APPENDIX E - GREENHOUSE GAS ASSESSMENT

E-1: Greenhouse Gas Emissions Reduction Assumptions

Appendix E-1: Greenhouse Gas Emissions Reduction Assumptions

Background

The proposed Draft PLAN Hermosa includes a goal for the City to achieve community carbon neutrality no later than 2040, aligning with the 25 year time horizon of implementing PLAN Hermosa. This memo identifies the sources, tools, and assumptions used to calculate the potential greenhouse gas reductions that could be achieved by 2040 based on the policies, goals, and actions included in PLAN Hermosa.

Greenhouse Gas Emissions Calculation Methods

This section identifies the types of activities that generate emissions either directly in Hermosa Beach or outside of the jurisdiction, but due to activities in Hermosa Beach. The City of Hermosa Beach, through the South Bay Cities Council of Governments, has calculated and prepared an inventory and forecasts of the greenhouse gas emissions generated by community activities in Hermosa Beach. The entirety of the GHG Emissions Inventory and detailed explanation of methodology is provided as part of the Appendix E-2 – City of Hermosa Beach GHG Inventory, Forecast, and Target-Setting Report.

GHG Inventory Protocols

The inventories prepared are consistent with industry protocols and calculation methods. The U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions (ICLEI 2012) and the Local Government Operations Protocol for the Quantification and Reporting of GHG Emissions Inventories (LGOP) (CARB2010) were the primary protocols used for developing the community and municipal inventories, respectively.

Activity Sources

For the community inventory, the following sources or activities were included:

- Commercial and industrial energy (natural gas and electricity)
- Residential energy (natural gas and electricity)
- Transportation (highway, non-highway)
- Waste (direct landfill emissions, emissions from community waste)
- Water (wastewater treatment, energy for filtration and movement)
- Off-road equipment and vehicles (lawn and garden equipment, construction vehicles and equipment)
- Stationary sources (major industrial point source emissions)

Overview of Calculation Methodology

GHG emissions were calculated using reported activity data (e.g., kilowatt-hours of electricity, tons of solid waste) for each sector by collecting information from the appropriate agencies and utility companies including Southern California Edison, So Cal Gas, California Water Service, and Athens Waste Services.

These activities are converted into GHG emissions using an emissions factor or coefficient. These emissions factors are supplied by the energy provider or emissions modeling software and indicate the greenhouse gases that are emitted for every kWh produced, mile traveled, or ton of waste disposed. The coefficients used for calculating emissions from each activity follow international inventory standards and are utility-, county-, or California-specific, when available.

For example, if a community consumed 1 million kilowatt-hours of electricity and each kWh of electricity results in 0.0004 metric tons (MT) of CO_2, the CO_2 emissions calculation would be as follows:

$$1 \text{ million kWh} * .0004 \text{ MTCO}_2/\text{kWh} = 400 \text{ MTCO}_2$$

Baseline GHG Emissions Inventory

Emissions inventories have been prepared for the calendar years of 2005, 2007, 2010, and 2012. **Table 1** illustrates Hermosa Beach's GHG inventory for the years 2005, 2007, 2010 and 2012. In 2005, Hermosa Beach generated approximately 137,160 metric tons of CO_2e ($MTCO_2e$), with on-road transportation generating 73,567 $MTCO_2e$ or approximately 54 percent of overall emissions. In 2007, the city generated approximately 132,768 $MTCO_2e$, representing a 3.2 percent decrease from the total emissions in 2005. This decrease was attributed to fewer emissions from all emission categories. By 2012, the City had a reduction in emissions of 7.7 percent from the 2005 inventory, with emissions decreasing in most sectors. Between 2005 and 2012, the wastewater sector observed a small increase in emissions and the residential energy sector observed a five percent increase in emissions.

