process of establishing one, including large entities such as the City and County of San Diego and smaller ones such as Solana Beach and La Mesa. Imperial Beach will identify options to meet the 75% target that can also be expanded upon to potentially achieve 100% grid-supplied renewable power before 2030. As part of the FY22-23 and FY23-24 municipal budgeting and CIP process, the City will evaluate additional resources to support any additional staffing and/or capital investments necessary to meet a 100% goal. A critical aspect of the process will involve evaluating the potential costs and benefits of different CCE structures. It will also require a detailed analysis of energy demand, efficiency opportunities, and available clean electricity sources available for purchase. Given Imperial Beach's small size, it is expected that a partnership with other cities will provide the best path forward for optimizing the benefits and minimizing the local costs from a CCE. Exploration and establishment of a CCE will take time and require careful consideration and diligent study. Citywide energy efficiency improvements will also help reduce energy demand and contribute to the meeting of the measure emission reduction targets. As a result, working with SDG&E to increase resident and business awareness of available rebates and subsidies is included as a supporting effort that is not quantified but will contribute to emissions reductions.

Implementation Table E.1:

Action	Description	Responsibility	Timeline
1	Explore the potential to join a regional CCE through a partnership with other jurisdictions	City	Near-term
2	Work with identified partnership jurisdictions to conduct a feasibility study and other related research and administrative efforts necessary to establish a CCE	City	Medium-term
3	Evaluate the need for additional resources to increase to 100% grid-supplied renewable power by 2030	City	Medium-term
Supporting Effort			
1	Work with SDG&E to publicize energy efficiency rebates and subsidies to increase the efficiency of Imperial Beach's existing building stock	City	Near-term

E.2 INCREASE COMMERCIAL BEHIND-THE-METER PV

Increase solar PV on certain new and redeveloped commercial projects.

2030 GHG Reduction Potential: 59 MT CO_2e
Co-benefits: Improved Air Quality
Methodology: See Appendix B, pages 28 – 29

The State does not currently have requirements for new non-residential commercial properties to have solar PV or other on-site renewable energy generation. With the substantial decline in solar prices commercial solar PV is an increasingly cost-effective means to increase behind-the-meter renewable energy, reduce emissions, and achieve long-term cost savings for property owners.

Not all commercial properties will be ideal candidates for solar PV however. Solar may not currently be cost-effective on some buildings due to a variety of factors including size and orientation. The measure assumes an additional .3 MW of commercial solar PV by 2030. The City will need to either identify size thresholds for requiring solar PV on new and redeveloped commercial projects or create a mechanism through the development approval process to establish strong incentives. Given the rapidly declining costs of solar PV, buildings that may not be candidates for solar now may become ideal candidates in the future. Ensuring that new buildings are solar ready to accommodate this potential will be important as well. Finally, buildings and properties, especially parking areas, under the jurisdiction of the City and other public agencies may be ideal candidates for solar PV.

Implementation Table E.2:

Action	Description	Responsibility	Timeline
1	Establish requirements or incentives through the development review and approval process to spur installation of commercial solar PV	City	Near-term
2	Develop a directory of solar PV funding sources, rebates, and incentives, and leverage existing efforts and materials from the CSE, California Solar Initiative, SDG&E, and other organizations.	City	Near-term
3	Review/revise applicable building, zoning, and other codes/ordinances to encourage the development of solar ready commercial developments.	City	Medium-term
Supporting Effort			
1	Identify opportunities to install solar PV on public facilities such as municipal buildings, schools, libraries, and parking lots.	City	Medium-term

4.5 The Waste Emissions Category

The Solid Waste category, accounts for 2% of the emissions in the Imperial Beach inventory. Emissions in this category are generated when organic waste is buried in landfills, anaerobic digestion takes place, and methane is emitted. While methane has a much shorter atmospheric lifespan than CO2, it has a much more powerful greenhouse gas effect. Currently, EDCO is the solid waste service company for Imperial Beach and has the primary responsibility for complying with State waste reduction targets and achieving the CAP emissions reductions targeted from this category. EDCO's efforts are already aligned with the long-term objective of achieving Zero Waste and CAP measure SW.1's specific target of 80% waste diversion by 2030 and 90% diversion goal by 2050.

While EDCO is the protagonist in achieving these targets, success will require the City to be a strong partner. This will include the adoption of a Zero Waste by 2050 policy, community outreach and education, and related efforts.

CAP measure W.1 is estimated to account for 51% of emissions (3,318 MT CO_2e) reductions from local measures by 2030.

Table 4.6 Waste Category Strategy and Measure

Strategy	Measure	Description
Reduce Waste	SW.1 Divert Waste from Landfill	80% waste diversion by 2030
% of Total 2030 Emission Reductions from Local Measures		51%
Total 2030 Emission Reductions from Category (MT CO_2e)		3,318

W.1: DIVERT WASTE FROM LANDFILL

Adopt a Zero Waste by 2050 policy and work with the City's waste service company (currently EDCO) to achieve 80% landfill diversion by 2030.

2030 GHG Reduction Potential: 3,798 MT CO_2e
Co-benefits: Reduced Waste, Improved Water Quality
Methodology: See Appendix B, page 30

In 2011 Assembly Bill (AB) 341 was adopted establishing a policy goal that 75% of statewide solid waste should be reduced, recycled, or composted by 2020. This is an expansion of previous State goals to divert 50% of community-wide waste (1997 Source Reduction and Recycling Element), with the two metrics measured in different ways.

The emissions reductions for this measure would result from an 80% diversion rate of waste from landfills by 2030. During the development of this measure the City confirmed with EDCO, the City's waste provider, that this in alignment with company goals. This measure alone would account for approximately 51% of needed emissions reductions to meet 2030 CAP targets. As a result, the City and the community will need to partner effectively with the City's waste service company to successfully implement this measure and the CAP. The City will need to adopt a Zero Waste by 2050 policy and then work with the City's waste service company and other stakeholders to conduct outreach so that there is a strong community-wide understanding of the waste management service offerings and overall behavioral change focused on lifecycle of materials.

Implementation Table W.1:

Action	Description	Responsibility	Timeline
1	Adopt a Zero Waste by 2050 policy	City	Near-term
2	Work with the City's waste service company and stakeholders to develop a public outreach campaign to increase awareness of existing waste management services and drive behavioral change	City	Medium-term

4.6 The Carbon Sequestration Category

In contrast to the other CAP measures which will focus their efforts on reducing emissions, measure S.1 will focus on taking CO_2 out of the air, also known as sequestration. Trees and other plants utilize photosynthesis to capture CO_2 and convert it into oxygen, effectively capturing carbon and storing it. In urban areas trees are generally the most feasible means for carbon capture and storage. They also provide a range of other health, economic, environmental, and aesthetic co-benefits that positively impact the community. According to SANDAG's 2015 Laser Identification Detection and Ranging (LIDAR) study Imperial Beach has the lowest tree canopy coverage, 6%, of the 18 surveyed cities in the region.

Measure S.1 would sequester carbon via a net increase of trees in the community. It is also important to recognize that a substantial portion of the City consists of estuary and wetlands habitat that perform this function, as well as other land in the Tijuana Estuary and along the San Diego Bay. The City already recognizes the value of these lands to its economy and quality of life, and moving forward there may be opportunities to further conserve and enhance habitat that could also help the City meet goals both in this CAP and future updates. To take advantage of this potential the City will need to collaborate with entities such as Tijuana River National Estuarine Research Reserve (TRNERR), U.S. Fish and Wildlife Service (USFWS), SDUPD, and other agencies to identify conservation and enhancement opportunities that can be pursued.

CAP measure S.1 is estimated to account for .5% of emissions (31 MT CO_2e) reductions from local measures by 2030.

Table 4.7 Carbon Sequestration Category Strategy and Measure

Strategy	Measure	Description
Carbon Sequestration	S.1 Tree Planting	Plant 866 trees by 2030
% of Total 2030 Emission Reductions from Local Measures		.5%
Total 2030 Emission Reductions from Category (MT CO_2e)		31

S.1: Tree Planting

Plant an additional 866 trees citywide by 2030.

2030 GHG Reduction Potential: 31 MT CO_2e
Co-benefits: Improved Water Quality, Reduced Water Run-off, Reduced Temperature
Methodology: See Appendix B, pages 30 – 31

In addition to the carbon sequestration and other co-benefits mentioned in the strategy description, trees enhance overall community resiliency. The additional 866 trees would be achieved through a combination of the City planting 300 trees within its own Right of Way (ROW) and an additional 566 from new and redeveloped residential and commercial projects.

In order to ensure that this measure results in a net increase of trees, the City will need to develop a monitoring program to regularly assess the condition of the urban forest. It will also need to revise its code to require one tree per new or redeveloped residential dwelling unit and one per every three parking spaces in new or redeveloped commercial use, as well as make any changes to encourage planting of trees along streets, parking lots, and public spaces. In particular, prioritizing tree planting along active transportation corridors has been shown to increase biking and walking.

The City will also identify and pursue opportunities to enhance and conserve habitat within City boundaries, the Tijuana Estuary, and along the San Diego Bay in collaboration with the partnering agencies mentioned in the Carbon Sequestration Category discussion section preceding this measure or other stakeholders. Such efforts could also result in meaningful sea level rise adaptation benefits. For now this has been included as a supporting effort in this measure due to the lack of currently identified opportunities. As projects are identified the City could create a separate measure with quantified reductions that would contribute to meeting the 2030 targets or to meet post-2030 reduction goals. This would occur as part of future CAP updates. The City also intends to pursue funding to establish an Urban Forest Management Plan. This would enable the City to better maintain and manage its urban forest and its role in sequestering GHG

Implementation Table S.1:

Action	Description	Responsibility	Timeline
1	Plant 300 trees within City ROW by 2030	City	Medium-term
2	Make changes to the City code to require tree planting in new and redeveloped residential and commercial developments	City	Near-term
Supporting Effort			
1	Identify opportunities to enhance or conserve habitat that would sequester carbon in collaboration with relevant state and federal agencies	City	Medium-term
2	Identify and pursue funding to develop an Urban Forest Management Plan	City	Medium-term

5.0 CAP Monitoring and Updates

This document is the City's first effort to assess and reduce its community-wide emissions consistent with State policy. It should be utilized as a living document, be regularly monitored for effectiveness, and updated as necessary to ensure that targets are met. The two main components of monitoring will be progress towards the overall 2030 GHG emissions reduction target and the reduction targets of the individual measures.

Regular GHG inventory updates will provide the best method to evaluate progress towards meeting the overall 2030 targets. Direct comparisons of inventories from one year to the next can be challenging. The state of climate science is constantly evolving which leads to methodology revisions. Relatedly, emissions factors which play an important role in GHG quantifications are regularly refined by agencies such as the CARB, and others. Finally, as noted previously, the State's approach to reducing emissions will continue to evolve and is expected to include additional legislation and regulations which will need to be accounted for. The passage of SB 100 and the accelerated of renewable grid-supplied energy provide the most recent example of an evolving regulatory and policy landscape. To best adapt to these changes the City should build its own institutional knowledge and continue to work with SANDAG and other agencies that provide technical assistance so that inventory updates are comparable and can be used to track progress towards CAP targets.

Assessments of the effectiveness in implementing each of the measures will also be necessary. City staff will need to track progress towards meeting the actions included in the implementation tables for each measure. A Consolidated Measure Implementation matrix has been included in Appendix D to facilitate implementation action tracking. This will serve to evaluate whether the necessary policy framework is in place to implement each measure. Additionally, City staff will need to track the primary target metrics for each measure since these are linked to their corresponding GHG reductions. As an example, measure S.1 has a target of planting an additional 866 trees citywide by 2030. While the City would be directly responsible for 300 trees, the additional 566 would result from requiring trees be planted as part of future residential and commercial developments. Adjustments to City code would provide the policy framework for the 566 trees while market conditions would be the primary factor driving the number of new and redeveloped residential units and commercial uses. Strong market growth would likely result in more development and the planting of well over the number of targeted trees, effectively increasing the GHG emission reductions from this measure. In this way, monitoring of progress towards the overall targets and the individual measures will provide the City with a clearer picture of what adjustments may need to be made to the CAP. Adjustments could include changes to individual measures, new measures, and/or removal of measures.

In order for monitoring to be effective, it must be done regularly and reported to decisionmakers, including but not necessarily limited to the City Council and the community. There is no required period or format for monitoring reports or updating the CAP; however, a commitment to regular monitoring reports and CAP updates are critical to ensure the City remains on track to meet its 2030 targets and plan for post-2030 targets, which are anticipated to be adopted by the State in the next several years .To verify that the City meets the 2020 target, and to maintain consistency with SANDAG's Regional Framework schedule, in the City will complete a regular monitoring report in 2020 and every two years thereafter. At a minimum, the monitoring report will consist of an inventory update, details on progress implementing measure actions in their identified timeframes, outcomes achieved, and geographic distribution of measure investments and benefits in the community. This latter component, geographic distribution of measure investments and benefits, will enable the City to identify any steps needed to ensure that low-income and disadvantaged communities are benefitting from CAP implementation. Again utilizing measure S.1 as an example, the City would describe progress making code changes, the number of trees planted, and the geographic distribution of trees. If necessary, the City could identify steps to ensure more trees are planted in low-income and disadvantaged communities. While Imperial Beach does have low-income communities it does not have any census tracts defined by the State as Disadvantaged Communities under SB 535. As such, the City will either limit its geographic distribution evaluation to low-income neighborhoods in the city or establish its own disadvantaged communities definition.

The City will use these reports as tools to decide what changes need to be made, if any, to meet the 2030 target. The City also commits to at least one comprehensive CAP update between 2025 and 2030 and evaluate adapting this CAP into a CEQA mitigation document by 2025. This update will include any course corrections to meet the 2030 target and identify post-2030 targets, strategies, and measures necessary to chart a path for consistency with interim target years between 2030 statewide targets and 2050 goals, or alternative yet to be defined statewide targets.

Appendix A

Greenhouse Gas Emissions Inventory and Projections

Appendix A. Greenhouse Gas Emissions Inventory and Projections

August 2018

Prepared for the City of Imperial Beach

Prepared by the Energy Policy Initiatives Center

About EPIC

The Energy Policy Initiatives Center (EPIC) is a non-profit research center of the USD School of Law that studies energy policy issues affecting California and the San Diego region. EPIC's mission is to increase awareness and understanding of energy- and climate-related policy issues by conducting research and analysis to inform decision makers and educating law students.

For more information, please visit the EPIC website at www.sandiego.edu/epic.

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1 OVERVIEW

This document presents a summary of the greenhouse gas (GHG) emissions for the City of Imperial Beach (referred to as Imperial Beach or the City) from 2012 to 2014, and the business-as-usual (BAU) emissions projections for 2020, 2030, and 2050. This BAU projection demonstrates emissions growth in the absence of any new policies and programs and does not consider future impacts of adopted federal and State policies. GHG reductions from these policies are considered later in the climate action planning process and are referred to as the "legislatively-adjusted BAU".

Section 2 describes the background sources and common assumptions used for the inventory and projections. Section 3 provides the results of the GHG emissions inventory for 2012 to 2014. The methods used to prepare each category of the inventory are provided in Section 4. Section 5 provides a summary of the emissions projections for 2020, 2030, and 2050, and the methods used to prepare each category of projections.

2 BACKGROUND

2.1 Greenhouse Gases

The primary GHGs included in the emissions estimates presented here are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Each GHG has a different capacity to trap heat in the atmosphere, known as its global warming potential (GWP), which is normalized relative to CO_2 and expressed in carbon dioxide equivalents (CO_2e). In general, the 100-year GWPs reported by the Intergovernmental Panel on Climate Change (IPCC) are used to estimate GHG emissions. The GWPs used in this inventory are from the IPCC Fourth Assessment Report (AR4),[1] provided in Table 1.

Table 1 Global Warming Potentials Used in the Imperial Beach GHG Emission Inventory & Projections

Greenhouse Gas	Global Warming Potential
Carbon dioxide (CO_2)	1
Methane (CH_4)	25
Nitrous oxide (N_2O)	298

2.2 Categories of Emissions

The U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (U.S. Community Protocol),[2] developed by ICLEI USA, requires a minimum of five basic emissions-generating activities to be considered a Protocol-compliant community-scale GHG inventory. These categories are: electricity, natural gas, on-road transportation, water and wastewater, and solid waste. GHG emissions are calculated by multiplying activity data (e.g., kilowatt-hours of electricity, tons of solid waste) by an emission factor (e.g., pounds of CO_2e per unit of electricity). For these five categories, methods used in

[1] IPCC Fourth Assessment Report: Climate Change 2007: Direct Global Warming Potentials (2013).
[2] ICLEI – Local Governments for Sustainability USA: U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.0 (2012).

this inventory were based on the U.S. Community Protocol standard methods and modified with regional- or City-specific data when available.
All activity data and GHG emissions reported in this document are annual values, and all emission factors reported in this document are annual average values, unless stated otherwise.

2.3 Demographics

The San Diego Association of Governments (SANDAG) estimates and forecasts population and employment for all jurisdictions in the San Diego region. The population and jobs estimate from 2012 to 2014 for Imperial Beach are provided in Table 2.[3]

Table 2 Population and Jobs Estimates (Imperial Beach, 2012-2014)

Year	Population	Jobs
2012	26,750	3,421
2013	26,993	3,532
2014	27,114	3,644
SANDAG 2013, 2017. Energy Policy Initiatives Center, 2018.		

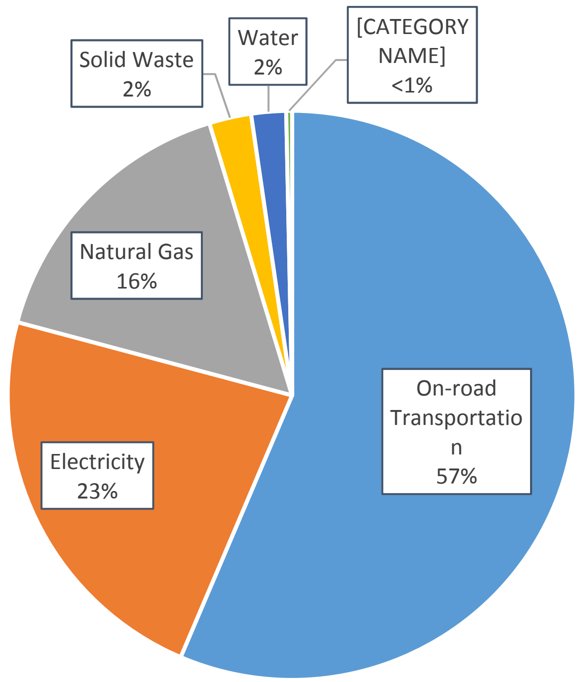
2.4 Rounding of Values in Tables and Figures

Rounding is used only for the final GHG values within the tables and figures throughout the document. Values are not rounded in the intermediary steps in the calculation. Because of rounding, some totals may not equal the exact values summed in any table or figure.

3 SUMMARY OF GHG EMISSIONS INVENTORY

The total GHG emissions from Imperial Beach in 2012 were estimated at 96,400 metric tons CO_2e (MT CO_2e), distributed into categories as shown in Figure 1.

[3] 2012-2014 Population are from SANDAG's Demographic & Socio-Economic Estimates (March 9, 2017 Version). Jobs in 2012 are from SANDAG Series 13 Regional Growth Forecast (October 2013). Jobs in 2013 and 2014 are interpolated linearly based on SANDAG's 2012 and 2020 jobs estimates. The number of jobs are for civilian jobs only, and does not include military jobs. SANDAG Data Surfer. SANDAG Data Surfer Accessed on October 24, 2017.



Percentage may not add to totals due to rounding.
Energy Policy Initiatives Center, 2018

Figure 1 Breakdown of GHG Emissions in Imperial Beach (2012)

Total GHG emissions in the years 2012, 2013, and 2014 are provided in Table 3. The 2013 estimate was 95,800 MT CO_2e and the 2014 estimate was 90,500 MT CO_2e, 6% lower than the total emissions in 2012. The largest categories of emissions are on-road transportation, electricity, and natural gas end-use. The totals and breakdown of emissions by category for 2012–2014 are presented in Table 3.

Table 3 Total and Breakdown of GHG Emissions in Imperial Beach (2012–2014)

Emissions Category	2012 GHG Emissions (MT CO_2e)	2013 GHG Emissions (MT CO_2e)	2014 GHG Emissions (MT CO_2e)
On-Road Transportation*	54,400	54,400	54,200
Electricity	21,900	21,000	18,200
Natural Gas	15,600	15,800	13,700
Solid Waste	2,300	2,400	2,300
Water	1,900	1,800	1,800
Wastewater	300	300	400
Total	**96,400**	**95,800**	**90,500**

Sums may not add up to totals due to rounding.
GHG emissions for each category are rounded to the nearest hundreds. Values are not rounded in the intermediary steps in the calculation.
*Based on SANDAG Series 13 vehicle miles traveled (VMT) estimates. 2012 is the Series 13 Base Year.
Energy Policy Initiatives Center, 2018.

4 METHODS TO CALCULATE EMISSIONS INVENTORY

4.1 On-Road Transportation

The emissions associated with on-road transportation in Imperial Beach are calculated by multiplying the estimated vehicle miles traveled (VMT) and the average vehicle emission rate in the San Diego region in a given year. Average weekday VMT data were provided by SANDAG based on its activity-based model[4] and the Origin-Destination (O-D) method.[5] The O-D VMT method is the preferred method proposed by the U.S Community Protocol in 'TR.1 Emissions from Passenger Vehicles' and 'TR.2 Emissions from Freight and Service Trucks' that estimates miles traveled based on where a trip originates and where it ends to attribute on-road emissions to cities and regions of miles traveled (Figure 2).[6]

[4] SANDAG (2015): San Diego Forward: The Regional Plan. Appendix T Travel Demand Model Documentation.
[5] SANDAG (2013): Vehicle Miles Traveled Calculation Using the SANDAG Regional Travel Demand Model. Technical White Paper.
[6] ICLEI – Local Governments for Sustainability USA: U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.0 (2012), Appendix D: Transportation and Other Mobile Emission Activities and Sources.