TABLE 1 - Hermosa Beach Greenhouse Gas Emissions by Sector

Sector	Baseline Year 2005 ($MTCO_2e$)	% of Total	2007 ($MTCO_2e$)	% of Total	2010 ($MTCO_2e$)	% of Total	2012 ($MTCO_2e$)	% of Total
On-road Transportation	73,567	54%	71,863	54%	70,277	55%	68,235	54%
Residential Energy	32,293	24%	31,964	24%	32,700	26%	33,808	27%
Commercial Energy	20,280	15%	19,792	15%	18,372	14%	17,830	14%
Solid Waste	6,015	4%	4,584	3%	3,510	3%	3,334	3%
Water	4,065	3%	3,942	3%	2,552	2%	2,600	2%
Off-road Sources	888	1%	588	<1%	419	<1%	745	<1%
Wastewater	52	<1%	35	<1%	59	<1%	59	<1%
Total	**137,160**		**132,768**		**127,889**		**126,611**	
Change from 2005			**-3.2%**		**-6.8%**		**-7.7%**	

Source: South Bay Cities Council of Governments, 2015.

Transportation sector emissions are the result of gasoline and diesel combustion in vehicles traveling to, from, or within Hermosa Beach, but excludes emissions associated with vehicles that pass-through Hermosa Beach without stopping. Residential and commercial energy use contributes emissions from electricity generation and natural gas consumption by residences and commercial businesses within Hermosa Beach, while solid waste emissions are based on the amount of waste disposed in landfills, where it decomposes and generates methane. Finally, water and wastewater emissions are calculated by determining the energy needed to extract, transport, treat, and dispose of the water resources consumed by the community.

Emissions Forecast

It is also important to consider how emissions in Hermosa Beach might change over time, with small increases in the number of residents, employees, and housing units based on the capacity of vacant or underutilized land within the City. While the South Bay Cities Council of Governments also prepared a forecast of emissions for Hermosa Beach, the forecast only projected to 2035, whereas the time horizon of PLAN Hermosa extends to 2040. The City of Hermosa Beach adjusted the Business As Usual Forecast of GHG Emissions using the Carbon

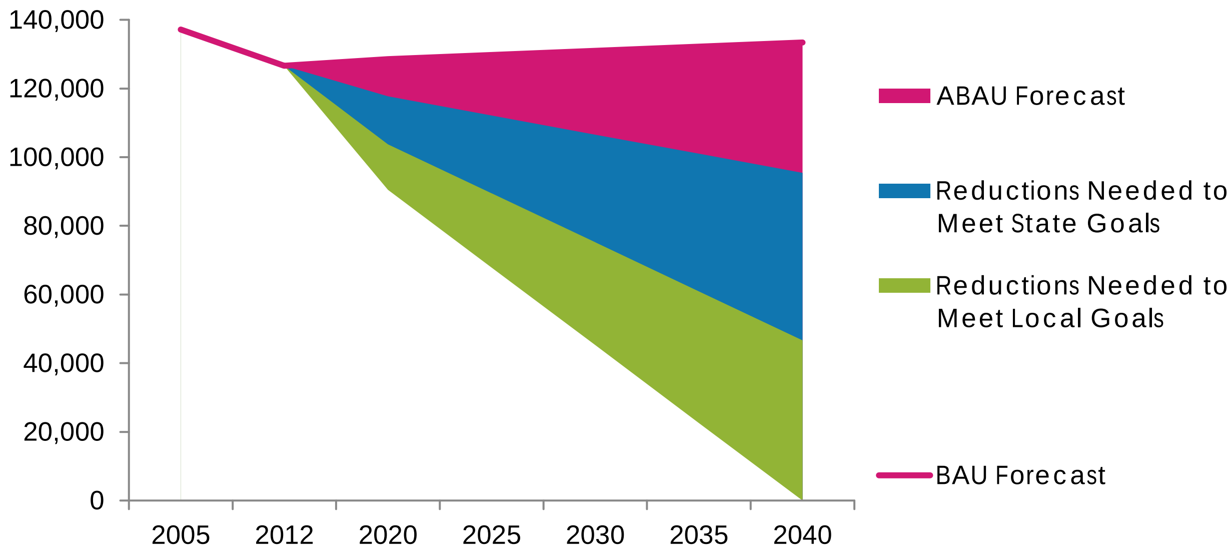
Planning Tool to develop a forecast based on the residential, employment, and housing projections developed as part of PLAN Hermosa for 2040. **Table 2 and Figure 1** indicate the projected levels of emissions in the years 2040, the impact that state legislation and programs will have on reducing emissions, and the remaining gap to achieve a carbon neutral goal.