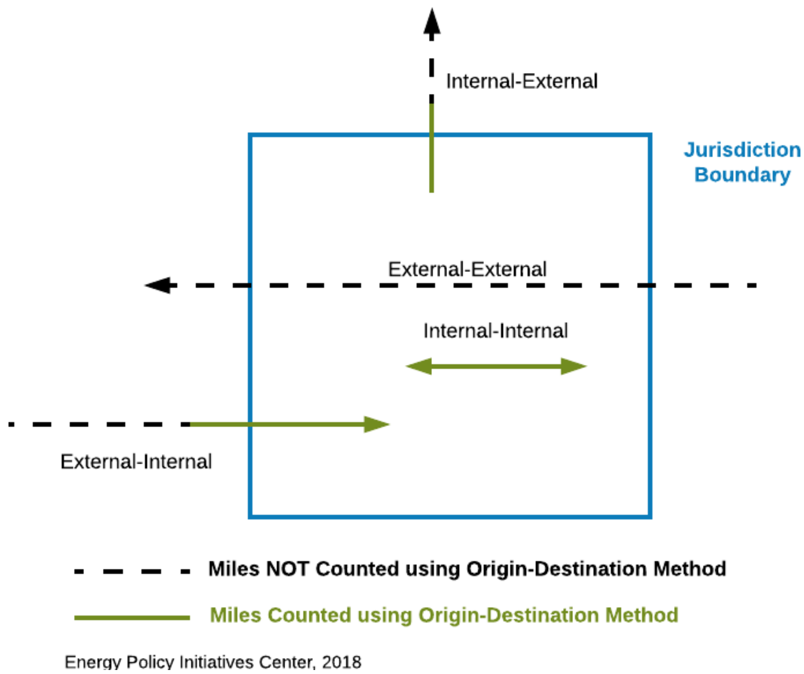


Figure 2 Components of O-D Method for VMT Calculation

O-D VMT data include all miles traveled for trips that originate and end within Imperial Beach city limits, referred to as Internal-Internal), and half of the miles traveled of the trips that either begin within Imperial Beach and end outside the City (referred to as Internal-External), or vice versa (referred to as External-Internal). In accordance with the methodology, VMT from trips that begin and end outside Imperial Beach that only pass through the City limits (referred to as External-External) are not included in the total City VMT.

The average weekday O-D VMT data for each trip type in 2012 and 2014 were provided by SANDAG, and 2013 VMT were interpolated linearly by EPIC using 2012 and 2014 values (Table 4).[7]

[7] Series 13 2012 (Base Year) and 2014 average weekday VMT estimates were provided by SANDAG (January 30, 2017 and October 18, 2017). 2013 VMT were interpolated linearly between 2012 and 2014 VMT. Original data tables provided by SANDAG are in Appendix A.

Table 4 O-D VMT and Trip Types (Imperial Beach, 2012–2014)

Year	Internal-Internal Trips (Miles/Average Weekday)	External-Internal/Internal-External Trips (Miles/Average Weekday)	External-External Trips (Miles/Average Weekday (Information only, excluded from City VMT)*
2012	10,105	628,503	10,424
2013	10,057	638,730	10,430
2014	10,008	648,957	10,436
*Miles from External-External trips (pass-through trips) are the portion within the City boundary, not the entire trip. Based on SANDAG Series 13 VMT estimates. 2012 is the Series 13 Base Year. 2013 is linearly interpolated between 2012 and 2014. SANDAG, 2018; Energy Policy Initiatives Center, 2018.			

In accordance with the methodology, all estimated and projected Internal-External and External-Internal miles associated with Imperial Beach are divided in half to allocate the miles between Imperial Beach and all other outside jurisdictions (see Appendix A for source data). EPIC multiplies the total average weekday VMT by 347 to adjust from average weekday VMT to average annual VMT (Table 5), which includes weekends.[8]

The average annual vehicle emission rate expressed in grams of CO_2e per mile driven (g CO_2e/mile) is derived from the statewide mobile source emissions model EMFAC2014 developed by CARB.[9] EMFAC2014 was used to generate average emission rates for the San Diego region for all vehicle classes, model years, speeds, and fuel types.[10] The average emission rates (g CO_2e/mile) were calculated based on the VMT distribution of each vehicle class and its emission rate. This report assumes Imperial Beach has the same distribution of vehicle types as the region. The average vehicle emission rate was adjusted from g CO_2/mile to g CO_2e/mile, to account for total GHG emissions, including CO_2, CH_4, and N_2O.[11] It is assumed Imperial Beach has the same distribution of vehicle types as the region.

The total VMT, average vehicle emission rates, and corresponding GHG emissions from the on-road transportation category for years 2012 to 2014 are given in Table 5.

[8] The conversion of 347 weekdays to 365 days per year as used by CARB. CARB: California's 2000-2014 Greenhouse Gas Emission Inventory Technical Support Document (2016 Edition), p. 41 (September 2016).
[9] CARB: EMission FACtors model, EMFAC2014 (2015).
[10] EMFAC2014 Web Database: Emission rates for SANDAG, download date: January 22, 2016. The vehicle classes in EMFAC2014 are the same as the vehicle classes in the previous model EMFAC2011.
[11] The conversion factor, 1.01, was calculated based on the ratio of CO_2 emissions to total GHG emissions (CO_2, CH_4 and N_2O expressed as CO_2e) using methods from EPA GHG Equivalencies Calculations and References. Emissions were from mobile fossil fuel combustion in the transportation end-use category in 2013 (the latest available data year), on-road emissions. EPA *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2013* (2015), Table 3-12 to 3-14.

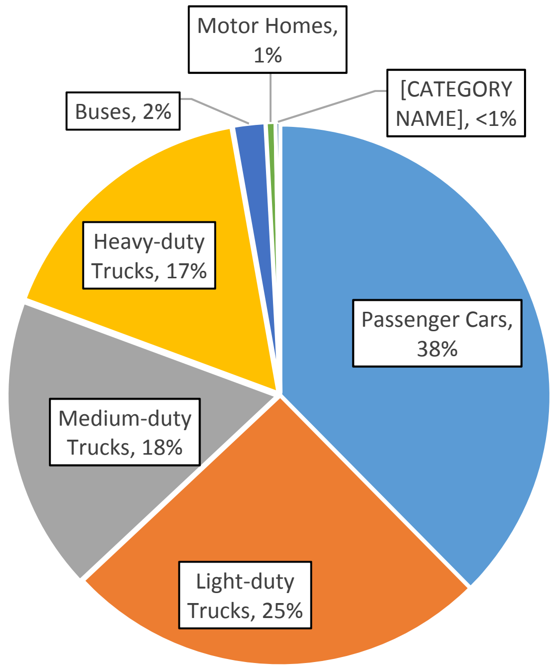
Table 5 VMT, Emission Rate, and GHG Emissions from the On-Road Transportation Category (Imperial Beach, 2012–2014)

Year	Average Vehicle Emission Rate (g CO_2e/mile)	Total VMT		GHG Emissions (MT CO_2e)
		Average Weekday Miles*	Average Annual Miles	
2012	483	324,357	112,551,781	54,400
2013	476	329,422	114,309,318	54,400
2014	467	334,487	116,066,855	54,200

*Consistent with the methodology, this is the sum of internal-internal and half of both external-internal and internal-external VMT from Table 4. Weekday miles are converted to annual average before converting to GHG emissions.
Based on SANDAG Series 13 VMT estimates. 2012 is the Base Year. 2013 is linearly interpolated between 2012 and 2014.
GHG emissions for each category are rounded to the nearest hundreds. Values are not rounded in the intermediary steps in the calculation.
CARB, 2015; SANDAG, 2018; Energy Policy Initiatives Center, 2018.

The decrease in the emission rate is likely due to improved vehicle emission standards of new vehicles. Figure 3 gives the breakdown of emissions by vehicle class in 2012, based on the EMFAC vehicle class distribution in the San Diego region. This report assumes Imperial Beach has the same distribution of vehicle types as the region. Passenger cars and light-duty trucks account for about 63% of the City's on-road transportation emissions, while medium- and heavy-duty trucks account for an additional 35 percent of the on-road transportation emissions.[12]

[12] In California's EMFAC2014, passenger cars are all cars and fuel types designated as Light Duty Automobiles (LDAs). Light Duty Trucks (LDTs) are divided into LDT1 and LDT2, where LDT1 includes gas, diesel, and electric fuel vehicles, while LDT2 does not include electric vehicles. Medium-duty trucks included medium duty vehicles (MDV with Gross Vehicle Weight Rating (GVWR) 5751-8,500 lbs), and heavy-duty trucks (HDTs), with GVWR larger than 8,500 lbs. In contrast, under the EPA Emission Standard, category vehicles with GVWR under 8,500 lbs are considered light-duty trucks/vehicles.



EMFAC2014. Energy Policy Intiatvies Center, 2018
Percentages may not add to totals due to rounding.
*EMFAC vehilce categorization is different from Enviromental Protect Agency (EPA) Emission Standards categorization.

Figure 3 On-Road Transportation Emissions by Vehicle Class in the San Diego Region

4.2 Electricity

Emissions from electricity use in Imperial Beach were estimated using the Built Environment (BE.2) method from the U.S. Community Protocol.[13] Annual electricity sales by the local utility, San Diego Gas & Electric (SDG&E) to Imperial Beach customers[14] were adjusted by 1) a loss factor[15] of 1.07[16] to account for transmission and distribution losses; and 2) subtracting electricity use associated with moving water within the City limits, which is allocated to the water category emissions.

Emissions are calculated by multiplying the adjusted net energy for load (electricity sales + losses) by the corresponding City-specific electricity emission factor, given in Table 6, expressed in pounds of CO_2e per megawatt-hour (lbs CO_2e/MWh). For a given year, the City-specific electricity emission factor is estimated based on the specific power mix of bundled power[17] and Direct Access (DA) power[18] and their

[13] ICLEI – Local Governments for Sustainability USA: U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.0 (2012), Appendix C: Built Environment Emission Activities and Sources.
[14] 2012-2016 metered electricity sales were provided by SDG&E to EPIC (August 14, 2017).
[15] The transmission and distribution loss factor is used to scale end-use demand or retail sales to produce net energy for load. L. Wong, *A Review of Transmission Losses In Planning Studies*, CEC Staff Paper (August 2011).
[16] California Energy Commission (CEC): *California Energy Demand 2015–2025 Final Forecast Mid-Case Final Baseline Demand Forecast Forms*, SDG&E Mid. The transmission and distribution loss factor is calculated based on the ratio of net energy for load (total sales + net losses) and total sales from SDG&E Form 1.2 Mid.
[17] SDG&E bundled power includes the electricity from SDG&E-owned power plants and the electricity from its net procurements.

respective emission factors. The SDG&E bundled emission factors are calculated using Federal Energy Regulatory Commission (FERC) Form 1[19] data, the California Energy Commission (CEC) Power Source Disclosure Program,[20] data on SDG&E-owned and purchased power, and U.S. EPA Emissions and Generating Resource Integrated Database (eGRID)[21] on specific power plant emissions. The DA emission factor is taken from the California Public Utilities Commission (CPUC) Decision D.14-12-037.[22]

The differences in the electricity emission factors from 2012 to 2014 reflect in part the change in the electricity power mix in the City and in SDG&E's service territory. The emission factor increased in 2012 due to the shutdown of the zero-emissions electricity supply from the San Onofre Nuclear Generation Station (SONGS) and replacement by natural gas-fired power plant sources.[23] In the later years, more renewable resources were included in the power mix that resulted in a lower electricity emission factor. SDG&E had 32% renewable sources in the electricity supplied to its bundled customers in 2014, an increase from 19% in 2012.[24]

The net energy for Imperial Beach's load (electricity sales + losses), electricity emission factors, and corresponding GHG emissions from the electricity category for the years 2012–2014 are given in Table 6.

Table 6 Net Energy for Load, Emission Factor and GHG Emissions from Electricity Category (Imperial Beach, 2012–2014)

Year	Net Energy for Load (electricity sales + losses) (MWh)	City-Specific Emission Factor (lbs CO_2e/MWh)	GHG Emissions (MT CO_2e)
2012	63,955	756	21,900
2013	63,057	736	21,000
2014	63,238	636	18,200
GHG emissions for each category are rounded to the nearest hundreds. Values are not rounded in the intermediary steps in the calculation. SDG&E, 2017; Energy Policy Initiatives Center, 2018.			

GHG emissions from the electricity category decreased 17% from 2012 to 2014 which may be partly attributed to the increase of renewable content in the electricity supply.

The net energy for load does not include self-serve renewable supply such as customer-owned behind-the-meter photovoltaic (PV) systems or self-serve non-renewable supply. The estimated cumulative PV capacity in Imperial Beach at the end of 2014 was 1.1 MW, more than three times the cumulative PV capacity at the end of 2012 (0.3 MW), corresponding to an estimated total of 1,940 MWh of behind-the-

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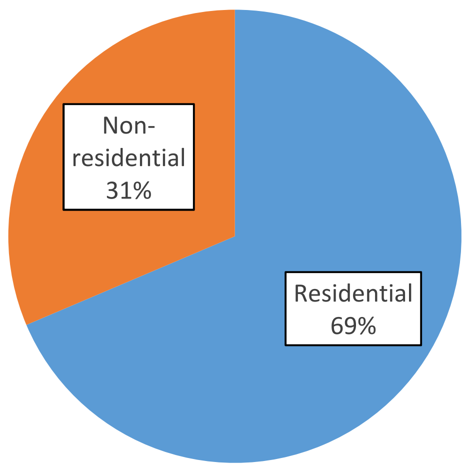
[18] The SDG&E Direct Access Program includes electricity that customers purchased from non-SDG&E electric service providers (ESPs), but SDG&E still provides transmission and distribution services.
[19] FERC: Form 1- Electricity Utility Annual Report, download date: July 20, 2015.
[20] CEC Power Source Disclosure Program under Senate Bill 1305. The SDG&E annual power source disclosure report (2012-2014) was provided by CEC staff to EPIC.
[21] U.S. EPA. eGRID 2012 (2015) and eGRID 2014 v2 (2017).
[22] Decision 14-12-037, December 18, 2014 in Rulemaking 11-03-012 (filed March 24, 2011). The recommended emission factor is 0.379 MT CO_2e/MWh (836 lbs CO_2e/MWh).
[23] SONGS historically accounted for approximately 15–20% of SDG&E power generation. SONGS was permanently closed in 2013 and the energy generation was replaced by other sources, including non-renewable sources, which increased the emission factor of SDG&E-generated electricity.
[24] CEC: Utility Annual Power Content Label.

meter solar generation. The number of newly added PV systems in each year from 2012 to 2014 is also shown in Table 7.[25] Electricity generation from PV systems is considered renewable and assumed to have no associated GHG emissions.

Table 7 Behind-the-meter PV Systems and Electricity Generation (Imperial Beach, 2012–2014)

Year	New PV Systems		Cumulative PV Systems since 1999		Estimated Behind-the-meter Solar Generation (MWh)
	Number of Systems	Capacity (MW_{dc})	Number of Systems	Capacity (MW_{dc})	
2012	11	0.1	82	0.3	496
2013	31	0.6	113	0.9	1,573
2014	39	0.2	152	1.1	1,940
California Distributed Generation Statistics, 2017; Energy Policy Initiatives Center, 2018.					

The emissions from the electricity category can be broken down further into residential and non-residential customer classes. In 2012, 31% of emissions were attributed to non-residential electricity use, 69% were attributed to residential electricity use, as shown in Figure 4.



Energy Policy Initiatives Center 2018.

Figure 4 Electricity Emissions by Customer Class (Imperial Beach, 2012)

4.3 Natural Gas

Emissions from natural gas end-use in Imperial Beach were estimated using method Built Environment (BE.1) from the U.S. Community Protocol.[26] Annual natural gas sales were provided by SDG&E.[27]

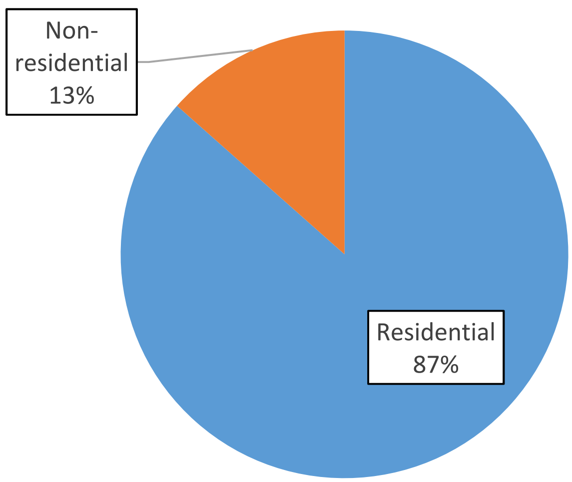
[25] NEM Interconnection Data Set (current as of May 31, 2017), download date: September 12, 2017. Based on the date of NEM interconnection applications approved. Solar capacities are reported in direct current (DC). Estimated electricity generation is converted from capacity using an average solar PV system capacity factor of 20% and an annual system degradation rate of 1%.
[26] ICLEI– Local Governments for Sustainability USA: U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.0 (2012), Appendix C: Built Environment Emission Activities and Sources.
[27] 2012-2016 metered natural gas sales were provided by SDG&E to EPIC (August 14, 2017).

To estimate emissions from the combustion of natural gas, fuel use was multiplied by an emission factor for natural gas based on data from CARB.[28] The total natural gas use and corresponding GHG emissions from the natural gas category for the years 2012–2014 are given in Table 8.

Table 8 Natural Gas Use and GHG Emissions from Natural Gas Category (Imperial Beach, 2012–2014)

Year	Natural Gas Use (Million Therms)	GHG Emissions (MT CO_2e)
2012	2.8	15,600
2013	2.9	15,800
2014	2.5	13,700
GHG emissions for each category are rounded to the nearest hundreds. Values are not rounded in the intermediary steps in the calculation. SDG&E, 2017; Energy Policy Initiatives Center, 2018.		

Emissions from the natural gas category can be broken down further into residential and non-residential customer classes. In 2012, 87% of emissions resulted from residential natural gas use and the result 13% resulted from non-residential natural gas use, as shown in Figure 5.



Energy Policy Initiatives Center 2018.

Figure 5 Natural Gas Emissions by Customer Class (Imperial Beach, 2012)

4.4 Solid Waste

Emissions from solid waste disposed by Imperial Beach were estimated using method Solid Waste (SW.4) from the U.S. Community Protocol.[29] To estimate emissions, the amount of waste disposed by a city in a given year is multiplied by an emission factor for mixed solid waste. Solid waste disposal data

[28] Emission factor for natural gas: 0.00554 million metric tons CO_2e/Million therms. CARB: Documentation of California's GHG Inventory – Index.
[29] ICLEI – Local Governments for Sustainability USA: U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.0 (2012), Appendix E: Solid Waste Emission Activities and Sources.

were retrieved from the California Department of Resources Recycling and Recovery (CalRecycle) Disposal Reporting System (DRS).[30]

The emission factor of mixed solid waste depends on the percentage of each waste type within the waste stream disposed in a landfill. The City of San Diego's 2012–2013 Waste Characterization Study was used as a reasonable proxy for Imperial Beach's solid waste composition and applied to 2012–2014 waste disposed for the emission calculation.[31] Only the CH_4 emissions from waste degradation are considered non-biogenic and included in this category in accordance with the methodology. The CO_2 emissions from waste degradation are considered biogenic and not included in this category.

The default capture rate of CH_4 emissions from landfills is 75% based on that in the U.S. Community Protocol; any CH_4 emissions above this are included as emissions from the solid waste category. The total and per-capita solid waste disposal and the corresponding GHG emissions for the years 2012–2014 are given in Table 9.

Table 9 Solid Waste Disposal and GHG Emissions from Solid Waste Category (Imperial Beach, 2012–2014)

Year	Solid Waste Disposal (MT/year)	Per Capita Solid Waste Disposal (kg/person/day)	GHG Emissions (MT CO_2e)
2012	12,466	1.3	2,300
2013	12,868	1.3	2,400
2014	12,204	1.2	2,300
GHG emissions for each category are rounded to the nearest hundreds. Values are not rounded in the intermediary steps in the calculation. CalReycle, 2017; Energy Policy Initiatives Center, 2018.			

4.5 Water

California American Water Company (CalAm) Southern Division, a privately owned public utility company, provides potable water to the City of Imperial Beach. CalAm Southern Division is not a member agency of the San Diego County Water Authority (SDCWA), however it purchases water from the City of San Diego, which is a SDCWA member agency.[32]

It is assumed the sources of the water provided by CalAm Southern Division are the same as those of the City of San Diego. The water supply sources for City of San Diego include: 1) imported untreated water from SDCWA; 2) imported treated water from SDCWA, 3) local surface water runoff and 4) groundwater from the Santee/El Monte Basin.[33]

CalAm Southern Division's service area is larger than the City of Imperial Beach and includes the City of Coronado (but not the North Island Naval Air Station), the City of San Diego's southern San Diego Bay

[30] CalRecycle: Disposal Reporting System (DRS): Jurisdiction Disposal and Alternative Daily Cover (ADC) Tons by Facility. 2012–2014 solid waste disposal data from CalRecycle. Download date: June 7, 2017.
[31] City of San Diego 2014, *Waste Characterization Study 2012–2013 Final Report*. The emission factor of 0.744 MT CO_2e/short ton was calculated based on the waste distribution and emission factor for each waste type in *Version 13 Waste Reduction Model (WARM)*.
[32] California American Water. June 2016. 2015 Urban Water Management Plan. Southern Division – San Diego County District.
[33] City of San Diego. Jun 2016. 2015 Urban Water Management Plan. Section 3 Description of Existing Water System.

area, and a small portion of the City of Chula Vista. It is assumed that the percentage of water from each source supplied to the City of Imperial Beach is the same as that of the entire service area.

The potable water supplied by CalAm Southern Division to Imperial Beach only was not available, instead, the water supplied to Imperial Beach and Coronado by CalAm Southern Division was allocated to Imperial Beach based on the population ratio of the cities.[34]

The potable water supplied to Imperial Beach and the percentage of water from each source are given in Table 10.[35]

Table 10 Potable Water Supplied and Supply Source (Imperial Beach, 2012–2014)

Year	% of Potable Water from each Water Supply				Potable Water Supplied (acre-foot)
	SDCWA Treated Water	SDCWA Untreated Water	Local Surface Water	Local Groundwater	
2012	9%	76%	15%	0.4%	4,001
2013	9%	79%	11%	0.5%	3,692
2014	7%	75%	18%	0.3%	3,952
City of San Diego, 2016; Energy Policy Initiatives Center, 2018.					

The energy use to produce and distribute potable water from each supply is different due to the different raw source type and its location. Emissions from water use in Imperial Beach were estimated using method Wastewater and Water (WW.14) from the U.S. Community Protocol.[36] The method considers each segment of the water-use cycle (water supply and conveyance, water treatment, and water distribution) individually, as described below.

Upstream Supply and Conveyance – This is defined as supply and conveyance of water from the raw sources to the local service area. The upstream supply and conveyance energy use for SDCWA treated and untreated water consists of conveyance of water from the State Water Project and Colorado River through Metropolitan Water District's service area and SDCWA's service area.

Local Water Treatment –This is the energy used for water treatment plant operations. CalAm Southern Division purchases only treated water from the City of San Diego, which owns three water treatment plants. The water treatment plants treat SDCWA untreated water and local water to potable water standards.

[34] 2012-2016 water purchased by CalAm from City of San Diego (excluding City of San Diego's southern San Diego Bay) were provided by City of San Diego Public Utilities Department to EPIC (July 2017). The 2012-2016 population in the City of Coronado (excluding military population) are from SANDAG's Demographic & Socio-Economic Estimates (March 9, 2017 Version). SANDAG Data Surfer. Accessed on October 24, 2017.
[35] Water supply sources represents the City of San Diego's water supply sources. CalAm purchases water from the City of San Diego to supply its service area. The calendar year 2012-2014 water source data are not available, the percentages represent fiscal year 2012-2014 water source data. Water supply sources data were provided by the City of San Diego Public Utilities Department to EPIC (August 2016).
[36] ICLEI – Local Governments for Sustainability USA. U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions. Version 1.0. (2012). Appendix F. Wastewater and Water Emission Activities and Sources.

Local Water Distribution – This is defined as the energy required to move treated water from water treatment plants to end-use customers. Distribution energy use includes energy use for water pump stations and/or pressure reduction stations, water storage tanks, etc. The distribution energy for water delivered to Imperial Beach has two parts: 1) the energy needed for the City of San Diego to deliver water from its water treatment plants to CalAm Southern Division service area; and 2) the energy needed for distribution within CalAm Southern Division service area.

The energy intensity per unit of water for each segment of the water-use cycle is given in Table 11.

Table 11 Energy Intensity for Each Segment of Water-Use Cycle (Imperial Beach, 2012–2014)

<table>
<tr><th>Year</th><th>Upstream Supply and Conveyance - SDCWA treated water (kWh/acre-foot)[37]</th><th>Upstream Supply and Conveyance - SDCWA untreated water (kWh/acre-foot)[38]</th><th>Local Water Treatment Energy Intensity (kWh/acre-foot)[39]</th><th>Local Distribution Energy Intensity (kWh/acre-foot)[40]</th></tr>
<tr><td>2012</td><td rowspan="3">1,816</td><td rowspan="3">1,755</td><td rowspan="3">46</td><td rowspan="3">43</td></tr>
<tr><td>2013</td></tr>
<tr><td>2014</td></tr>
<tr><td colspan="5">CalAm, 2016; City of San Diego, 2016 and 2017; MWD, 2016; SDCWA, 2016.</td></tr>
</table>

For upstream supply and conveyance emissions, the potable water from SDCWA (treated and untreated) was multiplied by the upstream energy intensity to estimate the total electricity use from upstream supply. The electricity use was multiplied by the average California electricity emission factor to calculate the GHG emissions.[41] Because the electricity use and GHG emissions associated with upstream supply and conveyance are outside the City boundary and would not be included in the electricity category, they are accounted for in the water category.

Emissions from water treatment were calculated by multiplying the volume of potable water use by Imperial Beach by the water treatment energy intensity and SDG&E's electricity emission factor. The electricity use associated with water treatment is not included in the electricity category for Imperial

[37] Anything upstream of the agency or district is part of upstream supply and conveyance, therefore, the upstream supply and conveyance energy intensity for SDCWA *treated* water includes conveyance from the State Water Project and Colorado River water to Metropolitan Water District's (MWD) distribution system, distribution from MWD to MWD's member agencies, SDCWA conveyance of raw water to its water treatment plants, treatment in SDWCA's plants and distribution of treated water from SDCWA's treatment plant to SDCWA's member agency. SDCWA 2016: Urban Water Management Plan 2015, Metropolitan Water District of Southern California, Urban Water Management Plan 2015.

[38] Upstream supply and conveyance energy intensity for SDCWA *untreated* water includes conveyance from the State Water Project and Colorado River water to MWD's distribution system, distribution from MWD to MWD's member agencies, and SDCWA's conveyance of raw water supplies to SDCWA's member agencies.

[39] The average energy intensity at City of San Diego's three water treatment plants in 2016 does not include the electricity from on-site PV generation at the treatment plants. The energy intensity was provided by City of San Diego Public Utilities Department in July 2017.

[40] The electricity distribution intensity (42.8 kWh/AF) within City of San Diego's service area is used as a proxy for the distribution energy intensity to deliver water from treatment plants to CalAm service area. City of San Diego. Jun 2016. 2015 Urban Water Management Plan. Section 10 Energy Intensity Analysis. The distribution intensity (0.3 kWh/AF) within CalAm service area includes the energy at the interconnection with City of San Diego supply and a storage tank. California American Water. June 2016. 2015 Urban Water Management Plan. Southern Division – San Diego County District.

[41] The Western Electricity Coordinating Council (WECC) CAMX (eGRID Subregion) emission rate from eGRID was used as representative of the average California electricity emission rate for upstream electricity. U.S. EPA. eGRID 2012. (2015) and eGRID 2014 v2 (2017).

Beach since the treatment plants are located outside Imperial Beach boundaries, therefore, the GHG emissions are accounted for in this water category.

GHG emissions associated with water distribution were estimated by multiplying potable water used by Imperial Beach by the energy intensity for local water distribution and the SDG&E electricity emission factor. The portion of electricity and GHG emissions associated with water distribution occurs within the City boundary (within CalAm Southern Division service area) and have been subtracted from the electricity category, as they are accounted for in the water category.

In addition to providing potable water to Imperial Beach, Padre Dam MWD also produces and delivers recycled water to Imperial Beach. The recycled water is treated at the Padre Dam MWD's Ray Stoyer Water Recycling Facility (Ray Stoyer WRF).[42] The energy use from recycled water treatment and distribution is calculated based on the Padre Dam MWD local operation energy intensity given in Table 11. Because Ray Stoyer WRF is located outside Imperial Beach, the electricity use associated with recycled water treatment and distribution would not be included in the electricity category and are accounted for in the water category.

No recycled water was supplied to the City during the inventory years 2012 to 2014.

In 2012, 93 percent of the GHG emissions in the water category were from upstream supply and conveyance. The breakdown of emissions for the water category is given in Figure 6.

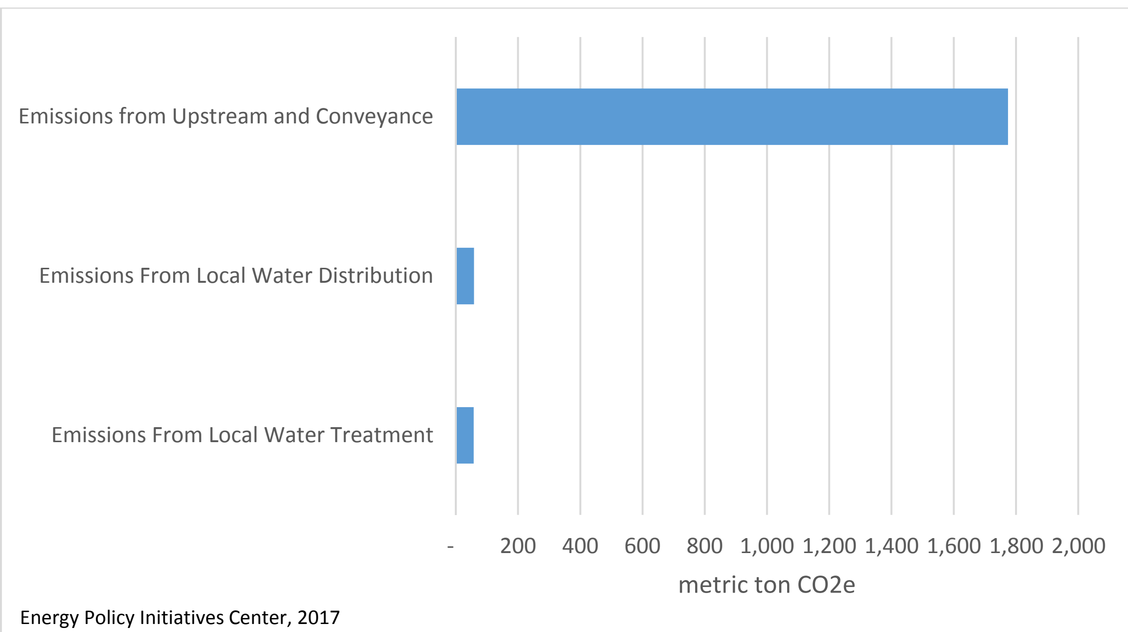


Figure 6 Emissions from the Water Category by Water System Segment (Imperial Beach, 2012)

The total and per-capita potable water supplied, as well as the corresponding GHG emissions from the water category for the years 2012-2014 are given in Table 12.

[42] Padre Dam Municipal Water District (October 2016). 2015 Urban Water Management Plan, Section 6.4 Wastewater and Recycled Water.

Table 12 Water Supplied and GHG Emissions from the Water Category (Imperial Beach, 2012-2014)

Year	Potable Water Supplied (acre-feet)	Per Capita Potable Water Supplied (gallons/person/day)	GHG Emissions (MT CO_2e)
2012	4,001	134	1,900
2013	3,692	122	1,800
2014	3,952	130	1,800
GHG emissions for each category are rounded to the nearest hundreds. Values are not rounded in the intermediary steps in the calculation. Energy Policy Initiatives Center, 2018.			

Emissions associated with water end-use, such as water heating and cooling, are included in the electricity and natural gas category, and not in this water category, as data are not available to separate out those values.

4.6 Wastewater

The emissions from wastewater generated by Imperial Beach were estimated by multiplying the total amount of wastewater generated in a given year with the emission factor of the wastewater treatment processes.

The City's Public Works Department operates and maintains the wastewater collection system within the City. The wastewater is delivered to the City of San Diego Metropolitan Sewerage System and treated at its wastewater treatment plants (WWTPs).

The wastewater treatment emission factor (MT CO_2e/million gallon) at Point Loma WWTP, one of the WWTPs in the Metropolitan Sewage System, is used to estimate the wastewater emissions. Point Loma WWTP reports the wastewater flow in its plant annual report[43] and plant operation GHG emissions to CARB under the Mandatory GHG Reporting Regulation (MRR).[44] The reported GHG emissions include three components: 1) direct CO_2 from combustion of anaerobic digester gas; 2) CH_4 and N_2O emissions from digester gas combustion; and 3) operational fossil fuel emissions from complete combustion. The direct CO_2 from combustion of anaerobic digester gas is considered biogenic, while the other two components of CO_2 emissions are considered non-biogenic emissions.

The wastewater emission factor derived from Point Loma WWTP was applied to all annual wastewater flow from the City of Imperial Beach. The total wastewater flow, wastewater emission factors, as well as the corresponding GHG emissions are given in Table 13.[45]

[43] City of San Diego, Public Utilities. Point Loma Wastewater Treatment Plant & Ocean Outfall – Annual Reports.
[44] CARB. Mandatory GHG Reporting – Reported Emissions. http://www.arb.ca.gov/cc/reporting/ghg-rep/reported-data/ghg-reports.htm
[45] 2010–2016 Wastewater (million gallons per day) flow from El Cajon to Metropolitan Sewerage System were provided by City of San Diego through a Public Records Request in July 2017 and converted to million gallons per year.

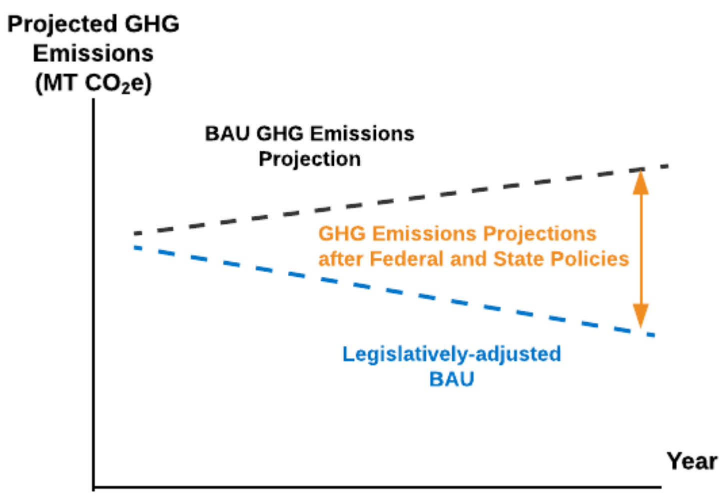
Table 13 Wastewater Generated and Treated at Centralized Treatment Plant (Imperial Beach, 2012–2014)

Year	Total Wastewater Generated (Million Gallons/year)	Wastewater Emission Factor ($MT\ CO_2e$/ Million Gallon)	GHG Emissions ($MT\ CO_2e$)
2012	784	0.41	300
2013	791	0.38	300
2014	789	0.45	400
GHG emissions for each category are rounded to the nearest hundreds. Values are not rounded in the intermediary steps in the calculation. CARB, 2017; City of San Diego, 2017; Energy Policy Initiatives Center, 2018.			

5 BUSINESS-AS-USUAL GHG EMISSIONS PROJECTIONS

To inform the development of GHG reduction strategies within a jurisdiction's Climate Action Plan (CAP), GHG emissions are projected from the latest data available, as well as projections for population, housing, and job growth. The latest year with available data may be different for different inventory categories. This is used to develop a business-as-usual (BAU) projection, which demonstrates emissions growth in the absence of any new policies and programs. Next, emissions reductions attributable to federal and State policies and programs are applied in the future, creating a legislatively-adjusted BAU.

Figure 7 provides an illustrative example of the difference between a BAU and a legislatively-adjusted BAU. Only the BAU projection is discussed in this document; GHG reductions from the policies and programs included in the legislatively-adjusted BAU are considered later in the climate action planning process.



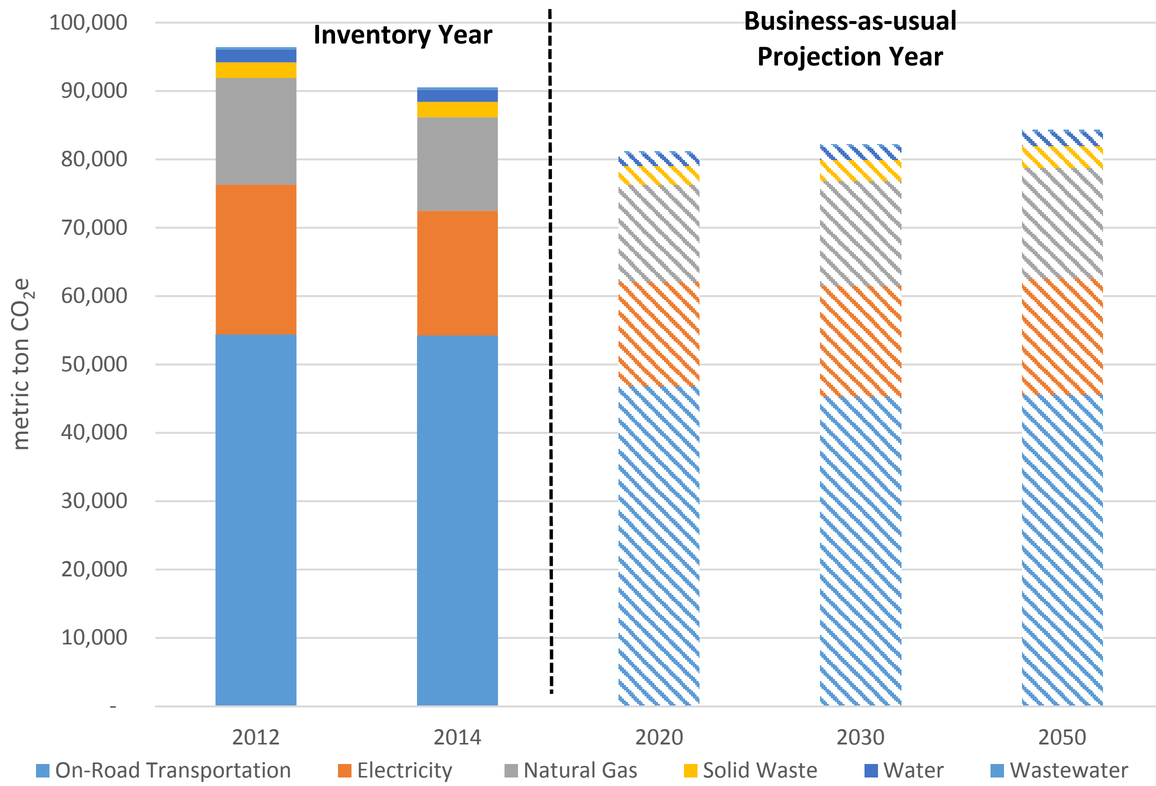
Energy Policy Initiatives Center, 2018

Figure 7 Illustrative Example Only: BAU and Legislatively-adjusted BAU Emissions Projections

Section 5.1 provides a summary of the BAU emissions projections for years 2020, 2030, and 2050, and Section 5.2 provides the projection methodologies used for each category.

5.1 Emissions Projections for 2020, 2030, and 2050

The total GHG emissions in 2020 are projected to be approximately 81,100 $MT\ CO_2e$, 16% lower than the 2012 emissions level and 10% lower than the 2014 emissions level. The total GHG emissions in 2030 are projected to be approximately 82,200 MT CO_2e, and the total GHG emissions in 2050 are projected to be approximately 84,400 MT CO_2e. Figure 8 below shows a comparison of the emissions breakdown by category for the inventory years and projection years.



Energy Policy Initiatives Center, 2018

Figure 8 BAU GHG Emissions Projections (Imperial Beach, 2020, 2030, and 2050)

As shown in Figure 8, the on-road transportation category contributes the most to the overall emissions in each projection year. Emissions from on-road transportation are expected to decline through 2030 and then rise again through 2050, but are not projected to be higher than the on-road transportation emissions in 2012 and 2014. One of the likely reasons for the decline of on-road transportation emissions is the decline of average vehicle emission rates, as newer, more efficient vehicles replace old vehicles in the region. The total and distribution of projected emissions by category are presented in Table 14.

Table 14 Projected Total and Category-GHG Emissions in Imperial Beach (2020, 2030, and 2050)

Emissions Category	Projected GHG Emissions (MT CO_2e)		
	2020	2030	2050
On-Road Transportation	46,900	45,300	45,600
Electricity	15,100	16,200	17,000
Natural Gas	14,200	15,400	16,200
Solid Waste	2,800	3,100	3,200
Water	1,700	1,900	2,000
Wastewater	400	400	400
Total	**81,100**	**82,200**	**84,400**

Sum may not add up to totals due to rounding. Projected GHG emissions for each category are rounded to the nearest hundreds. Values are not rounded in the intermediary steps in the calculation.
Energy Policy Initiatives Center, 2018.

5.2 Methods to Project GHG Emissions

The SANDAG Series 13 Regional Growth Forecast was used as the basis of population and job growth in Imperial Beach, as shown in Table 15.[46] The methods used to project future emissions are provided below for each emissions category.

Table 15 SANDAG Population Projection and Job Growth Forecast (Imperial Beach, 2020, 2030, and 2050)

Year	Population	Jobs
2020	27,506	4,311
2030	29,928	4,473
2050	31,691	4,613

SANDAG, 2013.

5.2.1 On-Road Transportation

Average weekday O-D VMT forecast for each trip type in 2020, 2030, and 2050 were provided by SANDAG based on its Series 13 activity-based model, as shown in Table 16 (See Appendix A for original data tables provided).[47]

[46] Population and jobs data are from the SANDAG Series 13 Regional Growth Forecast (updated in October 2013). SANDAG Data Surfer, accessed October 24, 2017. Series 13 has a baseline calibrated year of 2012. Therefore, projections from the 2012 baseline may differ from more recent estimates by the state, such as the Department of Finance (DOF).
[47] Series 13 2020, 2030, and 2050 VMT average projections were provided by SANDAG (January 30, 2017 and October 18, 2017).

Table 16 Projected O-D VMT and Trip Types (Imperial Beach, 2020, 2030, and 2050)

Trip Type (Miles/Average Weekday)	2020	2030	2050
Internal-Internal	10,268	9,882	9,027
Internal-External/External-Internal	634,583	669,726	677,960
External-External (Information only, excluded from VMT and GHG calculations)*	9,638	10,366	9,322
*Miles from External-External trips are the portion within the City boundary, not the entire trips. SANDAG, 2017.			

To convert VMT of each type to total VMT, the method discussed in Section 4.1 was used. The VMT was multiplied by the adjusted average vehicle emission rate derived from EMFAC2014 for each projection year. Two adjustments were made to the EMFAC2014 emission rates for the projections: 1) the electric vehicle penetration rate in 2016 was kept constant for all projection years;[48] and 2) for all new vehicles entering the fleet after 2016, the emission rates are equal to the emission rates of new model year 2016 vehicles with the same vehicle class and fuel type.[49]

The projected total VMT, average vehicle emission rates, and corresponding GHG emissions from the on-road transportation category are given in Table 17.

Table 17 Projected VMT, Average Vehicle Emission Rate and GHG Emissions from On-Road Transportation Category (Imperial Beach, 2020, 2030, and 2050)

Year	Projected Total VMT		Average Vehicle Emission Rate (g CO_2e/mile)	Projected GHG Emissions (MT CO_2e)
	Average Weekday Miles	Average Annual Miles		
2020	327,559	113,663,077	412	46,900
2030	344,745	119,626,556	379	45,300
2050	348,007	120,758,437	377	45,600
Projected GHG emissions for each category are rounded to the nearest hundreds. Values are not rounded in the intermediary steps in the calculation. CARB, 2015. SANDAG, 2017. Energy Policy Initiatives Center, 2018.				

As newer, more efficient vehicles replace older, less efficient vehicles in the region, the average vehicle emission rate decreases.