TABLE 2 – Hermosa Beach 2030 and 2040 Projected Emissions Levels

Timeframe/Target	2040 Projected Emissions Levels ($MTCO_2e$)
Baseline Emissions (2005)	137,160
Business As Usual Forecasted Emissions	133,430
Reductions from State Programs	38,010
Local Reductions Needed to Achieve Carbon Neutral Target	95,420

Source: City of Hermosa Beach Carbon Planning Tool 2015.

Figure 1 – Emissions Reductions Needed to Meet State and Local Targets



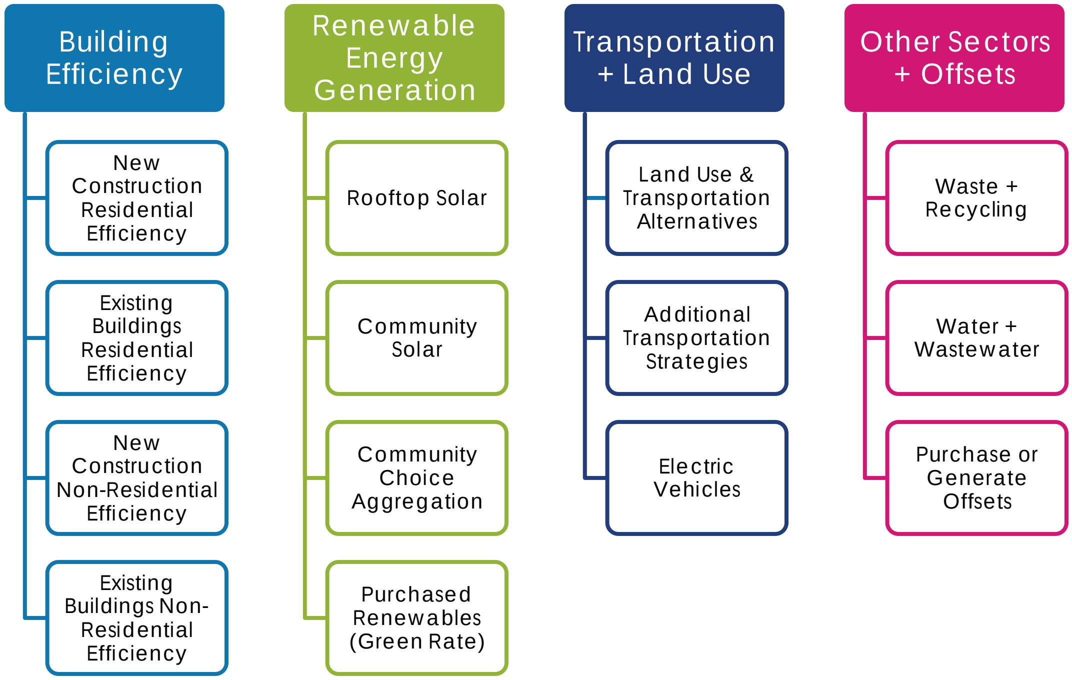
Source: City of Hermosa Beach Carbon Planning Tool 2015.

Methods and Tools for Estimating Potential Emissions Reductions

Carbon Planning Tool

The Carbon Planning Tool, developed by the Brendle Group for the City of Hermosa Beach in 2015, provides a series of strategies that the community can employ to reduce GHG emissions. The tool is tailored to the emissions profile and physical conditions in Hermosa Beach, and is designed to estimate the effectiveness and relative costs/benefits of the various strategies based on assumptions related to level of participation or implementation over a certain time period. The range of strategies available are identified in **Figure 2.**

Figure 2 – Carbon Planning Tool Strategies



The effectiveness of each strategy is determined based on a series of assumptions on the rate(s) of implementation identified in **Table 3**. The tool allows custom rates of implementation to be identified, based on the goals, policies, and actions included in PLAN Hermosa. The Hermosa Beach Carbon Planning Tool and User Guide is provided in Appendix E-3.

The transportation strategies, because the effectiveness of reducing GHG emissions is dependent which suite of strategies are selected, the assumptions are further detailed in Appendix G-6: VMT Reduction Methods and TDM+ Tool Outputs.

Table 3 – Carbon Planning Tool Strategy Assumption Questions

	2040 PLAN Hermosa Assumptions
1. Building Efficiency	
For existing homes…	
What percent could undergo a **deep energy renovation**?	30%
What percent of homes' annual energy use would be reduced?	50%
What is the cost (per square foot) of deep energy renovations?	$5.60
What percent could undergo a **standard energy renovation**?	50%
What percent of the homes' annual energy use would be reduced?	15%
What is the cost (per square foot) of standard energy renovations for homes?	$1.00
For new homes…	
What percent could be constructed **beyond code**?	90%
What percent of the homes' annual energy use would be reduced?	75%
What is the cost (per square foot) of green building for residential new construction?	$5.00
For existing commercial and industrial buildings…	
What percent of buildings could undergo a **deep energy renovation**?	30%
What percent of the buildings' annual energy use would be reduced?	50%
What is the cost (per square foot) of deep energy renovations for commercial and industrial buildings?	$11.20
What percent of buildings could undergo a **standard energy renovation**?	50%
What percent of the buildings' annual energy use would be reduced?	15%
What is the cost (per square foot) of standard energy renovations for commercial and industrial buildings?	$1.00
For new commercial and industrial buildings…	
What percent of buildings could be constructed **beyond code**?	90%
What percent of the buildings' annual energy use would be reduced?	75%
What is the cost (per square foot) of green building for commercial and industrial new construction?	$5.00
2. Renewable Energy Generation	
Rooftop Solar	
What percent of homes could install rooftop solar (by 2040)?	50%
What is the average size of a solar array (in kilowatts, kW)?	5.0
What percent of businesses could install rooftop solar (by 2040)?	50%
What is the average size of a commercial solar array (in W/ft^2)?	6
What is the current cost (per kilowatt) of rooftop solar?	$3,700
What is the annual cost reduction (as a percentage) for rooftop solar installation?	2%
For community solar…	
How large of a **solar garden** could the community support (in kilowatts)?	2,000
How much would a **solar garden** cost (in dollars per kilowatt)?	$3,000
Utility Based Renewables	