5.2.2 Electricity

Electricity use in the City was projected separately for residential and non-residential customer classes. For the residential customer class, the per-capita electricity use (metered electricity sales) in 2016 (1,352

[48] This uses a fixed 2016 electric vehicle penetration rate of about 2% of light duty vehicles instead of using the estimated impact of the state Zero Emission Vehicle (ZEV) program on BAU emissions. The 2016 electric vehicle penetration rate is based on EMFAC2014 Technical Documentation, Section 3.2.2.4.3. The ZEV program requires auto manufacturers to make and sell ZEVs that will increase VMTs driven by ZEVs.
[49] This uses a fixed actual emission rate of the new 2016 models instead of the effect of adopted federal and state vehicle efficiency standards 2017–2025 for light-duty and heavy-duty vehicles.

kWh/person/year), the latest year with available SDG&E data, was calculated by dividing the total electricity sales in the residential class by the population in 2016. The per-capita electricity use is held constant and used to project total electricity use for a future year by multiplying by the SANDAG Series 13 population forecast for the future year. The projected total electricity use was multiplied by the City-specific electricity emission factor in 2016 (542 lbs CO_2e/MWh), held constant, for a projected total GHG emission. The City-specific electricity emission factor in 2016 is significantly lower than that of 2012 and 2014 because SDG&E has since reached 43% renewable energy in its power mix.[50]

A similar method was used for the non-residential class. The total non-residential electricity use was projected based on job growth and the per-job electricity consumption in 2016 (4,757 kWh/job/year) for all future years. The total projected net energy for load (electricity sales + transmission and distribution losses) and corresponding GHG emissions from the electricity category are given in Table 18.[51]

Table 18 Projected Net Energy for Load and GHG Emissions from the Electricity Category (Imperial Beach, 2020, 2030, and 2050)

Year	Projected Net Energy for Load (electricity sales + losses) (MWh)	Projected GHG Emissions (MT CO_2e)
2020	61,567	15,100
2030	65,854	16,200
2050	69,038	17,000
Projected GHG emissions for each category are rounded to the nearest hundreds. Values are not rounded in the intermediary steps in the calculation. Energy Policy Initiatives Center, 2018.		

5.2.3 Natural Gas

The projection method for the natural gas category is similar to that for the electricity category. The natural gas use in residential and non-residential classes are calculated separately. The per-capita residential natural gas consumption (77 therms/person/year) and the per-job natural gas consumption (118 therms/job/year) in 2016 were held constant with population and job growth for the projection. The natural gas emission factor used in Section 4.3 was held constant for future years. The projected total natural gas use and corresponding GHG emissions from the natural gas category are given in Table 19.

[50] 2016 renewable content in SDG&E bundled power is based on SDG&E's 2016 power source disclosure report submitted to the California Energy Commission (CEC). The 2016 report was provided by CEC staff to EPIC in July 2017.
[51] The net energy for load of each future year is adjusted using the method described in Section 4.2. The net energy for load does not include self-serve renewable supply, such as electricity generation from behind-the-meter PV systems.

Table 19 Projected Natural Gas Use and GHG Emissions from Natural Gas Category (Imperial Beach, 2020, 2030, and 2050)

Year	Projected Total Natural Gas Use (Million Therms)	Projected GHG Emissions (MT CO_2e)
2020	2.6	14,200
2030	2.8	15,400
2050	3.0	16,200
Projected GHG emissions for each category are rounded to the nearest hundreds. Values are not rounded in the intermediary steps in the calculation. Energy Policy Initiatives Center, 2018.		

5.2.4 Solid Waste

The BAU solid waste disposal by Imperial Beach was projected using the population growth and the per-capita solid waste disposed in 2016 (1.5 kg/person/day), held constant for future years, to be consistent with other categories. The projected emissions from the disposal were calculated by multiplying the disposal amount with the emission factor for mixed solid waste, provided in Section 4.4. The projected total waste disposal and corresponding GHG emissions from the solid waste category are given in Table 20.

Table 20 Projected Solid Waste Disposal and GHG Emissions from Solid Waste Category (Imperial Beach, 2020, 2030, and 2050)

Year	Projected Solid Waste Disposal (MT)	Projected GHG Emissions (MT CO_2e)
2020	15,212	2,800
2030	16,551	3,100
2050	17,526	3,200
Projected GHG emissions for each category are rounded to the nearest hundreds. Values are not rounded in the intermediary steps in the calculation. Energy Policy Initiatives Center, 2018.		

5.2.5 Water

The total water use for all projection years was based on the fixed 2016 per-capita water consumption and population growth. It is assumed that the current percentage of water from each supply source (SDCWA treated, SDCWA untreated, and local surface water) remained unchanged for the BAU projection. It is also assumed that no recycled water sources or new potable water sources are developed under the BAU projection.

The per-capita potable water used in 2016 (114 gallons/person/day), significantly lower than in 2012 (134 gallons/person/day) and 2014 (130 gallons/person/day). The energy intensity for each element of the water cycle (Table 11) and the electricity emission factor were held constant for all projection years. The projected total water supply and corresponding GHG emissions from the water category are given in Table 21.

Table 21 Projected Water and GHG Emissions from the Water Category (Imperial Beach, 2020, 2030, and 2050)

Year	Projected Water Supply (Acre-Feet)	Projected GHG Emissions (MT CO_2e)
2020	3,522	1,700
2030	3,832	1,900
2050	4,058	2,000
Projected GHG emissions for each category are rounded to the nearest hundreds. Values are not rounded in the intermediary steps in the calculation. Energy Policy Initiatives Center, 2018.		

5.2.6 Wastewater

The total wastewater generation for all projection years is based on the fixed 2016 per-capita wastewater generation and projected population growth. Similarly, the 2016 Point Loma WWTP wastewater emission factor was held constant for the projection years.

The projected total wastewater generation and the GHG emissions from the wastewater category are given Table 22.

Table 22 Projected Wastewater Generated and GHG Emissions from the Wastewater Category (Imperial Beach, 2020, 2030, and 2050)

Year	Projected Wastewater Generated (Million Gallons)	Projected GHG Emissions (MT CO_2e)
2020	769	400
2030	837	400
2040	886	400
Projected GHG emissions for each category are rounded to the nearest hundreds. Values are not rounded in the intermediary steps in the calculation. Energy Policy Initiatives Center, 2018.		

Appendix A. IMPERIAL BEACH VMT BY TRIP TYPE

Average weekday VMT data tables were provided by SANDAG (from SANDAG ABM Series 13, Release 13.3.0). Revenue Constrained refers to the transportation network scenario adopted in San Diego Forward: The 2015 Regional Plan.[52] Emphasis (red squares and text) was added by EPIC.

2012 Base Year (573)

JURISDICTION	TOTAL VMT	TOTAL City of Imperial Beach VMT	Two Trip End City of Imperial Beach VMT	One Trip End City of Imperial Beach VMT	NON-City of Imperial Beach VMT
		I-I, I-E and E-I	I-I	I-E and E-I	E - E
CARLSBAD TOTAL	3,112,152	1,904	-	1,904	3,110,248
CHULA VISTA TOTAL	3,516,790	127,688	-	127,688	3,389,102
CORONADO TOTAL	403,272	37,797	-	37,797	365,475
DEL MAR TOTAL	77,408	10	-	10	77,398
EL CAJON TOTAL	1,895,381	3,458	-	3,458	1,891,923
ENCINITAS TOTAL	1,798,580	1,958	-	1,958	1,796,622
ESCONDIDO TOTAL	2,644,325	1,878	-	1,878	2,642,447
External TOTAL	173,565	1,739	-	1,739	171,826
IMPERIAL BEACH TOTAL	92,302	81,878	10,105	71,773	10,424
LA MESA TOTAL	1,529,813	3,311	-	3,311	1,526,502
LEMON GROVE TOTAL	790,802	4,280	-	4,280	786,522
NATIONAL CITY TOTAL	1,545,814	48,941	-	48,941	1,496,873
OCEANSIDE TOTAL	2,675,329	755	-	755	2,674,574
POWAY TOTAL	868,020	215	-	215	867,805
SAN DIEGO TOTAL	36,928,711	290,862	-	290,862	36,637,849
SAN MARCOS TOTAL	1,838,277	361	-	361	1,837,916
SANTEE TOTAL	947,195	586	-	586	946,609
SOLANA BEACH TOTAL	603,987	862	-	862	603,125
Unincorporated TOTAL	16,372,880	30,074	-	30,074	16,342,806
VISTA TOTAL	1,610,610	51	-	51	1,610,559
REGIONWIDE TOTAL	79,425,213	638,608	10,105	628,503	78,786,605

100% of I-I VMT
50% of I-E/E-I VMT
0% of E-E VMT

Figure A-1 Estimated Imperial Beach 2012 VMT by Trip Type (miles/weekday)

2014 (554)

JURISDICTION	TOTAL VMT	TOTAL City of Imperial Beach VMT	Two Trip End City of Imperial Beach VMT	One Trip End City of Imperial Beach VMT	NON-City of Imperial Beach VMT
		I-I, I-E and E-I	I-I	I-E and E-I	E - E
CARLSBAD TOTAL	3,203,491	2,247	-	2,247	3,201,244
CHULA VISTA TOTAL	3,692,961	130,769	-	130,769	3,562,192
CORONADO TOTAL	411,735	39,052	-	39,052	372,683
DEL MAR TOTAL	78,339	8	-	8	78,331
EL CAJON TOTAL	1,995,801	3,905	-	3,905	1,991,896
ENCINITAS TOTAL	1,847,344	2,223	-	2,223	1,845,121
ESCONDIDO TOTAL	2,773,377	2,295	-	2,295	2,771,082
External TOTAL	207,246	2,107	-	2,107	205,139
IMPERIAL BEACH TOTAL	92,994	82,558	10,008	72,550	10,436
LA MESA TOTAL	1,574,971	3,605	-	3,605	1,571,366
LEMON GROVE TOTAL	826,372	4,719	-	4,719	821,653
NATIONAL CITY TOTAL	1,587,711	51,099	-	51,099	1,536,612
OCEANSIDE TOTAL	2,812,768	913	-	913	2,811,855
POWAY TOTAL	875,032	291	-	291	874,741
SAN DIEGO TOTAL	37,907,330	297,878	-	297,878	37,609,452
SAN MARCOS TOTAL	1,896,887	275	-	275	1,896,612
SANTEE TOTAL	973,960	627	-	627	973,333
SOLANA BEACH TOTAL	623,215	970	-	970	622,245
Unincorporated TOTAL	17,593,148	33,395	-	33,395	17,559,753
VISTA TOTAL	1,667,845	29	-	29	1,667,816
REGIONWIDE TOTAL	82,642,527	658,965	10,008	648,957	81,983,562

100% of I-I VMT
50% of I-E/E-I VMT
0% of E-E VMT

Figure A-2 Estimated Imperial Beach 2014 VMT by Trip Type (miles/weekday)

[52] San Diego Forward: The 2015 Regional Plan was adopted by the SANDAG Board of Directors on October 9, 2015.

2020 (553)					
JURISDICTION	TOTAL VMT	TOTAL City of Imperial Beach VMT	Two Trip End City of Imperial Beach VMT	One Trip End City of Imperial Beach VMT	NON-City of Imperial Beach VMT
		I-I, I-E and E-I	I-I	I-E and E-I	E-E
CARLSBAD TOTAL	3,472,436	2,160	-	2,160	3,470,276
CHULA VISTA TOTAL	4,110,315	124,106	-	124,106	3,986,209
CORONADO TOTAL	376,776	50,217	-	50,217	326,559
DEL MAR TOTAL	75,193	7	-	7	75,186
EL CAJON TOTAL	1,999,957	3,279	-	3,279	1,996,678
ENCINITAS TOTAL	1,882,878	2,097	-	2,097	1,880,781
ESCONDIDO TOTAL	2,805,409	1,891	-	1,891	2,803,518
External TOTAL	194,117	1,782	-	1,782	192,335
IMPERIAL BEACH TOTAL	91,844	82,206	10,268	71,938	9,638
LA MESA TOTAL	1,600,130	3,103	-	3,103	1,597,027
LEMON GROVE TOTAL	822,920	4,084	-	4,084	818,836
NATIONAL CITY TOTAL	1,620,907	44,723	-	44,723	1,576,184
OCEANSIDE TOTAL	2,854,499	842	-	842	2,853,657
POWAY TOTAL	925,978	243	-	243	925,735
SAN DIEGO TOTAL	39,059,773	291,304	-	291,304	38,768,469
SAN MARCOS TOTAL	1,971,319	243	-	243	1,971,076
SANTEE TOTAL	1,028,034	653	-	653	1,027,381
SOLANA BEACH TOTAL	643,319	926	-	926	642,393
Unincorporated TOTAL	17,475,190	30,958	-	30,958	17,444,232
VISTA TOTAL	1,666,374	27	-	27	1,666,347
REGIONWIDE TOTAL	84,677,368	644,851	10,268	634,583	84,032,517

100% of I-I VMT; 50% of I-E/E-I VMT; 0% of E-E VMT

Figure A-3 Projected Imperial Beach 2020 VMT by Trip Type (miles/weekday)

2030 (550)					
	JURISDICTION	TOTAL VMT	TOTAL City of Imperial Beach VMT	Two Trip End City of Imperial Beach VMT	One Trip End City of Imperial Beach VMT
		I-I, I-E and E-I	I-I	I-E and E-I	E - E
CARLSBAD TOTAL	3,612,570	2,258	-	2,258	3,610,312
CHULA VISTA TOTAL	4,707,744	129,286	-	129,286	4,578,458
CORONADO TOTAL	385,001	51,566	-	51,566	333,435
DEL MAR TOTAL	76,024	6	-	6	76,018
EL CAJON TOTAL	2,161,071	3,450	-	3,450	2,157,621
ENCINITAS TOTAL	1,924,311	2,125	-	2,125	1,922,186
ESCONDIDO TOTAL	2,972,037	2,019	-	2,019	2,970,018
External TOTAL	222,080	1,785	-	1,785	220,295
IMPERIAL BEACH TOTAL	95,173	84,807	9,882	74,925	10,366
LA MESA TOTAL	1,755,098	3,191	-	3,191	1,751,907
LEMON GROVE TOTAL	867,492	4,177	-	4,177	863,315
NATIONAL CITY TOTAL	1,777,970	46,773	-	46,773	1,731,197
OCEANSIDE TOTAL	3,048,450	834	-	834	3,047,616
POWAY TOTAL	966,183	273	-	273	965,910
SAN DIEGO TOTAL	41,736,317	312,388	-	312,388	41,423,929
SAN MARCOS TOTAL	2,215,053	296	-	296	2,214,757
SANTEE TOTAL	1,097,270	566	-	566	1,096,704
SOLANA BEACH TOTAL	667,905	956	-	956	666,949
Unincorporated TOTAL	19,108,723	32,843	-	32,843	19,075,880
VISTA TOTAL	1,829,321	9	-	9	1,829,312
REGIONWIDE TOTAL	91,225,793	679,608	9,882	669,726	90,546,185

100% of I-I VMT; 50% of I-E/E-I VMT; 0% of E-E VMT

Figure A-4 Projected Imperial Beach 2030 VMT by Trip Type (miles/weekday)

2050 (551)					
JURISDICTION	TOTAL VMT	TOTAL City of Imperial Beach VMT	Two Trip End City of Imperial Beach VMT	One Trip End City of Imperial Beach VMT	NON-City of Imperial Beach VMT
		I-I, I-E and E-I	I-I	I-E and E-I	E-E
CARLSBAD TOTAL	3,704,149	2,248	-	2,248	3,701,901
CHULA VISTA TOTAL	5,166,673	129,474	-	129,474	5,037,199
CORONADO TOTAL	373,115	45,106	-	45,106	328,009
DEL MAR TOTAL	76,239	5	-	5	76,234
EL CAJON TOTAL	2,334,107	3,523	-	3,523	2,330,584
ENCINITAS TOTAL	1,997,941	2,227	-	2,227	1,995,714
ESCONDIDO TOTAL	3,114,588	2,310	-	2,310	3,112,278
External TOTAL	288,169	1,642	-	1,642	286,527
IMPERIAL BEACH TOTAL	94,778	85,456	9,027	76,429	9,322
LA MESA TOTAL	1,916,985	3,134	-	3,134	1,913,851
LEMON GROVE TOTAL	995,411	4,044	-	4,044	991,367
NATIONAL CITY TOTAL	1,861,451	46,741	-	46,741	1,814,710
OCEANSIDE TOTAL	3,160,266	834	-	834	3,159,432
POWAY TOTAL	1,053,924	272	-	272	1,053,652
SAN DIEGO TOTAL	43,462,426	323,605	-	323,605	43,138,821
SAN MARCOS TOTAL	2,324,039	293	-	293	2,323,746
SANTEE TOTAL	1,158,547	651	-	651	1,157,896
SOLANA BEACH TOTAL	683,791	961	-	961	682,830
Unincorporated TOTAL	21,844,585	34,427	-	34,427	21,810,158
VISTA TOTAL	1,932,008	34	-	34	1,931,974
REGIONWIDE TOTAL	97,543,192	686,987	9,027	677,960	96,856,205

100% of I-I VMT
50% of I-E/E-I VMT
0% of E-E VMT

Figure A-5 Projected Imperial Beach 2050 VMT by Trip Type (miles/weekday)

Appendix B. SOURCE DATA FOR THE SOLID WASTE EMISSION FACTOR

Waste Component	Waste Distribution (%)[1]	Landfill Gas Emissions	
		CH_4 without LFG Recovery (MT CO_2e/short ton)	Source[2]
Paper	16.8%	-	-
Corrugated Containers/Cardboard	*5.0%*	2.36	Exhibit 3-27, WARM v14 Containers /Packaging
Newspaper	*0.8%*	0.95	Exhibit 3-27, WARM v14 Containers /Packaging
Magazine	*0.6%*	1.08	Exhibit 3-27, WARM v14 Containers /Packaging
Mixed Paper (general)	*10.4%*	2.14	Exhibit 3-27, WARM v14 Containers /Packaging
Plastic	8.9%	-	-
Glass	1.7%	-	-
Metal	3.5%	-	-
Organics	38.9%	-	-
Food	*15%*	1.57	Exhibit 1-49, WARM V14 Organic Materials
Tree	*5.3%*	0.77	Exhibit 2-11 WARM V14 Organic Materials
Leaves and Grass	*6.8%*	0.59	Exhibit 2-11 WARM V14 Organic Materials
Trimmings	*3.5%*	0.59	Exhibit 2-11 WARM V14 Organic Materials
Mixed Organics	*8.3%*	0.53	Exhibit 2-11 WARM V14 Organic Materials
Electronics	0.6%	-	-
Construction & Demolition	24.6%	-	-
Household Hazardous Waste	0.2%	-	-
Special Waste	3.1%	-	-
Mixed Residue	1.6%	0.53	
Mixed Waste Emission Factor		**0.744**	
Source: 1) City of San Diego 2014. 2) EPA Waste Reduction Model (WARM) Version 14 (2016)			

Appendix B

Methods for Estimating Greenhouse Gas Emissions Reductions in the Imperial Beach Climate Action Plan

APPENDIX B. METHODS FOR ESTIMATING GREENHOUSE GAS EMISSIONS REDUCTIONS IN THE IMPERIAL BEACH CLIMATE ACTION PLAN

February 2019

Prepared for the City of Imperial Beach

Prepared by the Energy Policy Initiatives Center

About EPIC

The Energy Policy Initiatives Center (EPIC) is a non-profit research center of the USD School of Law that studies energy policy issues affecting California and the San Diego region. EPIC's mission is to increase awareness and understanding of energy- and climate-related policy issues by conducting research and analysis to inform decision makers and educating law students.

For more information, please visit the EPIC website at www.sandiego.edu/epic.

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1 OVERVIEW

This document provides a summary of the methods used to calculate the greenhouse gas (GHG) emissions reductions for the strategies and measures included in the City of Imperial Beach (referred to as “the City” or “Imperial Beach”)’s Climate Action Plan (CAP).

Section 2 provides emission reduction targets for Imperial Beach in 2020 and 2030. Section 3 provides a summary of emissions reduction estimates in each emission category from federal and California (State) actions and five local CAP strategies in 2030. Section 4 provides the common data sources and methods used throughout the document. The detailed methods used to estimate emissions reductions from each strategy and action are presented in Sections 5 and 6.

1.1 Rounding of Values in Tables and Figures

Rounding is used only for the final GHG values within the tables and figures throughout the document. Values are not rounded in the intermediary steps in the calculation. Because of rounding, some totals may not equal the values summed in any table or figure.

2 EMISSION REDUCTION TARGETS

California has a statewide target to reach the 1990 GHG emissions level by 2020 or 431 million metric tons of CO_2e (MMT CO_2e), and to reach 40% below the 1990 level by 2030, or 260 MMT CO_2e.[1] According to the California Air Resources Board (CARB)’s statewide inventory, the 2012 statewide total GHG emissions level was at 450 MMT CO_2e.[2] At the State level, the emission reduction target for 2020 is equivalent to 4% below 2012 and for 2030 it is equivalent to 42% below 2012, as illustrated in Figure 1.

[1] CARB: California’s 2017 Climate Change Scoping Plan (November 2017), accessed on April 26, 2018.
[2] CARB: California Greenhouse Gas Inventory for 2000–2016 (June, 2018), accessed on December 13, 2018.

Figure adapted from California's 2017 Climate Change Scoping Plan Figure 6 that shows a linear, straight-line path to the 2030 target. The 2050 goal is 80% below 1990 level
Source: California Air Resources Board California Greenhouse Gas Emission Inventory - 2018 Edition (June 2018) 2017 Climate Change Scoping Plan.

Figure 1 California Statewide GHG Inventory and Emission Reduction Targets

The Imperial Beach CAP has a baseline year of 2012. To be consistent with the emissions reduction targets at the State level, the target emission levels for Imperial Beach are set at 4% below the 2012 emissions level by 2020 and 42% below the 2012 emissions level by 2030.

Table 1 shows the business-as-usual (BAU) emissions projection, reduction targets, and CO_2e reductions needed in 2020 and 2030 to achieve the target emission levels.[3]

Table 1 Emissions Projection, Reduction Targets, and Emissions Reduction Needed

Year	Business-as-usual Projection (MT CO_2e)	Target Emission Level (% below baseline)	Target Emission Levels (MT CO_2e)	Emissions Reduction Needed to Meet Target (MT CO_2e)
2012	96,400	-	-	-
2020	81,100	-4%	92,700	-11,500
2030	82,200	-42%	55,900	26,300
Emissions values are rounded. Energy Policy Initiatives Center 2018.				

No local actions are needed for the City to reach its 2020 target. In 2030, a reduction of 26,300 MT CO_2e is needed for the City to meet its 2030 target. This document focuses on the State and local actions needed to reach the 2030 target.