	2040 PLAN Hermosa Assumptions
What should your utility-based renewables strategy be?	
Either Community Choice Aggregation (CCA)...	
What year should the **CCA** begin?	2017
What percent of customers would stay participating in a CCA program?	85%
Would you like to change the percentage of renewable energy for this rate? If so what should be the percentage?	100%
What will be the initial utility rate for this level of participation?	$0.17
What percent of customers will opt to pay for a rate with 100% renewable energy from a CCA (beginning in 2017)?	10%
What will be the initial utility rate for this level of participation?	$0.20
Or a Green rate...	
Should electricity be purchased from the electric utility (Southern California Edison, or SCE) at a **green rate instead?** If so what percentage of electricity should be purchased at this higher rate?	0%
What will be the premium for a SCE Green Rate?	34%
3. Transportation + Land Use	
Vehicle Miles Traveled (VMT) Reduction Strategies	
Please select your preferred Land Use and Transportation Scenario (from the PLAN Hermosa update process) from the box on the right.	Scenario C: 12.9%
What level of policies and programs should be added to the general plan to further reduce VMT?	Medium: 6%
What will be the implementation cost (in dollars per vehicle mile traveled) of this strategy?	$0.75
Electric Vehicle (EV)	
What percentage of new car purchases in 2040 will be EVs?	75%
What percentage of EV charging stations, both residential and around town, will rely on **solar power**?	75%
What will be the incremental cost of EVs be in...	
2015?	$7,500
2030?	$0
What will be the cost of charging stations for...	
Residential?	$2,000
Community?	$3,500
Other Sectors + Offsets	
What percentage of remaining emissions should be reduced through the purchase or generation of carbon **offsets**?	100%
What percentage of waste should be diverted from landfills?	100%
What level of water conservation might be achieved?	20%

Source: City of Hermosa Beach Carbon Planning Tool, 2015.

Emissions Reduction Summary

Based on the emissions profile for Hermosa Beach, the goals, policies, and actions identified in PLAN Hermosa and the implementation assumptions utilized, **Table 4** provides a summary of the emissions reductions achieve by 2040 for each strategy. State programs account for 27.7 percent of the overall emissions reductions, leaving 95,420 MTCO2e to be reduced through local programs. The building efficiency, renewable energy generation, and transportation and land use sectors account for 9.8 percent, 13.6 percent, and 13.0 percent, respectively. The other sectors and offsets sector accounts for 32.9 percent of the reductions, with the majority of those reductions coming from the purchase or generation of carbon offsets.

TABLE 4 – Summary of Emissions Reduction Scenarios in 2040

	Share of Carbon Reductions (%)	Annual Carbon Reduction ($MTCO_2e$)
Baseline 2005 Emissions		137,160
2012 Emissions	-7.7%	126,610
BAU Emissions (2040)	+5.0%	133,430
State Programs (2040)	-27.7%	38,010
Local Remaining Emissions to be Reduced		95,420
Building Efficiency		
New Construction Residential Efficiency	-1.3%	1,810
Existing Buildings Residential Efficiency	-4.4%	6,100
New Construction Non-Residential Efficiency	-2.0%	2,810
Existing Buildings Non-Residential Efficiency	-2.0%	2,770
Sub Total	**-9.8%**	**13,490**
Renewable Energy Generation		
Rooftop Solar	-5.9%	8,100
Community Solar	-0.4%	550
Community Choice Aggregation	-7.3%	10,010
Purchased Renewables (Green Rate)	-0.0%	0
Sub Total	**-13.6%**	**18,660**
Transportation + Land Use		
Land Use & Transportation Alternatives	-4.0%	5,500
Additional Transportation Strategies	-1.9%	2,560
Electric Vehicles	-7.4%	10,100
Sub Total	**-13.0%**	**18,160**
Other Sectors + Offsets		
Waste + Recycling	-2.5%	3,480
Water + Wastewater	-0.2%	330
Purchase or Generate Offsets	-30.1%	41,310
Sub Total	**-32.9%**	**45,120**
TOTAL	**-100.0%**	**95,420**

Source: City of Hermosa Beach Carbon Planning Tool, 2015.

Carbon Neutral by 2030 Analysis

In April 2016, the City Council directed staff to consider an alternative to the EIR that would achieve a Carbon Neutral Goal by 2030 and remove the use of carbon offsets from the policies considered. This memo identifies changes in assumptions used to calculate the potential greenhouse gas reductions that could be achieved by 2030 based on the additional strategies identified in the Carbon Neutral by 2030 Alternative. Since costs and co-benefits are not typically considered within the context of an EIR, a separate memo documenting the relative cost differences between the two scenarios has been prepared.