[3] The method to project emissions at 2020 and 2030 is provided in Appendix A, *City of Imperial Beach Greenhouse Gas Emissions Inventory and Projection* (EPIC, 2018).

3 SUMMARY OF EMISSIONS REDUCTION ESTIMATES

This section summarizes the GHG emissions reductions from strategies and measures included in the Imperial Beach CAP. Table 2 below presents a summary of emissions reductions from the five local strategies in the City's CAP, as well as the federal and State actions considered.

Table 2 Summary of GHG Emissions Reduction by Strategy in the Imperial Beach CAP

Year	Emissions Reduction by CAP Strategy (MT CO_2e)						Reductions from Federal and State Actions (MT CO_2e)	Total Emissions Reduction (MT CO_2e) *
	Increase Renewable and Zero-Carbon Electricity	Clean and Efficient Transportation	Reduce Vehicle Miles Traveled	Achieve Zero Waste	Sequester Carbon	Total		
2030	1,264	799	1,041	3,318	31	6,454	19,992	26,300

*The total emissions reduction in 2030 is rounded.
Source: EPIC 2018.

Each CAP strategy includes several quantifiable measures and non-quantifiable supporting activities. Table 3 presents a detailed summary of the emissions reduction from each local measure and each federal and State action.

Table 3 Summary of GHG Emissions Reductions by Measure in Imperial Beach CAP

Emission Category	Federal and State Actions, and Local CAP Measures	2030 Emissions Reductions (MT CO_2e)
Energy	**Local CAP Measures**	
	E.1 Increase grid-supply renewables	1,204
	E.2 Increase commercial behind-the-meter photovoltaic (PV) systems	59
	Federal and State Actions	
	SE.1 California Renewables Portfolio Standard	6,022
	SE.2 California solar policies, programs and 2019 mandates	1,856
	SE.3 California energy efficiency programs	3,033
On-road Transportation	**Local CAP Measures**	
	T.1 Increase citywide electric vehicle charging stations	751
	T.2 Clean municipal fleet	48
	T.3 Increase mass transit ridership	687
	T.4 Improve pedestrian and bicycle facilities	342
	T.5 Reduce municipal employee vehicle miles traveled (VMT)	13
	Federal and State Actions	
	ST.1 Federal and California vehicle efficiency standards	9,081
Waste	**Local CAP Measures**	
	W.1 Divert waste from landfill	3,318
	S.1 Urban tree planting	31
	All Federal and State Actions	19,992
	All Local CAP Measures	6,454
	All (Federal, State, and Local CAP) *	26,400

*The total emissions reduction in 2030 is rounded.
Energy Policy Initiatives Center 2018.

Figure 2 provides a visualization of the emissions trend for the CAP horizon year, as well as an estimated future trend through 2050. The Imperial Beach CAP does not include a GHG reduction goal for 2050. Emissions beyond 2030 are included to show future trends and potential reduction needed for the City to be consistent with the State’s long-term goal to reduce statewide emissions 80% below 1990 levels.

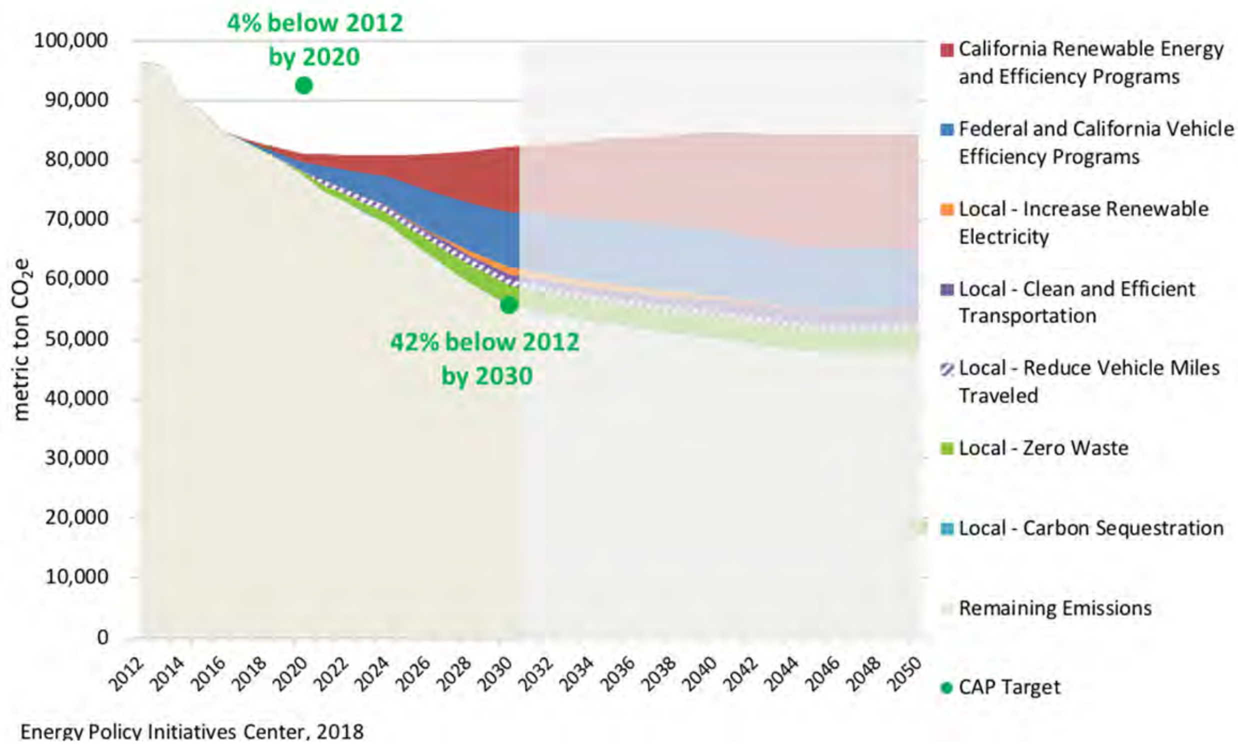

Figure 2 Imperial Beach GHG Emissions Trend (2012–2050)

In Figure 2, the BAU emissions projection is represented along the top of the graph. The green dots represent the target emissions levels in 2020 and 2030. In this case, the City meets both 2020 and 2030 targets with the federal and State actions, and the local measures identified in the CAP. The colored wedges represent the reduction estimates of each CAP strategy and of federal and State actions. The grey area beneath the colored wedges represents the remaining emissions after all the actions have taken place.

4 BACKGROUND AND COMMON ASSUMPTIONS

Unless stated otherwise, all activity data and GHG emissions reported in this document are annual values for the calendar year, and all emission factors reported in this document are annual average values for the calendar year.

A set of common assumptions and sources was used to calculate potential emissions reductions for many of the measures included in the CAP. The following section provides assumptions that were applied to measures related to electricity, natural gas, and on-road transportation. Measures related to other categories do not have common assumptions. The detailed methods and data for each measure are provided in Section 5 and Section 6.

4.1 Common Background Data

Table 4 presents a summary of common data used to estimate overall GHG emissions levels and the reduction estimates across several CAP measures.

Table 4 Common Data Used for the Imperial Beach Climate Action Plan

Year	2012	2020	2030
Population[4]	26,750	27,506	29,928
Labor Force[5]	12,300	13,604	14,116
Vehicle Miles Traveled (VMT) (annual miles)[6]	112,551,781	113,663,077	119,626,556
Electricity Gross Generation (GWh)[7]	64	66	73
VMT projections are based on the SANDAG Series 13 forecast. 2012 is the Series 13 Base Year. For other categories, data in 2012 are historical data and data in 2020 and 2030 are the latest available forecasted data as of October 2018, based on various sources. Energy Policy Initiatives Center 2018.			

4.2 Common Assumptions and Methods for Calculating Electricity Emissions Reductions

The following overall assumptions and methods are used in the calculation of emissions reductions related to electricity, including from federal and State actions and local measures. Details for the calculation of each measure are provided in Sections 5 and 6.

4.2.1 GHG Emission Factor for Electricity

The GHG emission factor for electricity for a city, expressed in pounds of CO_2e per megawatt-hour (lbs CO_2e/MWh) is specific to each city and depends on the types of supply to the city. Therefore, for purposes of estimating GHG reduction from measures, the GHG emission factor for electricity in the City is the weighted average emission factor of gross generation from three sources of supply: the utility (San Diego Gas & Electric [SDG&E] and other electric service providers), a potential local renewables and zero-carbon program, and behind-the-meter PV systems. This city-wide emission factor is used to estimate the effects of State and local measures that increase the grid-supply of renewable electricity, and to estimate the impact of adding behind-the-meter photovoltaic (PV) systems.

The citywide emission factor is calculated based on the percentage of renewable content in, and the percentage of, gross generation from each source of supply as described below. This method is applied to 2016, the emissions projection starting year, as well as to each year included in the CAP horizon.[8] As the percentage of renewable supply in the mix increases, the weighted average emission factor of electricity supply decreases.

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[4] The 2012 population is from SANDAG's Demographic & Socio-Economic Estimates (March 9, 2017 version). The population in 2020 and 2035 are from SANDAG's Series 13 Regional Growth Forecast (Updated in October 2013). SANDAG Data Surfer, accessed on October 24, 2017. Series 13 has a base year of 2012. Projections from 2012 may differ from more recent estimates by the State, such as from the Department of Finance (DOF).

[5] The 2012 labor force is from the California Employment Development Department (EDD) Database, accessed on October 25, 2017. The 2020 and 2030 labor force are based on SANDAG Series 13 forecast for civilian jobs estimates in 2020 and 2030, and the ratio of the 2016 labor force (latest EDD data available as of October 2017) and civilian jobs. SANDAG's Series 13 Regional Growth Forecast (Updated in October 2013). SANDAG Data Surfer, accessed October 24, 2017.

[6] Based on SANDAG Series 13 Origin-Destination weekday VMT, provided to EPIC (January 30, 2017 and October 18, 2017). Weekday VMT were converted to annual VMT using the methods described in *Appendix A. Greenhouse Gas Emissions Inventory and Projection* (EPIC, 2018)

[7] Gross generation is the sum of the forecasted utility electricity sales, electricity generated from behind-the-meter PV systems, additional load from electric vehicles (EVs) and transmission and distribution losses.

[8] The method to project emissions at 2020 and 2030 is provided in Appendix A. *Greenhouse Gas Emissions Inventory and Projection* (EPIC, 2018).

4.2.1.1 Renewables Content in Supply from SDG&E and Other Electric Service Providers

SDG&E's power mix includes electricity generated from SDG&E's own power plants and electricity procured by SDG&E (both specified and unspecified sources), known as bundled power. As of 2016, SDG&E's bundled power mix is 43% renewable.[9] It is assumed that SDG&E and the electric service providers of SDG&E's Direct Access customers will be at 60% renewable power by 2030, as required by the Renewables Portfolio Standard (RPS) under Senate Bill (SB) 100.[10] The RPS mandate is discussed in detail in Section 5.1.

4.2.1.2 Renewables Content in a Potential Local Renewables and Zero-Carbon Program

CAP Measure E.1 includes the potential for the City to join a local program, such as a regional Community Choice Energy (CCE) program. It is assumed that such a program would increase the renewable and zero-carbon electricity to 75% in 2030, or 15% beyond the RPS mandate for that year.

The renewable content of the program would affect the citywide weighted average emission factor. Because the RPS requires all of California's electricity retail providers, including local programs, to meet the RPS requirement, a portion of the emissions reduction from the program is attributed to RPS compliance as a reduction from State actions. The remaining portion of reductions, beyond the 60% in 2030, is attributed to the City action under CAP Measure E.1.

4.2.1.3 Renewables Supply from behind-the-meter PV Systems

Electricity generation from behind-the-meter PV systems in the City, including residential and non-residential PV systems, is considered part of the overall electricity supply. Electricity generation from PV is considered 100% zero carbon (i.e., GHG-free). The State's solar policies and programs, the 2019 California Building Energy Efficiency Standards (Title 24, Part 6), residential PV mandates, and CAP Measure E.2 all contribute to increase behind-the-meter PV systems in the City; they are discussed in Sections 5.2 and 6.3.2.

Considering behind-the-meter PV as a supply source that contributes to the citywide emission factor allows for calculating the effects of energy efficiency programs that may reduce behind-the-meter electricity use or from additional load from electric vehicle (EV) charging which may come from behind-the-meter electricity sources and not just from grid supply.

4.2.1.4 Weighted Average GHG Emission Factor for Electricity

The weighted average GHG emission factor for electricity is based on the percentage of gross generation supplied by each of the previously referenced supplies, as well as the percentage of renewable or zero-carbon content in each supply.

Table 5 shows the contribution from each supply to gross generation and their renewable content, as well as the overall citywide weighted average emission factors for 2016 and 2030.

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[9] California Energy Commission: Power Content Label.

[10] SB100 (de León) California Renewables Portfolio Standard Program: emissions of greenhouse gases (2017–2018). The interim RPS targets are 44% by 2024 and 52% by 2027 from eligible renewable energy resources.

Table 5 2016 and Projected 2030 GHG Emission Factor for Electricity in Imperial Beach

Year	Local Renewables and Zero-Carbon Program		Utility		Behind-the-meter PV		Overall Citywide	
	% of Gross Generation Supplied	Zero-Carbon Content in Supply	% of Gross Generation Supplied	Renewable Content in Supply	% of Gross Generation Supplied	Zero-Carbon Content in Supply	Citywide Renewable and Zero-Carbon Supply	Electricity Emission Factor (lbs CO_2e/MWh)
2016	-	-	94%	43%	6%	100%	47%	493
2030	67%	75%	17%	60%	16%	100%	76%	217

2016 is the latest year with utility data available. The 2016 electricity emission factor is used for business-as-usual emissions projection in future years including 2030.
2030 data are projections under the CAP based on current status, estimated future impact of State policies and programs, and assumptions used for CAP local measures.
Energy Policy Initiatives Center 2018.

In 2016, SDG&E supplied 94% of the gross generation with 43% eligible renewable sources; behind-the-meter PV systems supplied the remainder. SDG&E's 2016 bundled emission factor was 525 lbs CO_2e/MWh, resulting in a citywide emission factor of 493 lbs CO_2e/MWh in 2016.[11]

In 2030, the projected electricity supply from behind-the-meter PV systems is expected to be 16% of gross generation.[12] To comply with the 2030 RPS target, the renewable content in SDG&E's supply will increase to 60%; this document assumes the utility's supply is fixed at the RPS mandate level to avoid overestimating the emissions reduction from the utility's renewable program. The local renewables and zero-carbon program is assumed to have 75% zero-carbon sources in 2030, or 15% beyond the 2030 RPS eligible renewables mandate. Based on these supply contributions, the citywide weighted electricity emission factor in 2030 is projected to be 217 lbs CO_2e/MWh (76% renewable or zero-carbon).[13]

This weighted citywide electricity emission factor is used to calculate the GHG reductions from CAP measures that increase renewable supply or reduce electricity use.

4.2.2 Allocation of GHG Emissions Reductions from Measures that Increase Renewables in Electricity to State Policy, Local Programs or Behind-the-meter PV Supply

The projected citywide electricity emission factor is used to estimate the GHG emissions reductions from any measure that increases the overall renewable and zero-carbon supply. The total reductions from State (mandated RPS) and local CAP measures (Measures E.1 and E.2) to increase renewable and zero-carbon supply is given in Table 6, and calculated using projected gross generation in 2030 and the difference in the 2030 citywide emission factor and BAU emission factor.

[11] The SDG&E bundled emission factor is calculated by EPIC and reported in the SANDAG Regional Climate Planning Framework (ReCAP) Technical Appendix I, Table 6. (2018). The 2016 citywide emission factor is 525 lbs CO_2e/MWh * 94%.
[12] Detail to estimate PV capacity and electricity generation are described in Section 5.2 and Section 6.3.
[13] Using SDG&E's bundled emission factor 525 lbs CO_2e/MWh (43% renewable), the projected 2030 utility emission factor is 368 lbs CO_2e/MWh (60% renewable) and the projected 2030 local program emission factor is 230 lbs CO_2e/MWh (75% renewable or zero-carbon). The 2030 citywide emission factor is 230 lbs CO_2e/MWh *67% + 368 lbs CO_2e/MWh * 17%.

Table 6 Emissions Reduction from All Measures Increasing Renewable and Zero-Carbon Supply in Imperial Beach

Year	Gross Generation (GWh)	BAU Projections		Projections with State and local Measures Increasing Renewable and Zero-Carbon Supply		Emissions Reduction from Increased Renewable and Zero-Carbon Supply ($MT\ CO_2e$)
		BAU Electricity Emission Factor (lbs CO_2e/MWh)	BAU Emissions from Electricity ($MT\ CO_2e$)	Projected Electricity Emission Factor (lbs CO_2e/MWh)	Projected Emissions from Electricity ($MT\ CO_2e$)	
2030	73	493	16,313	217	7,172	9,142

The projections with increasing renewable supply are the projections under the CAP, including future impact of State policies and programs, and local CAP actions.
Energy Policy Initiatives Center 2018.

The BAU emission factor for 2016 (Table 5) is kept constant through the year 2030 as opposed to using the emission factor for the 2012 baseline year, because the additional renewable content in SDG&E's supply and behind-the-meter PV supply in 2016 are already included in the BAU emissions projection.[14]

The total emissions reduction from increasing renewable supply (Table 6) is allocated to each policy based on the renewable (or zero-carbon, if beyond the RPS mandate) contribution from each supply to the total citywide renewable content. This allocation and its impact on GHG reduction from each type of measure is shown in Table 7.

Table 7 Allocation of Emissions Reductions from Increasing Renewable (or Zero-Carbon) Supply in Imperial Beach

Year	Electricity Supply	Total	Local Renewables and Zero-Carbon Program	Utility	Behind-the-meter PV
2030	% of Gross Generation Supplied by Renewables and Zero-Carbon Sources	76%	50%	10%	16%
	Emissions Reduction from Increased Renewables and Zero-Carbon Supply ($MT\ CO_2e$)	9,142	6,022	1,204	1,916

2030 data are the projections under the CAP, including future impact of State policies and programs, and assumptions used for local CAP measures.
Energy Policy Initiatives Center 2018.

4.3 Common Assumptions and Methods for Calculating Natural Gas Emissions Reductions

For the CAP actions related to reducing natural gas (e.g., reduce natural gas use in buildings) the default emission factor of 0.0054 $MT\ CO_2e$ per therm is used for all years to estimate emissions reduction.

[14] The method to project emissions at 2020 and 2030 is provided in Appendix A. *Greenhouse Gas Emissions Inventory and Projection* (EPIC, 2018).

4.4 Common Assumptions and Methods for Calculating On-Road Transportation Emissions Reductions

The following assumptions and methods are used to calculate emissions reductions for strategies related to on-road transportation, including federal actions, State actions, and local CAP measures.

4.4.1 GHG Emission Factor for On-Road Transportation

The GHG emission factor for on-road transportation, expressed in grams of CO_2e per mile (g CO_2e/mile), is used in several ways throughout the document. It is used to estimate the effect of State actions to increase the vehicle fuel standard, the impact of reduced VMT, and the effect of State and local actions to increase the miles driven by electric vehicles (EVs).

The default outputs of the CARB's Mobile Source Emissions Inventory EMFAC2014 model is used to determine the average vehicle emission rates for the San Diego region.[15] The average vehicle emission rates for the San Diego region were used as proxy for Imperial Beach. The EMFAC2014 model outputs include all key federal and State regulations related to tailpipe GHG emissions reductions that were adopted before the model release date in 2015. The regulations embedded in the outputs are:

- For passenger cars and light-duty vehicles - Federal Corporate Average Fuel Economy (CAFE) standards and California Advanced Clean Car (ACC) Program[16]
- For heavy-duty vehicles (heavy-duty trucks, tractors, and buses) - U.S. Environmental Protection Agency's Phase-I GHG Regulation and CARB Tractor-Trailer GHG Regulation[17]

The Low Carbon Fuel Standard (LCFS), which requires a reduction of at least 10% in the carbon intensity of California's transportation fuels by 2020, is not included in the EMFAC2014 model because most of the emissions benefits come from the production aspect of the fuel cycle rather than the combustion cycle. Therefore, the LCFS does not have a significant impact on tailpipe GHG emissions reduction.[18]

Using the EMFAC2014 default output, the average vehicle emission rates (g CO_2/mile) are calculated based on the distribution of VMT for each vehicle class and its emission rate. The results are adjusted to convert from g CO_2/mile to g CO_2e/mile to account for total GHG emissions, including CO_2, CH_4, and N_2O.[19] The average vehicle emission rates (Table 8) are used to estimate the GHG emissions reduction impact of policies that increase vehicle efficiency and increase the number of zero emissions vehicles (ZEVs) on the road.[20]

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[15] CARB: Mobile Source Emissions Inventory. EMFAC2014 was the latest model available at the beginning of the Imperial Beach CAP development process (mid-2017). The latest model is EMFAC2017 released in March 2018.

[16] The California Advanced Clean Cars (ACC) program includes additional standards for vehicle model years 2017–2025, and the Zero Emission Vehicle (ZEV) program requires manufacturers to produce increasing numbers of ZEVs and plug-in hybrid electric vehicles for 2017–2025 model year vehicles. CARB: EMFAC2014 Technical Documentation, Section 1.4 (v1.0.7 May 2017).

[17] EPA's Phase-I GHG regulation includes GHG emission standards for heavy-duty vehicle model years 2014–2018. CARB's Tractor-Trailer GHG Regulation includes the aerodynamic and tire improvements requirements to reduce GHG emissions from heavy-duty trucks. CARB: EMFAC2014 Technical Documentation, Section 1.4.

[18] CARB: EMFAC2014 Technical Documentation. Section 1.4. In the previous version of the Mobile Source Emissions Inventory model, EMFAC2011, the emissions effects of the LCSF were incorporated into the model output.

[19] The calculation and adjustment method are described in Section 4.1 of Appendix A. *City of Imperial Beach Greenhouse Gas Emissions Inventory and Projection* (EPIC 2018).

[20] EVs are ZEVs, however, ZEVs may include vehicles with other technologies such as fuel cell vehicles. EMFAC2014 only modeled the impact of EVs as ZEVs, therefore, in this document EVs and ZEVs are interchangeable.

Table 8 Average Vehicle Emission Rates in the San Diego Region

Year	Average Vehicle Emission Rate - with the impact of all adopted State and federal policies ($g\ CO_2e$/mile)
2016	446
2030	297
Based on CARB EMFAC2014 Model. The model includes all key federal and State regulations related to tailpipe GHG emissions reductions that were adopted before the model release date in 2015. CARB 2015. Energy Policy Initiatives Center 2018.	