Changed Parameters

This alternative would be focused on achieving a community-wide goal of carbon neutrality by 2030. Carbon neutrality is the state of achieving net zero carbon emissions, generally by balancing a measured amount of carbon released with an equivalent amount sequestered or offset by the community. There are two primary differences between this alternative and the proposed draft of PLAN Hermosa which currently includes a goal to achieve carbon neutrality no later than the year 2040: expediting achievement of a carbon neutral goal by ten years from 2040 to 2030 and bypassing the use of carbon credits to offset carbon emissions that could not be eliminated.

Changing these two parameters would have a number of effects on the proposed project. While the total level of local reductions needed to achieve a carbon neutral goal by 2030 or 2040 are virtually identical, the number of years to achieve the goal would be reduced from 24 years to just 14. A 2030 goal would necessitate the implementation of new policies and programs each year to reduce emissions at a rate of 6,750 $MTCO_2e$/yr, compared to annual reductions of 3,975 $MTCO_2e$/yr for a 2040 goal.

Amended GHG Reduction Strategies

To achieve a carbon neutral by 2030 goal, the following steps would be taken to modify PLAN Hermosa to increase and accelerate the rate of carbon emissions reductions from the energy, waste and transportation sectors:

- Require onsite renewable energy generation and Zero Net Energy as part of all new construction and major building renovations.
- Mandate retrofits to existing buildings to improve energy efficiency at time of sale, through rental inspections, and prior to issuance of building permits.
- Eliminate the use of natural gas within the city through the installation of biogas technologies and electrification of heating and cooking appliances and fixtures within the building stock.
- Participate in a Community Choice Aggregation program or other similar program and procure or generate renewable energy to account for 100% of the energy portfolio by increasing the rate of installation for local renewable energy generation sources or procuring long-term renewable energy contracts for sources outside of the city.
- Modify Land Use Designations to facilitate mixed-use development and increase commercial and residential densities within the Community Commercial and Gateway Commercial designations to facilitate shorter trips lengths and increase the number of trips captured internally.
- Mandate public and private clean fuel and electric vehicle infrastructure to facilitate deployment of electric vehicles, neighborhood electric vehicles and/or clean fuel vehicles.
- Modify parking standards and programs to disincentivize conventionally fueled automobile use, and incentivize alternative modes of transportation and zero-emission vehicle use through programs that include, but are not limited to: increases in the cost of public-parking, elimination of parking minimums and establishment of maximums for new development,

elimination of practices to assign parking spaces to particular uses, and changes to the preferential parking permit program.

- Pursue regional transportation projects and infrastructure to facilitate carbon-free regional travel options.
- Mandate Transportation Demand Management (TDM) programs for institutions and businesses.
- Accelerate the implementation of pedestrian and bicycle network investments, electric vehicle and alternative fuel infrastructure, programs to achieve zero waste, and net zero energy requirements.

Comparison of Carbon Neutral Scenarios

This Carbon Neutral by 2030 Alternative with the added or modified policies would result in greater levels of emissions reductions compared to the policies and programs proposed in PLAN Hermosa, as noted in Table 5.