The projected 2030 average vehicle emission rate in Table 8 is also used to estimate the emissions reduction from measures that reduce VMT (Section 6.2). Because vehicle efficiency improves, and the population of ZEVs increases over time, the average vehicle emission rate decreases. Therefore, measures that reduce VMT offset decreasing amounts of GHG emissions throughout the CAP horizon.

4.4.2 GHG Emissions Reduction from Increasing Zero Emission Vehicles

CAP Measure T.1 aims to increase EV charging stations at public and private spaces in the City (Section 6.1.1), and the State ZEV program requires manufacturers to produce increasing numbers of ZEVs and plug-in hybrid electric vehicles (PHEVs); both contribute to increasing the miles driven by ZEVs.

To avoid double-counting, the maximum emissions related to all measures in the CAP that increase miles driven by ZEVs are set at the amount expected from statewide programs and policies. The effect of the ZEV program in future years is estimated by comparing the emissions rate in the BAU projection with no additional policy impacts after 2016 (fixed 2016 ZEV penetration rate for the CAP horizon) and the emissions rate with the impact of the ZEV program (EMFAC2014's default ZEV penetration rate), as shown in Table 9.[21] The BAU projection is based on 2016, not baseline year 2012, to be consistent with the projection method in the electricity category. The additional 2016 model year vehicle fuel efficiency and ZEVs are already taken into consideration in the BAU emissions projection.

Table 9 Emissions Reduction from Increasing Miles Driven by Zero Emission Vehicles

Year	Projected VMT (annual million miles)	BAU Projection - With No Policy Impact after 2016		With Impact of Adopted ZEV Program		Total Emissions Reduction from ZEVs ($MT\ CO_2e$)
		BAU Average Vehicle Emission Rate ($g\ CO_2e$/mile)	BAU Emissions from On-Road Transportation ($MT\ CO_2e$)	Average Vehicle Emission Rate ($g\ CO_2e$/mile)	Emissions from On-Road Transportation ($MT\ CO_2e$)	
2030	120	379	45,317	361	43,144	2,173
The 2030 VMT projection is based on the SANDAG Series 13 Growth Forecast. The projected emission rates are the projections under the CAP, including future impact of State policies and programs used in the CARB EMFAC2014 model. Energy Policy Initiatives Center, 2018.						

[21] The method to project emissions at 2020 and 2030 is provided in Appendix A. *Greenhouse Gas Emissions Inventory and Projection* (EPIC, 2018).

A portion of the total emissions reduction from ZEVs (2,173 MT CO_2e) is allocated to Measure T.1 (751 MT CO_2e) in proportion to the measure's contribution of EV miles. Table 10 provides the key assumptions and results of allocating GHG emissions reduction from increasing ZEVs to Measure T.1.

Table 10 Allocation of GHG Emissions Reduction from Increasing Zero Emission Vehicles

Year	Projected miles driven by EVs as Percent of Total VMT	Projected miles driven by EVs (annual million miles)		Emissions Reduction from EVs (MT CO_2e)	
		With Impact of Adopted ZEV Program	Measure T. 1	With Impact of Adopted ZEV Program	Allocated to Measure T. 1
2030	7.6%	9.1	3.1	2,173	751

CAP Measure T.1: Increasing EV charging stations at public and private locations.
Projected miles driven by EVs as percent of total VMT are based on the assumptions in CARB EMFAC2014 model for the San Diego Region.
The emissions reduction from EVs is the projection under the CAP, including future impact of State policies and programs used in CARB EMFAC2014 model and assumptions used for local CAP measures.
Energy Policy Initiatives Center 2018.

Based on the EMFAC2014 model assumptions, in 2030, 7.6% of all VMT in the San Diego region will be driven by EVs, proportional to 9.1 million miles in Imperial Beach. Measure T.1 would result in about 3.1 million EV miles in 2030. Therefore, 35% (the ratio of 3.1 million miles to 9.1 million miles) of the emissions reduction from the ZEV program is allocated to Measure T.1.[22]

5 EMISSIONS REDUCTIONS FROM FEDERAL AND STATE ACTIONS

Federal and State actions are expected to reduce emissions significantly over the CAP horizon. This section provides a summary of the methods used to estimate the emissions reduction associated with the following federal and State actions to increase renewable energy and building efficiency (SE.1, SE.2, and SE.3), and clean and efficient transportation (ST.1):

- SE.1: California Renewables Portfolio Standard
- SE.2: California Solar Programs, Policies, and 2019 Mandates
- SE.3: California Energy Efficiency Programs
- ST.1: Federal and California Vehicle Efficiency Standards

5.1 SE.1: California Renewables Portfolio Standard

SB 100, the 100 Percent Clean Energy Act of 2018, approved by Governor Brown in September 2018, adopts a 60% RPS for all of California's retail electricity providers by 2030, which increases the current RPS standard from 50% to 60%. The legislation also provides goals for intervening years before 2030 and establishes a State policy requiring that "zero-carbon" resources supply 100% of all retail electricity sales to end-user customers and all State agencies by December 31, 2045.[23] The SB 100 renewable and zero-carbon targets are shown in Figure 3, below.

[22] 35% of 2,173 MT CO_2e is 751 MT CO_2e
[23] SB 100 (de León) California Renewables Portfolio Standard Program: emissions of greenhouse gases (2017–2018). The interim RPS targets are 44% by 2024 and 52% by 2027 from eligible renewable energy resources.

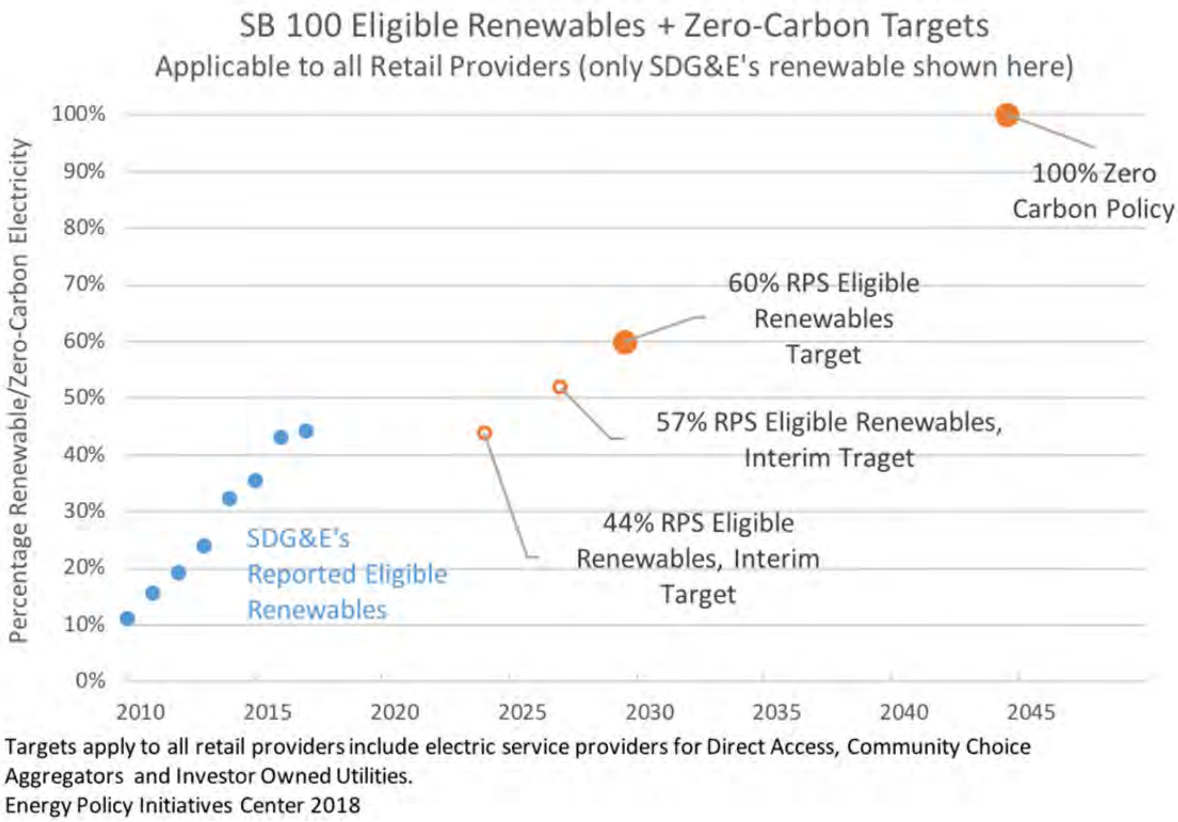


Figure 3 SB 100 RPS and Zero-Carbon Targets

All retail electricity providers are required to meet the State's RPS requirements, including SDG&E, electric service providers for SDG&E's Direct Access customers, and any local renewables and zero-carbon programs. In this document, a conservative approach is taken that assumes all providers for utility customers, including electricity provided to DA customers, will meet the RPS requirements for 2030 and not go beyond. Under this assumption, all emissions reductions from a utility reaching 60% renewables is due to RPS requirements.

For the local renewables and zero-carbon program, the CAP target is to reach 75% carbon-free by 2030. A portion of the emissions reduction from the local program will be attributed to RPS compliance, and the remaining reduction will be attributed to CAP Measure E.1, as described in Section 6.3.1. Table 11 shows results from the California RPS (SE.1) only.

Table 11 Electricity Providers and Projected 2030 Emissions Reduction from SE.1 California Renewables Portfolio Standard

Year	(a) RPS-Related Emissions Reduction from the Utility * (MT CO_2e)	(b) RPS-Related Emissions Reduction from Local Renewables and Zero-Carbon Program (MT CO_2e)	All RPS-Related Emissions Reductions (sum of a and b) (MT CO_2e)
2030	1,204	4,817	6,022

*Includes utility and electricity providers of utility's Direct Access customers.
2030 data are projections under the CAP based on current status, future impact of State policies and programs, and local CAP actions.
Energy Policy Initiatives Center 2018.

5.2 SE.2: California Solar Programs, Policies, and 2019 Mandates

5.2.1 Solar Policies and Programs

California has several policies and programs to encourage customer-owned, behind-the-meter PV systems, including the California Solar Initiatives, New Solar Home Partnership, Net Energy Metering, and electricity rate structures designed for solar customers.

The latest California Energy Demand 2018–2030 Revised Forecast, developed by the California Energy Commission (CEC), has projections for behind-the-meter PV generation in the SDG&E planning area through 2030.[24] The demand forecast provides three scenarios: high demand case, mid demand case and low demand case. The PV projection from 2018–2030 in the SDG&E planning area mid demand case forecast is used to project the PV generation in Imperial Beach.[25]

The California Distributed Generation (DG) Statistics database includes capacities of behind-the-meter PV systems interconnected in a jurisdiction in a given year for each of the three Investor Owned Utility (IOUs) planning areas, including SDG&E. The DG Statistics provide detailed information about the behind-the-meter PV systems installed in a jurisdiction from the start year of incentive programs through the current year. This provides a historical record used to determine the capacity in GHG inventory years and can also help determine trends in PV installation.

A comparison of the estimated capacity and electricity generation from PV systems in the City and in the SDG&E planning area are given in Table 12. [26]

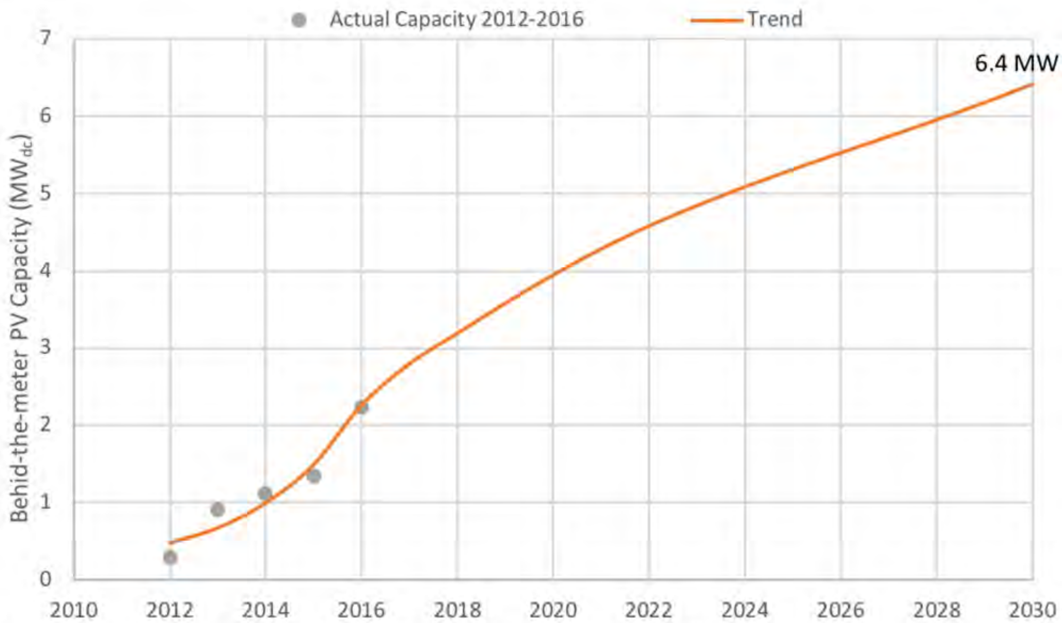
[24] Kavalec et al. 2018. California Energy Demand 2018 — 2030 Revised Forecast. California Energy Commission, Electricity Assessments Division. Publication Number: CEC-200-2018-002-CMF, accessed July 11, 2018. SDG&E planning area is larger than San Diego region.
[25] Kavalec et al. 2018. Mid Case Revised Demand Forecast (February 2018). California Energy Commission, Electricity Assessments Division. Publication Number: CEC-200-2018-002-CMF, accessed July 11, 2018.
[26] Capacity of all interconnected PV system in Imperial Beach are from California Distributed Generation Statistics NEM Currently Interconnected Data Set (current as of May 31, 2017), download date: September 12, 2017.

Table 12 Behind-the-meter PV Capacity and Estimated Electricity Generation (Imperial Beach and SDG&E Planning Area)

Year	Imperial Beach*		SDG&E Planning Area**	Ratio of Electricity Generation from PV (Imperial Beach to SDG&E)
	PV Capacity (MW)	Estimated Electricity Generation (GWh)	Estimated Electricity Generation (GWh)	
2012	0.29	0.51	238	0.2%
2013	0.91	1.59	335	0.5%
2014	1.13	1.97	496	0.4%
2015	1.34	2.36	744	0.3%
2016	2.24	3.92	1,129	0.3%
			Average	0.3%

* Estimated electricity generation based on PV capacity and 20% capacity factor.
**California Energy Demand 2018–2030 Revised Forecast mid demand case (February 2018 version)
California Distributed Generation Statistics 2017; CEC 2018; Energy Policy Initiatives Center 2018.

For future years, the electricity generation and capacity of behind-the-meter PV systems in the City are estimated based on the PV generation in the SDG&E planning area mid case forecast, and the average ratio of PV generation in the City to that of SDG&E's planning area from 2012–2016 (0.3%). The estimated PV capacity in Imperial Beach because of the California Solar Programs and Policies is projected to be 6.4 MW, with 11.3 GWh electricity generation. The trend of behind-the-meter PV in the City is shown in Figure 4.



Actual capacity from 2012-2016 based on California Distributed Generation Statistics, 2017.
Trend based on California Energy Demand 2018-2030 Revised Forecast (February 2018 version), SDG&E planning area mid-demand case.
The forecast does not include the additional PV installation due to the 2019 Title 24 Building Standards PV mandates.
Energy Policy Initiatives Center, 2018

Figure 4 Behind-the-meter PV Trend in Imperial Beach (2012–2030)

5.2.2 2019 Building Energy Efficiency Standards PV Mandates

The new California 2019 Building Energy Efficiency Standards which go into effect on January 1, 2020 require all newly constructed single-family homes, low-rise multi-family homes, and detached accessory dwelling units (ADUs) to have PV systems installed, unless the building qualifies for an exception.[27]

In the past few years, on average, eight new single-family homes were built in the city in one year.[28] To estimate the impacts of the PV mandates, it is assumed that, on average, 15 new single-family homes and ADUs will be built every year in the CAP horizon. For multi-family homes in the city, the projection in the SANDAG Series 13 Forecast is used and assumed to all be low-rise multi-family homes; the Series 13 Forecast assumes 900 new multi-family homes will be added between 2020 and 2030.[29] For the PV system size requirement of each housing unit type, the minimum qualified size required by the 2019 Building Energy Efficiency Standards is calculated for a unit type based on its average size, as shown in Table 13.[30]

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[27] CEC: 2019 Building Energy Efficiency Standards – 2019 Residential Compliance Manual (December 2018). For the requirements on newly constructed single-family and low-rise multi-family homes, see Section 7.2 Prescriptive Requirements for Photovoltaic System. For the requirements on newly constructed and detached ADU, see Section 9.3.5 Accessory Dwelling Units (ADUs).

[28] Housing data provided by City to EPIC, April 2018.

[29] SANDAG Series 13 Regional Growth Forecast (October 2013). SANDAG Data Surfer, accessed on October 24, 2017

[30] The site plan of the Blue Wave Hotel & Residences Project at Imperial Beach was provided by the City to EPIC (October 2018). The average size of apartments in the project, including studio, one-bedroom and two-bedroom apartments, is approximately 800 sq. ft.

Table 13 Estimated PV Requirement for New Homes after 2020 in Imperial Beach

Housing Unit Type	Average Unit Size (sq. ft.) *	PV Required for the Unit Size (kW_{dc})**
Single-family	1,700	2.1
Multi-family	800	1.6
Accessory Dwelling Units (ADUs)	800	1.6

* For single-family, the average home size in San Diego-Carlsbad-San Marcos Area is shown. For multi-family, the average size is based on the unit size of new multi-family development projects in Imperial Beach.
** Calculated based on unit size (sq. ft.) and 2019 Building Energy Efficiency Standards Residential Compliance Manual Equation 7-1 and Table 7-1. Imperial Beach is in Climate Zone 10. Minimum size required.
Energy Policy Initiatives Center 2018

For a conservative approach for all housing unit types, it is assumed that 10% of the new homes will not be subject to the PV mandates. The number of new homes with PV systems because of the PV mandate, as well as the estimated system capacity, are given in Table 14. The number of new homes with PV systems and capacity are those added between 2020 and 2030.

Table 14 New Homes with PV Systems after 2020 in Imperial Beach

Year	New Single-family Homes and ADUs after 2020		New Multi-family Homes after 2020		All New Homes after 2020	
	Number of New Homes with PV Systems	PV System Capacity (kW)	Number of New Homes with PV Systems	PV System Capacity (kW)	PV System Capacity (MW)	Estimated Electricity Generation (MWh)
2030	149	297	836	1,488	1.8	3,128

PV system capacity is the capacity in 2030 from all systems added at new homes and ADUs after 2020, and does not include existing PV or PV added on other new non-residential projects.
Energy Policy Initiatives Center 2018

5.2.3 All Solar Policies, Programs, and Mandates

The California Energy Demand 2018–2030 Revised Forecast, discussed in Section 5.2.1, does not include the additional impact of 2019 PV mandates; therefore, the PV installation trend shown in Figure 4 does not include the additional 1.8 MW PV capacity from new homes after 2020.[31] The total estimated PV capacity as a result of California solar policies, programs, and PV mandates in Imperial Beach is projected to be 8.2 MW (the sum of 6.4 MW and 1.8 MW).

CAP Measure E.2 aims to increase PV systems on new and redeveloped commercial projects, with a projected additional 0.3 MW PV capacity in the City by 2030 that will bring the total PV capacity in 2030 to 8.5 MW. Methods to estimate the PV capacity from Measure E.2 are described in Section 6.3.2.

[31] The 2018–2030 Revised Forecast assumes some single-family homes will install PV system without the mandates. However, it does not model the impact of PV mandates on ADUs and low-rise multi-family homes. Personal communication with CEC staff, December 14, 2018.

The emissions reductions from all State actions and CAP measures that increase the behind-the-meter renewable supply is 1,916 MT CO_2e, given in Section 4.2.2 (Allocation of GHG Emissions Reductions from Measures that Increase Renewables in Electricity to State Policy, Local Programs or Behind-the-meter PV Supply) and Table 7 (Allocation of Emissions Reductions from Increasing Renewable (or Zero-Carbon) Supply in Imperial Beach). The total reduction is allocated based on estimated capacity (MW) that would result from each action. As shown in Table 15, GHG emissions reductions are the projected reduction amounts for 2030 only.

Table 15 Key Assumptions and Results for California Solar Policies, Programs, and Mandates

Year	State or City Action	Total	Measure E.2 Increase Commercial Behind-the-meter PV	California Solar Polices, Programs, and Mandates*
2030	Projected Behind-the-meter PV Capacity (MW)	8.5	0.3	8.2
	Projected Emissions Reduction (MT CO_2e)	1,916	59	1,856

*Solar policies, programs and mandates include the impact of the PV mandates from 2019 Building Energy Efficiency Standard.
The projected capacity and emissions reduction are the projections under the CAP, based on current status, future impact of State policies and programs, and CAP assumptions.
Energy Policy Initiatives Center 2018

In 2030, 97% (8.2 MW out of 8.5 MW) of the projected citywide PV capacity will be due to State polices, programs, and mandates; therefore, 97% of the total emissions reduction from increasing behind-the-meter PV (1,856 MT CO_2e) is allocated to this State action.

5.3 SE.3: California Energy Efficiency Program

In September 2017, the California Public Utilities Commission (CPUC) adopted energy efficiency goals for ratepayer-funded energy efficiency programs to begin in 2018 (Decision 17-09-025). The adopted energy saving goals for SDG&E's service territory are given in the Decision on an annual basis from 2018 to 2030.[32] The sources of the energy savings include, but are not limited to, rebated technologies, building retrofits, behavior-based initiatives, and codes and standards.[33]

To evaluate the impact of the energy efficiency program on the City, the total energy savings in SDG&E's service territory is allocated to the City using a ratio of the City's natural gas and electricity demand to those of SDG&E's entire service territory. In the past few years, the ratios of City demand to SDG&E's service territory demand have been 0.3% for electricity and 0.6% for natural gas.[34] SDG&E's service territory electricity and natural gas savings were allocated accordingly to the City, as shown in Table

[32] CPUC: Decision 17-09-025. Adopting Energy Efficiency Goals for 2018–2030, accessed December 12, 2018. SDG&E's electricity service territory is larger than San Diego region.
[33] Navigant Consulting: Energy Efficiency Potential and Goals Study for 2018 and Beyond (August 2017), accessed December 12, 2018. Rebated technologies are the energy efficiency technologies from the utility's historic incentive programs, including equipment and retrofits.
[34] SDG&E service territory demand is from California Energy Demand 2018–2030 Revised Forecast, SDG&E planning area load 2014-2016. 2016 is the latest year with historical data in the demand forecast. Electricity and natural gas demand in Imperial Beach were provided to EPIC by SDG&E for the GHG inventory. Appendix A. *Greenhouse Gas Emissions Inventory and Projection* (EPIC, 2018).