Table 5 - Comparison of Emissions Reduction Scenarios 2030 vs 2040

	2030 Scenario		2040 Scenario	
	Share of Carbon Reductions (%)	Annual Carbon Reduction ($MTCO_2e$)	Share of Carbon Reductions (%)	Annual Carbon Reduction ($MTCO_2e$)
Baseline 2005 Emissions		137,160		137,160
2012 Emissions	-7.7%	126,610	-7.7%	126,610
BAU Emissions (2040)	+1.2%	128,290	+5.0%	133,430
State Programs (2040)	-24.6%	33,750	-27.7%	38,010
Local Remaining Emissions to be Reduced		94,540		95,420
Building Efficiency				
New Construction Residential Efficiency	-0.8%	1,090	-1.3%	1,810
Existing Buildings Residential Efficiency	-4.4%	6,100	-4.4%	6,100
New Construction Non-Residential Efficiency	-1.2%	1,690	-2.0%	2,810
Existing Buildings Non-Residential Efficiency	-2.0%	2,770	-2.0%	2,770
Sub Total	**-8.5%**	**11,650**	**-9.8%**	**13,490**
Renewable Energy Generation				
Rooftop Solar	-5.8%	8,020	-5.9%	8,100
Community Solar	-27.0%	36,990	-0.4%	550
Community Choice Aggregation	-7.5%	10,290	-7.3%	10,010
Purchased Renewables (Green Rate)	-0.0%	0	-0.0%	0
Sub Total	**-40.3%**	**55,300**	**-13.6%**	**18,660**
Transportation + Land Use				
Land Use & Transportation Alternatives	-8.1%	11,130	-4.0%	5,500
Additional Transportation Strategies	-3.2%	4,450	-1.9%	2,560
Electric Vehicles	-5.7%	7,750	-7.4%	10,100
Sub Total	**-17.0%**	**23,330**	**-13.0%**	**18,160**
Other Sectors + Offsets				
Waste + Recycling	-2.5%	3,430	-2.5%	3,480
Water + Wastewater	-0.6%	840	-0.2%	330
Purchase Offsets	-0.0%	0	-30.1%	41,310
Sub Total	**-3.1%**	**4,270**	**-32.9%**	**45,120**
TOTAL	**-100.0%**	**94,540**	**-100.0%**	**95,420**

Source: City of Hermosa Beach Carbon Planning Tool 2015.

The effectiveness of each strategy is determined based on a series of assumptions on the rate(s) of implementation identified in **Table 6**. The tool allows custom rates of implementation to be identified, based on the goals, policies, and actions included in PLAN Hermosa. The Hermosa Beach Carbon Planning Tool and User Guide is provided in Appendix E-3.

Table 6 – Carbon Planning Tool Strategy Assumption Questions

	2030 Carbon Neutral Assumptions
1. Building Efficiency	
For existing homes…	
What percent could undergo a **deep energy renovation**?	30%
What percent of homes' annual energy use would be reduced?	50%
What is the cost (per square foot) of deep energy renovations?	$5.60
What percent could undergo a **standard energy renovation**?	50%
What percent of the homes' annual energy use would be reduced?	15%
What is the cost (per square foot) of standard energy renovations for homes?	$1.00
For new homes…	
What percent could be constructed **beyond code**?	90%
What percent of the homes' annual energy use would be reduced?	75%
What is the cost (per square foot) of green building for residential new construction?	$5.00
For existing commercial and industrial buildings…	
What percent of buildings could undergo a **deep energy renovation**?	30%
What percent of the buildings' annual energy use would be reduced?	50%
What is the cost (per square foot) of deep energy renovations for commercial and industrial buildings?	$11.20
What percent of buildings could undergo a **standard energy renovation**?	50%
What percent of the buildings' annual energy use would be reduced?	15%
What is the cost (per square foot) of standard energy renovations for commercial and industrial buildings?	$1.00
For new commercial and industrial buildings…	
What percent of buildings could be constructed **beyond code**?	90%
What percent of the buildings' annual energy use would be reduced?	75%
What is the cost (per square foot) of green building for commercial and industrial new construction?	$5.00
2. Renewable Energy Generation	
Rooftop Solar	
What percent of homes could install rooftop solar (by 2040)?	50%
What is the average size of a solar array (in kilowatts, kW)?	5.0
What percent of businesses could install rooftop solar (by 2040)?	50%
What is the average size of a commercial solar array (in W/ft^2)?	6
What is the current cost (per kilowatt) of rooftop solar?	$3,700
What is the annual cost reduction (as a percentage) for rooftop solar installation?	2%
For community solar…	