16.[35]

Table 16 Estimated Energy Saving from California Energy Efficiency Program

Year	Electricity Savings (GWh)		Natural Gas Savings (MMTherms)	
	SDG&E Service Territory	Imperial Beach	SDG&E Service Territory	Imperial Beach
2030	3,328	9.8	60	0.4
SDG&E service territory savings are the cumulative savings after 2018 based on the 2018-2030 annual saving goals in CPUC Decision 17-09-025. Energy Policy Initiatives Center 2018				

Emissions reductions from electricity savings are calculated by multiplying the electricity savings by the GHG emission factor for electricity, discussed in Section 4.2.1 (GHG Emission Factor for Electricity) and Table 5 (2016 and Projected 2030 GHG Emission Factor for Electricity in Imperial Beach). As the renewable and zero-carbon content in electricity increases, the emissions reduction from the energy efficiency program decreases accordingly. Similarly, emissions reductions from natural gas savings were calculated using the natural gas savings amount and natural gas emission factor. Table 17 summarizes the key assumptions and results; the energy savings and GHG emissions reductions are the projected amounts in 2030 only.

Table 17 Key Assumptions and Results for California Energy Efficiency Programs

Year	Electricity Savings			Natural Gas Savings			Total Emissions Reduction (MT CO_2e)
	Electricity Savings (GWh)	Emission Factor (lbs CO_2e/MWh)	GHG Reduction from Electricity Savings (MT CO_2e)	Natural Gas Savings (MMtherm)	Emission Factor (MT CO_2e/therm)	GHG Reduction from Natural Gas Savings (MT CO_2e)	
2030	9.8	217	960	0.4	0.0054	2,073	3,033
The emissions reductions are the projections under the CAP, including future impact of State policies and programs, and CAP assumptions. Energy Policy Initiatives Center 2018							

5.4 ST.1: Federal and California Vehicle Efficiency Standards

As discussed in Section 4.4 (Common Assumptions and Methods for Calculating On-Road Transportation Emissions Reduction), CARB's EMFAC2014 model includes all key federal and State regulations related to tailpipe GHG emissions reductions for both light-duty and heavy-duty vehicles that were adopted before the model release date in 2015.

Table 18 shows a comparison of the average vehicle emission rate and emissions from on-road transportation under the BAU projection, as well as with the impact of policies that increase vehicle efficiency and ZEVs. As discussed in Section 4.4.2 (GHG Emissions Reduction from Increasing Zero Emission Vehicles), to avoid double-counting, the maximum emissions related to all measures in the CAP

[35] CPUC: Decision 17-09-025. Adopting Energy Efficiency Goals for 2018–2030, accessed December 12, 2018. The 2018 and beyond goals are given on an annual basis for each year from 2018 to 2030, different from previous studies, in which the cumulative goals are given. The cumulative savings in 2030 from 2018 are the sum of the annual savings.

that increase miles driven by ZEVs are set at the amount expected from statewide programs and policies. The effect of CAP Measure T.1 (Increase Citywide EV Charging Stations) is subtracted from the emissions reductions from State policies. Table 18 summarizes the key assumptions and results. The GHG emissions reduction is the projected reduction amount in 2030 only.

Table 18 Key Assumptions and Results for ST.1 Federal and California Vehicle Efficiency Standards

Year	Projected VMT (annual million miles)	BAU Projection - With no Policy Impact after 2016		With Impact of Adopted Statewide Policies		Emissions Reduction (MT CO_2e)		
		Average Vehicle Emission Rate (g CO_2e/mile)	Emissions from On-Road Transportation (MT CO_2e)	Average Vehicle Emission Rate (g CO_2e/mile)	Emissions from On-Road Transportation (MT CO_2e)	With Impact of Adopted Statewide Policies	From CAP Local Measure T.1	Remaining ST.1
2030	120	379	45,317	297	35,485	9,832	751	9,081

The 2030 VMT projections are based on SANDAG's Series 13 Growth Forecast. The emission rates and emission reductions are the projections under the CAP, including current status, future impact of State policies and programs used in CARB EMFAC2014 model, and CAP assumptions.
Energy Policy Initiatives Center 2018

6 EMISSIONS REDUCTIONS FROM LOCAL MEASURES

The following section describes the methods used to estimate the GHG reductions from CAP measures, which are organized into the following five main strategies:

- Increase Clean and Efficient Transportation
- Reduce Vehicle Miles Traveled
- Increase Renewable and Zero-Carbon Electricity
- Achieve Zero Waste
- Sequester Carbon

Each CAP strategy is supported by several measures and activities.

6.1 Strategy: Increase Clean and Efficient Transportation

Increased clean and efficient transportation can be achieved by increasing the use of alternatively-fueled vehicles citywide through Measures T.1 and T.2.

6.1.1 Measure T.1: Increase Citywide Electric Vehicle Charging Stations (EVCSs)

The goal of Measure T.1 is to add additional 100 electric vehicle charging stations (EVCSs) at both public and private spaces within the city by 2030. The addition of EVCSs encourages and promotes more EVs. To add EVCSs at public sites, the City will work with agencies in the region, including SANDAG, the Center for Sustainable Energy (CSE), SDG&E, and others, to install EVCSs at the Civic Center, libraries, schools, public beaches, and Port of San Diego parking lots.

To add EVCSs at private sites, the City will work through its development review process to ensure new commercial projects, redeveloped commercial projects, and multi-family buildings install EVCSs at 5% of parking spaces to facilitate the increasing demand of EV infrastructure at commercial properties and multi-family homes. The projected starting date of this action is 2023, which is the start of the next California Green Building Standards (CalGreen) code cycle.

For the EVCSs, it is assumed that Level 2 chargers will be installed. At the new and redeveloped commercial projects, an EVCS is assumed to be used for charging vehicles on average five hours a day. The EV miles that result from installation of these additional EVCSs are estimated based on a Level 2 charging capacity, EV drive efficiency, and hours in use, as shown in Table 19.[36] On average, it is assumed that 70,000 EV miles per year are charged at public EVCS.

Table 19 Electric Vehicle Charging Efficiency by Level 2 Charger Type

Type of Charging (Level 2)	Capacity (kW)*	Hours in Use per Day	EV Load (kWh/day)	Vehicle Drive Efficiency (kWh/mile) **	EV Miles per Day of Charge	EV Miles per Year per EVCS
Low	3.3	5	17	0.25	66	24,090
Medium	6.6	5	33	0.25	132	48,180
High	9.6	5	48	0.25	192	70,080
Highest	19.2	5	96	0.25	384	140,160
					Average	70,000

*Based on Electric Vehicle Charging Station Installation Best Practice, CSE, 2016.
**Based on CEC Plug-in Electric Vehicle Infrastructure Projections: 2017–2025 vehicle driven efficiency assumptions. Energy Policy Initiatives Center 2018

At new multi-family homes, the EVCSs will be used to charge the residents' personal EVs. Based on the EMFAC2014 model, in the San Diego region, approximately 35 miles per day are driven by EVs.[37]

In the past three years, the City has approved three new or redevelopment commercial projects with a total of 270 new parking spaces.[38] Assuming the trend continues, 5% of all new parking spaces will have EVCSs installed after 2023. The SANDAG Series 13 projections estimates that 900 new multi-family units will be added from 2020 to 2030.[39] Because the Imperial Beach Municipal Code requires 1.5 off-street parking spaces for each multi-family unit, 52 of new multi-family unit parking spaces will have EVCSs installed after 2023.[40]

The GHG emissions reduction from this measure is estimated based on the ratio of projected EV miles resulting from the installation of EVCSs under this measure to the total EV miles from EMFAC2014 model estimates, as discussed in Section 4.4.2 (GHG Emissions Reduction from Increasing Zero Emission Vehicles) and shown in Table 10 (Allocation of GHG Emissions Reduction from Increasing Zero Emission

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[36] The Level 2 charger capacity range comes from the Center for Sustainable Energy: Electric Vehicle Charging Station Installation Best Practice (June 2016). The vehicle drive efficiency assumption is based on Bedir etl al 2018. California Plug-In Electric Vehicle Infrastructure Projections: 2017–2025. California Energy Commission. Publication Number: CEC-600-2018-001.
[37] CARB: Mobile Source Emissions Inventory. EMFAC2014 San Diego County 2020-2030 estimates.
[38] The three new or redevelopment projects are Breakwater Hotel, Blue Wave Hotel & Residences and Imperial Beach Resort. The site plans for the three projects were provided to EPIC by the City (October 2018). Parking spaces given in the site plans include both surface parking lots and parking structures.
[39] SANDAG Series 13 Regional Growth Forecast (October 2013). SANDAG Data Surfer, accessed on October 24, 2017. Using linear interpolation, approximately 690 new multi-family units are projected to be added from 2023 to 2030.
[40] Imperial Beach Municipal Code. Chapter 19.48, Off-street Parking, accessed on October 25, 2017. Mixed-use projects in the City are eligible for parking reduction, however, data are not available to estimate the impact of mixed-use projects on the total number of parking spaces.

Vehicles). The number of parking spaces with EVCS, projected EV miles, and GHG emissions reductions are shown in Table 20. The GHG emissions reduction is the projected reduction amount in 2030 only.

Table 20 Key Assumptions and Results for Measure T.1 Increase Citywide Electric Vehicle Charging Stations (EVCS)

Year	New and Redeveloped Commercial Projects			Multi-Family Units			Total	
	% of Parking Space with EVCS	Additional EVCS after 2023	EV Miles Resulting from Charging at EVCS (annual million miles)	% of Parking Spaces with EVCS	Additional EVCS after 2023	EV Miles Resulting from Charging at EVCS (annual million miles)	EV Miles Resulting from Charging at EVCSs (annual million miles)	Emissions Reduction (MT CO_2e)
2030	0.05	36	2.5	0.05	52	0.6	3.1	751
The emissions reduction is the projection under the CAP, including current status, future impact of State policies and programs used in CARB EMFAC2014 model and CAP assumptions. Energy Policy Initiatives Center, 2018								

6.1.2 Measure T.2: Clean Municipal Fleet

The goal of Measure T.2 is to replace 24 fossil fuel vehicles in the municipal fleet with EVs by 2030. The City will work with the Center for Sustainable Energy's (CSE's) "EV Expert" to refine the fleet assessment and implement the fleet conversion plan.

CSE's "EV Expert" analyzed the City's current fleet inventory and determined that there are 24 total vehicles (18 unique models) that can be replaced with an electric vehicle. Based on information from City staff, Imperial Beach's municipal fleet has relatively low mileage, with approximately 5,000 miles driven per year. The fuel consumption of the identified vehicles was estimated based on the estimated mileage.[41] The vehicles, their fuel economy (miles per gallon [MPG]), and a replacement schedule are provided in Table 21.[42]

[41] Fuel consumption or mileage information of each individual vehicle were not available at the time of the CAP development.
[42] CSE EV Expert: City of Imperial Beach Fleet Assessment (2018). The fuel use was calculated by EPIC based on the vehicle MPG and average 5,000 miles driven a year by a typical city vehicle.

Table 21 Imperial Beach Municipal Fleet Vehicle Replacement Schedule

Count of Vehicle	Model Year	Make	Model	Miles per Gallon (MPG)	Replace by	Fuel Use (gallons/year)
1	1995	Ford	Ranger P/U	20	2019	250
1	1997	Ford	Ranger	20	2019	250
2	2002	Dodge	Stratus	20	2020	250
1	2002	Dodge	Dakota	17	2021	294
1	2004	Dodge	Dakota 4x4	15	2021	333
1	2004	Ford	Ranger	21	2022	238
1	2004	Ford	F150	16	2022	313
1	2005	Ford	Ranger	21	2023	238
3	2006	Ford	Ranger P/U	21	2024	238
1	2011	Ford	Ranger	20	2025	250
1	2013	Ford	F150	15	2025	333
1	2014	Ford	Explorer	20	2026	250
1	2014	Toyota	Tacoma	21	2026	238
1	2014	Ford	Expedition	16	2027	313
3	2015	Ford	F150	22	2028	227
2	2016	Chevrolet	Colorado	22	2029	227
1	2018	Ford	Fusion S Hybrid	42	2030	119
1	2018	Chevrolet	Colorado	22	2030	227
					Total	5,997

MPG based on U.S Department of Energy fuel economy database. Fuel use is calculated based on vehicle MPG and 5,000 miles driven a year.
CSE EV Expert 2018; Energy Policy Initiatives Center 2018

Based on the CSE fleet assessment, the vehicles will be replaced by PHEVs (Ford Fusion PHEV) or electric pickups (Workhorse electric pickup); therefore, all gasoline fuel used by these vehicles will be offset with the conversion. The gasoline fuel savings are approximately 34% of the current municipal fleet gasoline use.[43] The GHG emissions reduction in 2030 is shown in Table 22.[44]

[43] 2017 municipal fleet gasoline use is 17,755 gallons, provided by City to EPIC (October 2018).
[44] Gasoline carbon content based on estimates from U.S. Energy Information Administration. Frequently Asked Questions. Accessed October 24, 2018.

Table 22 Key Assumptions and Results for Measure T.2 Clean Municipal Fleet

Year	Gasoline Reduction (gallons)	Gasoline Carbon Content* (lbs CO_2/gallon)	GHG Emission Reduction (MT CO_2e)
2030	5,997	18	48
*Assume gasoline blend has 10% ethanol. The emissions reduction is the projection under the CAP assumptions. Energy Policy Initiatives Center 2018			

6.2 Strategy: Reduce Vehicle Miles Traveled (VMT)

Another strategy to reduce emissions from on-road transportation is to reduce VMT. This can be achieved by measures such as increasing alternative modes of transportation (Measures T.3 and T.4) for commuters and avoiding single-occupant driving, or by reducing municipal employee work-related VMT (Measure T.5).

6.2.1 Measure T.3: Increase Mass Transit Ridership

The San Diego Metropolitan Transit System (MTS) is the local public transit provider serving central, southern, and eastern parts of San Diego County. MTS recently received a grant for their Blue Line Rail Corridor Transit Enhancements program to support the Mid-Coast Trolley Extension.[45] The Enhancements program includes a new rapid bus service, Rapid 925, with service between Imperial Beach and the Otay Mesa International Border crossing, via the Iris Avenue Transit Center where the bus would connect with the Blue Line and other bus routes.[46]

Rapid 925 is anticipated to start service by 2021 with peak headways of up to every 7.5 minutes during weekday services. The route would also complement the existing local Route 933/934 on Coronado Avenue/Imperial Beach Boulevard within the City, which is one of the MTS bus routes with the highest ridership. The route will be serviced by electric buses with zero tailpipe emissions. The average annual ridership, which is assumed to be new riders, and estimated VMT avoided due to the New Rapid 925 service are given Table 23.[47]

[45] Extended trolley line from downtown San Diego and University of California San Diego/University Town Center. Currently under construction.
[46] The Blue Line Rail Corridor Transit Enhancements grant application was provided by MTS to EPIC, October 2018.
[47] The Blue Line Rail Corridor Transit Enhancements grant application was provided by MTS to EPIC, October 2018. The annual ridership at the starting year 2021, ridership annual rate of increase (1.18%), adjustment factor for transit dependency use (0.5) and length of average Rapid Bus trip (6.44 miles) are given in the grant application.

Table 23 Projected Average Annual Ridership of Rapid 925 and VMT Avoided

Year	Average Weekday Ridership	Average Annual Ridership*	Annual VMT Reduction of Full Rapid 925 Bus Trip** (miles per year)	Annual Imperial Beach VMT *** (miles per year)
2021	5,097	1,294,554	4,168,464	2,084,232
2022	5,157	1,309,854	4,217,731	2,108,866
2023	5,218	1,325,336	4,267,582	2,133,791
2024	5,280	1,341,000	4,318,021	2,159,011
2025	5,342	1,356,850	4,369,056	2,184,528
2026	5,405	1,372,887	4,420,697	2,210,349
2027	5,469	1,389,114	4,472,946	2,236,473
2028	5,534	1,405,532	4,525,814	2,262,907
2029	5,599	1,422,145	4,579,306	2,289,653
2030	5,666	1,438,953	4,633,429	2,316,715

*Based on weekday ridership and 255 workdays per year.
**Based on the assumptions in the MTS Blue Line Rail Corridor Transit Enhancements grant application, the adjustment factor for transit dependency use is 0.5 and the length of an average trip is 6.44 miles for the Rapid Bus.
***50% of the full trip VMT reduction is allocated to Imperial Beach based on Origin-Destination VMT allocation methods and assuming that bus trips have at least one trip-end within Imperial Beach.
Rapid 925 will also run on weekends. For the purpose of estimating commuting VMT reduction, the weekend ridership data are used in this table.
San Diego Metropolitan Transit System 2017; Energy Policy Initiatives Center 2018.

The avoided Imperial Beach VMT in Table 23 is converted to GHG emissions reduction using the average vehicle emission factor, discussed in Section 4.4.1 (GHG Emission Factor for On-Road Transportation). The GHG emissions reduction in 2030 is shown in Table 24.

Table 24 Key Assumptions and Results for Measure T.3: Increase Mass Transit Ridership

Year	VMT Avoided (miles per year)	Average Vehicle Emission Rate (g CO_2e/mile)	GHG Emissions Reduction (MT CO_2e)
2030	2,316,715	297	687

The emissions reduction is the projection under the CAP, including future impact of State policies and programs used in CARB EMFAC2014 model and CAP assumptions.
Energy Policy Initiatives Center 2018

6.2.2 Measure T.4: Improve Pedestrian and Bicycle Facilities

Imperial Beach has many planned projects to install new or improve existing bicycle facilities throughout the City and improve pedestrian facilities.

The city has existing bicycle infrastructure, such as a Class I bicycle path along the Bayshore Bikeway, and Class II separated bike lanes along Thirteenth Street, Palm Avenue, and other streets throughout the City. Class III bicycle routes, where bicycles share the street with motor traffic, may also have some impact on increasing bicycle commuting. However, studies of the impact of bicycle facilities on increasing bicycle commuting focus on separated bicycle lanes (Class II and better). The goal of this measure is to install 11 miles of Class II or better bicycle lane throughout the City by 2030. The locations of the new bicycle infrastructure projects and length of the bicycle lanes are provided in Table 25.[48]

Table 25 Planned New Bicycle Infrastructure in Imperial Beach to be Completed by 2030

Street	New Bicycle Infrastructure Type	New Planned Length One-Way (linear feet)	Total New Planned Bike Lanes (miles)
Thirteenth Street*	Class II	6,864	2.6
Palm Avenue/SR 75**	Class II	8,600	3.3
Imperial Beach Boulevard	Class II	7,200	2.7
	Class III	1,200	0.5
9th Street	Class II	5,280	2.0
Seacoast Drive	Class III	2,640	0.5
		Class II total	11
		2030 Imperial Beach Developed Area (square miles)	2.7
		Projected Additional Bicycle Lanes (miles per square mile)	4

*Completed in 2014, after SANDAG Series 13 VMT model base year 2012.
**Includes converting existing Class III bicycle facility to Class II.
Projected to be completed by 2030. Seacoast Drive bike lane is only one way, the rest are both ways.
City of Imperial Beach 2018, SANDAG 2013.

The increase in percentage of commuters using bicycles is assumed to be proportional to the increase in bicycle lane miles per square mile. The elasticity of adding each additional mile of Class II bicycle lanes per square mile is associated with a roughly 1% increase in commuters by bicycle.[49] Imperial Beach's developed area is approximately 2.7 square miles; therefore, 11 miles of Class II or better bicycle lanes is equal to four bicycle lane miles per square mile, as shown in Table 25. [50]

Bicycle lanes are used for both recreational and commuting purposes; however, for this measure, only the impact on avoiding single-occupant vehicle (SOV) commute VMT is quantified. To calculate annual SOV commute VMT avoided, the increase in percentage of commuters by bicycle was multiplied by an eight-mile commute distance avoided per day, assuming bicycle commuters are traveling within the City and that there are 255 workdays per year. The avoided VMT is converted to GHG emissions reduction using the average vehicle emission factor discussed in Section 4.4.1 (GHG Emission Factor for On-Road Transportation). The GHG emissions reduction in 2030 is shown in Table 26.

[48] Bicycle lane locations, infrastructure type, length, and projected completion year were provided by AECOM to EPIC (October 2018).
[49] Dill and Carr (2013). Bicycle Commuting and Facilities in Major U.S. Cities: If you build them, commuters will use them – another look.
[50] Developed are based on SANDAG's Series 13 Regional Growth Forecast (Updated in October 2013). SANDAG Data Surfer, accessed October 24, 2017.

Table 26 Key Assumptions and Results for Measure T.4 Improve Pedestrian and Bicycle Facilities

Year	Labor Force (number of commuters)	Additional Bike Lanes Added (bike lane miles per square mile)	% of Additional Labor Force Using Bicycle to Commute	Additional Labor Force Using Bicycle to Commute (number of commuters)	Commute VMT Avoided (miles per year)	Average Vehicle Emission Rate (g CO_2e/mile)	GHG Emissions Reduction (MT CO_2e)
2030	14,116	4	4%	565	1,151,826	297	342

Average VMT avoided by commuting by bicycle is assumed to be eight miles per workday and 255 workday per year.
The emissions reduction is the projection under the CAP, including future impact of State policies and programs used in CARB EMFAC2014 model and CAP assumptions.
Energy Policy Initiatives Center 2018

The City also plans to improve pedestrian infrastructure as part of Measure T.4, though the GHG emissions reductions for these improvements are not quantified because majority of the improvements include sidewalk widening and improvements to landscape, lighting, and benches.

6.2.3 Measure T.5: Reduce Municipal Employee VMT

To reduce municipal employee's work-related VMT, the City plans to obtain and maintain a fleet of 10 electric bicycles for City staff to utilize for short, intra-City trips, such as building inspection trips within the City. Assuming ten employees use the electric bicycles per day and avoid 18 miles of vehicle driving a day, the employee VMT avoided is shown in Table 27.[51]

The avoided VMT is converted to GHG emissions reduction using the average vehicle emission factor, discussed in Section 4.4.1 (GHG Emission Factor for On-Road Transportation). The GHG emissions reduction in 2030 is shown in Table 27.

Table 27 Key Assumptions and Results for Measure T.5 Reduce Municipal Employee VMT

Year	VMT Avoided (miles per workday)	VMT Avoided (miles per year)	Average Vehicle Emission Rate (g CO_2e/mile)	GHG Emissions Reduction (MT CO_2e)
2030	180	45,900	297	13

Assumes 255 workdays per year.
The emissions reduction is the projection under the CAP, including future impact of State policies and programs used in CARB EMFAC2014 model and CAP assumptions.
Energy Policy Initiatives Center 2018

6.3 Strategy: Increase Renewable and Zero-Carbon Electricity

The goal of this strategy is to increase grid and behind-the-meter renewables through Measures E.1 and E.2.

[51] Miles per day estimated based on City building inspector's work-related trips. The building inspector does 12 inspections per day and covers 18 miles per day.

6.3.1 Measure E.1: Increase Grid-Supply of Renewable and Zero-Carbon Electricity

As discussed in Section 5.1, SB 100 (100 Percent Clean Energy Act of 2018) adopts a 60% RPS for all of California's retail electricity providers by 2030. To further increase grid-supply renewable and zero-carbon electricity beyond the RPS mandate, CAP Measure E.1 includes the potential to join a local renewables and zero-carbon program, such as a regional CCE program, that increases the renewable/zero-carbon electricity to 75% in 2030, 15% beyond the RPS mandate for that year. It is assumed that the local program would supply 80% of the electricity load (not including the behind-the-meter PV generation) in 2030.[52]

As previously explained in Section 5.1 and Table 7 (Allocation of Emissions Reductions from Increasing Renewable Supply), because the local renewables and zero-carbon program is required to comply with the State's RPS mandates, a portion of the total emissions reduction from this measure is attributed to the State RPS compliance. The remaining emissions reduction beyond RPS compliance is allocated to this local Measure, E.1. The allocation of GHG emissions reductions in 2030 from this measure to State and local policies is shown in Table 28.

Table 28 Key Assumptions and Results for Measure E.1: Increase Grid-Supply Renewables

Year	State or City Action	Total for Local Renewables and Zero-Carbon Program	RPS-Related Local Renewables and Zero-Carbon Program (SE.1)	Beyond-RPS Local Renewables and Zero-Carbon Program (E.1)
2030	Projected Renewables and Zero Carbon (%)	75%	60%	15%
	Emissions Reduction (MT CO_2e)	6,022*	4,817	**1,204**

*Calculated in Table 5.
The emissions reduction is the projection under the CAP, including future impact of State policies and programs and CAP assumptions.
Energy Policy Initiatives Center 2018

6.3.2 Measure E.2: Increase Commercial Behind-the-Meter PV

To increase behind-the-meter PV at commercial projects, the City plans to require PV installation at new and redeveloped commercial projects within the city, including, but not limited to, retail, office, hotels, and mixed-used projects. The projected starting year of the requirement is 2020. The goal of Measure E.2 is to add 0.3 MW of PV at new and redeveloped commercial projects by 2030; this will bring the total PV capacity in 2030 to 8.5 MW. In addition, the City will work with local agencies to install PV at existing public facilities, such as the Civic Center, public libraries, schools, and public parking spaces.

[52] A 20% opt-out rate is a conservative assumption. Customer opt-out rates of current CCE programs in California range from 1% to 23%. The City of San Diego's CCA feasibility study used a 20% opt-out rate in the Base Case scenario and the CCA business plan used a 5% opt-out rate. DA customers are assumed to remain DA customers and not become part of a CCE. City of San Diego: Feasibility Study for a Community Choice Aggregate. Final Draft. July 2017. CCA Business Plan and Feasibility Study Comparison. November 2018.

In the past three years, the City has added three new or redeveloped commercial projects with approximately 50,000 sq. ft. of building footprint.[53] Assuming the trend continues, approximately 17,000 sq. ft. of commercial roof area will be added within the city annually that will be subject to this new commercial PV requirement. However, not all roof area is suitable for PV installation. Based on the 2019 Building Energy Efficiency Standards for nonresidential buildings, at least 15% of the total roof area must be reserved for the solar zone, where solar panels can be installed at a future date.[54] Assuming PV will be installed in the minimum required solar zone, using both the ratio of PV module to roof area and the PV module power density based on a National Renewable Energy Lab study on rooftop solar potential, the projected PV capacity due to Measure E.2 is given in Table 29.[55]

Table 29 Key Assumptions for Measure E.2: Increase Commercial Behind-the-Meter PV

Year	New Commercial Roof Area Added after 2020 (Sq. ft.)	Minimum Solar Zone to Roof Area Ratio	New Solar Zone Added after 2020 (Sq. ft.)	Ratio of PV Module to Flat Roof*	New PV Module Area after 2020 (sq. ft.)	PV Module Power Density (W/sq. ft.)*	New Commercial Behind-the-meter PV Capacity after 2020 (MW)
2030	187,000	15%	28,050	70%	17,672	15	0.3

*Based on National Renewable Energy Lab study, Gagnon et al, 2018.
Assume 10% of new or redeveloped projects are exempt from this requirement. The projected capacity are the projections under the CAP assumptions.
Energy Policy Initiatives Center 2018

The emissions reduction from all State and City actions that increase the behind-the-meter renewable supply is 1,916 MT CO_2e, given in Section 4.2.2 (Allocation of GHG Emissions Reductions from Measures that Increase Renewables in Electricity to State Policy, Local Programs or Behind-the-meter PV Supply), Table 7 Allocation of Emissions Reductions from Increasing Renewable (or Zero-Carbon) Supply in Imperial Beach), and shown in Table 30. The total reduction is allocated based on estimated capacity (MW) that would result from each action, as shown in Table 30. The GHG emissions reductions are projected reduction amounts in the year 2030 only.

[53] The three new or redevelopment projects are Breakwater Hotel, Blue Wave Hotel & Residences, and Imperial Beach Resort. The site plans of all three projects were provided by the City to EPIC (October 2018). The site plans include building footprint, gross floor area, gross building area, etc.
[54] CEC: 2019 Building Energy Efficiency Standards – 2019 Non-Residential Compliance Manual (December 2018). Chapter 9: Solar Ready.
[55] The ratios of PV module to roof area and PV module power density are based on Estimating rooftop solar technical potential across the US using a combination of GIS-based methods, lidar data, and statistical modeling. Gagnon et al (2018) Environ. Res. Lett. 13 024027.

Table 30 Key Assumptions and Results for Measure E.2 Increase Commercial Behind-the-Meter PV

Year	State or City Action	Total	California Solar Polices, Programs and Mandates*	Measure E.2 Increase Commercial Behind-the-Meter PV
2030	Projected Behind-the-meter PV Capacity (MW)	8.5	8.2	0.3
	Projected Emissions Reduction (MT CO_2e)	1,916	1,856	**59**
*Solar policies, programs, and mandates include the impact of the PV mandates from 2019 Building Energy Efficiency Standard. The projected capacity and emissions reduction are the projections under the CAP, including future impact of State policies and programs and CAP assumptions. Energy Policy Initiatives Center 2018				

6.4 Strategy: Achieve Zero Waste

The goal of this strategy is to reduce emissions from landfill waste through the following measure.

6.4.1 Measure W.1: Divert Waste from Landfill

Through Measure W.1, the City plans to adopt a "zero waste by 2050" policy and work with EDCO, the local waste hauler serving the city, to achieve an 80% waste diversion rate within the city by 2030. The 80% waste diversion rate is equivalent to reducing waste disposed at landfills to 1.6 pounds per person per day (PPD) by 2030.

The city's waste disposal rate was 2.8 PPD in baseline year 2012, and 3.3 PPD in 2016, which are equivalent to approximately 65% and 58% diversion rates, respectively.[56] The City has not completed a waste characterization study recently; therefore, it is assumed that the waste composition for the CAP time horizon would not change.[57] The emissions from landfills depend on how much waste is disposed as well as how much of the resulting methane emissions are captured. Landfills in San Diego region are in the process of upgrading landfill gas collection systems[58] and it is assumed that 90% of landfill gas will be captured in 2030, higher than the default 75% used in the BAU emissions projection. The emissions reduction from increasing the diversion rate is calculated by taking the difference between the BAU emissions projection from the solid waste category and the projected emissions from the solid waste category using the target diversion rates and PPD. Table 31 summarizes the key assumptions and results. The GHG emissions reduction projected is the reduction amount in the year 2030 only.

[56] Method to convert PPD to estimated diversion rate is based on Calrecycle. Per Capita Disposal and Goal Measurement. Jurisdiction PPD from 2012–2015 were downloaded from CalReycle Jurisdiction Diversion Summary.
[57] Recent State actions include organic waste recycling, which may reduce the mixed waste emission factor in future years.
[58] The main landfill, City of San Diego's Miramar Landfill, has added a landfill gas recovery improvement project to be completed late 2018.

Table 31 Key Assumptions and Results for Measure W.1: Divert Waste from Landfill

Year	Projections	Diversion Rate	Per Capita Waste Disposal After Diversion (pounds/person/day)	Emissions from Solid Waste Disposed in Landfill (MT/year)	Capture Rate of Landfill Gas (%)	Net Emissions from Waste Disposal (MT CO_2e)	GHG Emissions Reduction (MT CO_2e)
2030	BAU Projection	58%	3.3	16,551	75%	4,105	3,318
	Projection with W.1	80%	1.6	7,928	90%	787	
Emissions from waste are calculated based on a mixed waste emission factor (0.8 MT CO2e/short ton), oxidation rate (10%) and the waste capture rate. The projected emissions reduction are the projections under the CAP assumptions. Energy Policy Initiatives Center 2018							

6.5 Strategy: Sequester Carbon

Carbon sequestration helps to offset CO_2 from the emissions categories and can be achieved through the Measure S.1 described below.

6.5.1 Measure S.1: Increase Urban Tree Planting

The most recent urban tree canopy assessment in the San Diego region, based on high-resolution Light Detection and Ranging (LiDAR), shows that the city has approximately 6% existing urban tree canopy.[59]

To increase urban trees at private spaces, the City plans to require tree planting at all new and redeveloped multi-family and commercial projects starting in 2025. For new and redeveloped multi-family homes in the city, the requirement will be to plant one tree per unit. The projected new multi-family units from 2025 to 2030 in the SANDAG Series 13 Regional Growth Forecast is used to base assumptions of how many new trees would be planted in the city under this requirement.[60] For new and redeveloped commercial projects, the requirement will be to plant one tree per three surface parking spaces.[61] In the past three years, the City has added three new or redeveloped commercial projects, with a total of 130 new parking spaces.[62] Assuming the trend continues, 45 new commercial surface parking spaces will be added every year, on average, when subject to the requirement.

To increase urban trees at public spaces, the City plans to revise its landscape ordinance to increase planting along public rights-of-way. The goal is to plant 300 new trees by 2030 in public rights-of-way and to develop a program to track tree planting, maintenance, and removal.

The carbon sequestration potential from the net new trees is based on the total number of new trees planted and the CO_2 absorption rate per tree.[63] Table 32 summarizes the key assumptions and results. The GHG emissions reduction is the projected reduction amount in year 2030 only.

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[59] The assessment was done in 2014 for all urban areas in San Diego County using the method developed by University of Vermont and the USDA Forest Service.

[60] SANDAG Series 13 Regional Growth Forecast (October 2013). SANDAG Data Surfer , accessed on October 24, 2017.

[61] The current Imperial Beach municipal code requires a minimum 45 sq. ft. landscape for every three surface parking spaces.

[62] The three new or redevelopment projects are Breakwater Hotel, Blue Wave Hotel & Residences, and Imperial Beach Resort. The site plans of all three projects were provided City to EPIC (October 2018). Parking spaces given in the site plans include both surface parking lots and parking structures.

[63] On average the CO_2 sequestration rate is 0.035 MT CO_2e per tree per year. The carbon sequestration rate depends on the tree species, climate zone, planting location, and tree age; an average is used here. The actual carbon sequestration rate will be

Table 32 Key Assumptions and Results for Measure S.1 Urban Tree Planting

Year	Tree Planting in Public Rights-of-way	Tree Planting at Private Spaces						Total New Trees	Carbon Sequestration (MT CO_2)
		Multi-family			Commercial				
		New Units after 2025	S.1 Requirement	New Trees Planted at Units after 2025	New Surface Parking Spaces after 2025	S.1 Requirement	New Trees Planted at Parking Spaces after 2025		
2030	300	476	1 tree per unit	476	270	1 tree per three spaces	90	866	31

Carbon sequestration rate is 0.035 MT CO_2 per tree per year. The projected carbon sequestration are the projections under the CAP assumptions.
Energy Policy Initiatives Center 2018

evaluated once the parameters are decided in implementation of the measure. California Emissions Estimator Model (CALEEMOD). Appendix E Technical Source Documentation. (September 2016).

Appendix C

CAP Measure Cost Overview

Appendix C. City of Imperial Beach CAP Measure Cost Overview

August 2018

Prepared for the City of Imperial Beach

Prepared by the Energy Policy Initiatives Center

About EPIC

The Energy Policy Initiatives Center (EPIC) is a non-profit research center of the USD School of Law that studies energy policy issues affecting California and the San Diego region. EPIC's mission is to increase awareness and understanding of energy- and climate-related policy issues by conducting research and analysis to inform decision makers and educating law students.

For more information, please visit the EPIC website at www.sandiego.edu/epic.

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CAP MEASURE COST OVERVIEW

This Appendix provides an overview of potential cost and benefit impacts associated with measures included in the Imperial Beach Climate Action Plan (CAP).

This overview is based on a review of similar CAP measures included in currently available CAP cost-effectiveness analyses in the San Diego region[1] and identifies potential impacts to participants in the measure, that is, those who experience costs and/or benefits for directly engaging in the measure's activities. The participants impacted by each measure are identified Table 1 along with the policy type being pursued in the CAP (columns four and five respectively). A policy type is defined as being either mandatory or a City initiative; a mandatory policy requires participants to comply with the CAP measure and a City initiative seeks to encourage participants to engage in CAP measure activities to achieve greenhouse gas (GHG) emission reductions.

Table 1 ranks and color-codes the City of Imperial Beach's CAP measures according to their relative cost-effectiveness for participants using other cost-effectiveness studies (column 2).[1,2] A measure's cost-effectiveness is based solely on the associated direct costs and benefits, and the measure's ability to reduce GHG emissions. Measures included in the CAP may seek to achieve additional indirect goals (e.g., increase the resiliency of the urban forest); however, the cost-effectiveness to achieve those additional goals are not considered here. Measures ranked green typically provide a net benefit (positive net present value and $/MT CO_2e) to participants. Measures ranked red typically come at a net cost (negative net present value and $/MT CO_2e) to participants. The intensity of the color indicates whether the measure is more cost-effective (green) or less cost-effective (red) at reducing one metric ton of GHGs, but does not indicate the magnitude in difference.

For those measures where the City of Imperial Beach is a participant and for all other City programs identified in the CAP, the City anticipates that no additional staffing is necessary to implement CAP measures. The City currently has programs in place that can be expanded to accommodate all CAP measures aside from measure E.1 (Increase Grid Supply Renewables). For measure E.1, the City intends to leverage existing programs, such as the South Bay Energy Action Collaborative (SoBEAC), or partner with other jurisdictions to pursue other program options.

In addition to the benefits and costs experienced by measure participants, there are positive externalities, or co-benefits, experienced by the broader community. Co-benefits identified in the CAP for specific measures are included in Table 1 to provide some extra context on a measure's impact (column 3) although a full identification and interactions of side effects is well beyond even the most complex studies in the literature. The CAP does identify additional co-benefits as a result of CAP implementation that are not included in the table such as improved/increased natural habitat and an increase in local jobs. The inclusion of co-benefits may often have a positive, indirect monetary impact on the community at large, and differ by location and participant.

The cost-effectiveness of Imperial Beach CAP measures may differ from those used to determine the ranking (i.e., other jurisdictions in the region) in Table 1. Possible factors that can impact Imperial Beach-specific results include, but are not limited to:

- Type of measure adopted (e.g., mandatory measures will typically lead to more GHG reductions than voluntary measures);
- Specific measure details (e.g., who is/isn't covered by the measure);
- Jurisdiction specific rates, costs, and rebates/incentives

[1] CAP cost-effectiveness analyses reviewed include the County of San Diego and City of La Mesa.

[2] The proposed measure to increase renewables in the grid-supply requires a feasibility study, which is outside the scope of previously conduced CAP cost-effectiveness analyses.

Table 1. CAP Measure Cost Overview

CAP Measure	Relative Cost-Effectiveness Ranking	Co-Benefits	Participants	Policy Type
T.5 Reduce Municipal Employee VMT		Improved air quality, improved public health, reduced traffic congestion, improved mobility	• City of Imperial Beach	City Initiative
T.2 Clean Municipal Fleet		Improved air quality, energy savings	• City of Imperial Beach	City Initiative
E.2 Increase Commercial Solar PV		Improved air quality, energy savings	• New and redeveloped multi-family and commercial properties •EV owners	City Initiative
T.4 Improve Pedestrian and Bicycle Facilities		Improved air quality, improved public health, reduced traffic congestion, improved mobility, improved safety	• City of Imperial Beach • Commuters (new cyclists and pedestrians)	City Initiative
T.3 Increase Mass Transit Ridership	Positive $/MT CO_2e	Improved air quality, energy savings, reduced traffic congestion, improved mobility	• San Diego Metropolitan Transit System (MTS) • Commuters (new mass transit riders)	City Initiative
T.1 Increase Citywide EV Charging Stations	Negative $/MT CO_2e	Improved air quality, energy savings	• Charger installers • EV drivers	City Initiative
W.1 Divert Waste from Landfill		Reduced waste, improved water quality	• Waste hauler (some or all costs may pass through to waste bills)	Mandatory
S.1 Tree Planting		Improved air quality, improved water quality, reduced water run-off, reduced urban heat island effect	• New and redeveloped multi-family and commercial properties	Mandatory
E.1 Increase Grid-Supply Renewables	NA	Improved air quality, energy savings	• City of Imperial Beach • Electricity customers	City Initiative

Appendix D

Consolidated Measure Implementation Action Matrix

Appendix D. Consolidated Measure Implementation Matrix

Consolidated Measure Implementation Matrix					
Emissions Category	**Reduction Strategies and Measures**	**Action**	**Description**	**Responsibility**	**Timeline**
On-Road Transportation	Strategy: Clean and Efficient Transportation				
	T.1 Increase Citywide EVCSs	1	Encourage and incentivize EVCSs at new and redeveloped multifamily and commercial developments through the development review process	City	Near-term
		2	Identify a list of priority public facility installation sites on City sites and in collaboration with relevant partner agencies	City	Near-term
		3	Identify and pursue funding and financing resources to support EVCS installation	City	Near- and Mid-term
	T.2 Clean Municipal Fleet	1	Work with CSE's EV Expert to develop a municipal fleet assessment and conversion plan	City	Medium-term
		2	Utilize fleet assessment and conversion plan to decide when to replace vehicles	City	Medium-term
		3	Work with other agencies and jurisdictions to identify potential joint EV procurement options	City	Near-term
	Strategy: Reduce VMT				
	T.3 Increase Mass Transit Ridership	1	Coordinate with San Diego MTS to identify transit connectivity opportunities that improve transit access and mobility	City	Near-term
		2	Work with San Diego MTS to increase awareness of the Rapid 925 and existing bus routes as a means to increase ridership	City	Near-term
	T.4 Improve Bicycle and Pedestrian Facilities	1	Complete the suite of planned bicycle and pedestrian projects by 2030	City	Medium-term

Consolidated Measure Implementation Matrix					
Emissions Category	**Reduction Strategies and Measures**	**Action**	**Description**	**Responsibility**	**Timeline**
		2	Work to expand the number of bike parking facilities at commercial establishments throughout the City	City	Medium-term
		3	Work with scooter and bikeshare and other emerging companies to analyze data and better understand active transportation patterns and needs throughout the City	City	Medium-term
	T.5	1	Purchase 10 electric bicycles	City	Near-term
		2	Track the number of trips and VMT avoided through usage of the bicycles	City	Medium-term
Energy	Strategy: Increase Renewable Electricity				
	E.1 Increase Grid-Supply of Renewable and Zero Carbon Electricity	1	Explore the potential to join a regional CCE through a partnership with other jurisdictions	City	Near-term
		2	Work with identified partnership jurisdictions to conduct a feasibility study and other related research and administrative efforts necessary to establish a CCE	City	Medium-term
		SE.1	Work with SDG&E to publicize energy efficiency rebates and subsidies to increase the efficiency of Imperial Beach's existing building stock	City	Near-term
	E.2 Increase Commercial Behind-the-Meter PV	1	Establish requirements or incentives through the development review and approval process to spur installation of commercial solar PV	City	Near-term

Consolidated Measure Implementation Matrix					
Emissions Category	**Reduction Strategies and Measures**	**Action**	**Description**	**Responsibility**	**Timeline**
		2	Develop a directory of solar PV funding sources, rebates, and incentives, and leverage existing efforts and materials from the CSE, California Solar Initiative, SDG&E, and other organizations.	City	Near-term
		3	Review/revise applicable building, zoning, and other codes/ordinances to encourage the development of solar ready commercial developments.	City	Medium-term
		SE.1	Identify opportunities to install solar PV on public facilities such as municipal buildings, schools, libraries, and parking lots.	City	Medium-term
Waste	Strategy: Reduce Solid Waste				
	W.1 Divert Waste from Landfill	1	Adopt a Zero Waste by 2050 policy	City	Near-term
		2	Work with the City's waste service company and stakeholders to develop a public outreach campaign to increase awareness of existing waste management services and drive behavioral change	City	Medium-term
Carbon Sequestration	Strategy: Carbon Sequestration				
	S.1 Tree Planting	1	Plant 300 trees within City ROW by 2030	City	Medium-term
		2	Make changes to the City code to require tree planting in new and redeveloped residential and commercial developments	City	Near-term
		SE.1	Identify opportunities to enhance or conserve habitat that would sequester carbon	City	Medium-term

SE indicates that the action is a Supporting Effort