	2030 Carbon Neutral Assumptions
How large of a **solar garden** could the community support (in kilowatts)?	134,000
How much would a **solar garden** cost (in dollars per kilowatt)?	$3,000
Utility Based Renewables	
What should your utility-based renewables strategy be?	
Either Community Choice Aggregation (CCA)...	
What year should the **CCA** begin?	2017
What percent of customers would stay participating in a CCA program?	90%
Would you like to change the percentage of renewable energy for this rate? If so what should be the percentage?	100%
What will be the initial utility rate for this level of participation?	$0.17
What percent of customers will opt to pay for a rate with 100% renewable energy from a CCA (beginning in 2017)?	10%
What will be the initial utility rate for this level of participation?	$0.20
Or a Green rate...	
Should electricity be purchased from the electric utility (Southern California Edison, or SCE) at a **green rate instead?** If so what percentage of electricity should be purchased at this higher rate?	0%
What will be the premium for a SCE Green Rate?	34%
3. Transportation + Land Use	
Vehicle Miles Traveled (VMT) Reduction Strategies	
Please select your preferred Land Use and Transportation Scenario (from the PLAN Hermosa update process) from the box on the right.	Scenario D: 25%
What level of policies and programs should be added to the general plan to further reduce VMT?	High: 10%
What will be the implementation cost (in dollars per vehicle mile traveled) of this strategy?	$0.75
Electric Vehicle (EV)	
What percentage of new car purchases in 2040 will be EVs?	75%
What percentage of EV charging stations, both residential and around town, will rely on **solar power**?	75%
What will be the incremental cost of EVs be in...	
2015?	$7,500
2030?	$0
What will be the cost of charging stations for...	
Residential?	$2,000
Community?	$3,500
Other Sectors + Offsets	
What percentage of remaining emissions should be reduced through the purchase or generation of carbon **offsets**?	0%
What percentage of waste should be diverted from landfills?	100%
What level of water conservation might be achieved?	50%

Source: City of Hermosa Beach Carbon Planning Tool, 2015.

E-2: City of Hermosa Beach GHG Inventory, Forecast, and Target Setting Report

City of Hermosa Beach

GHG Inventory, Forecasting, Target-Setting Report for an Energy Efficiency Climate Action Plan

January 2015

Prepared for:

SOUTH BAY CITIES
COUNCIL OF GOVERNMENTS

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Funded by:
SOUTHERN CALIFORNIA EDISON
Local Government Strategic Plan Strategies Program
Under the auspices of the California Public Utilities Commission

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List of Acronyms and Abbreviations

AB	Assembly Bill
ADC	Alternative Daily Cover
BAU	Business-as-Usual
CAFE	Corporate Average Fuel Economy
CH_4	Methane
CARB	California Air Resources Board
CIWMB	California Integrated Waste Management Board
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalents
EECAP	Energy Efficiency Climate Action Plan
EO	Executive Order
GHG	Greenhouse Gas
GWP	Global Warming Potential
IEAP	International Local Government GHG Emissions Analysis Protocol
IFT	Inventories, Long-Term Forecasts, and Target-Setting
IPCC	Intergovernmental Panel on Climate Change
JWPCP	Joint Water Pollution Control Plant
kWh	Kilowatt-hour
LCFS	Low Carbon Fuel Standard
LGOP	Local Government Operations Protocol
MT	Metric Tons
NDN	Nitrification/denitrification
N_2O	Nitrous Oxide
RPS	Renewable Portfolio Standard
RTP	Regional Transportation Plan
SBCCOG	South Bay Cities Council of Governments
SCAG	Southern California Association of Governments
SCE	Southern California Edison
SCG	Southern California Gas Company
SEEC	Statewide Energy Efficiency Collaborative

Key Findings

Community

- The City of Hermosa Beach decreased emissions 7.7% from 2005 to 2012, from 137,160 MT CO_2e to 126,611 MT CO_2e.
- On-Road Transportation, Commercial Energy, Solid Waste, Water, and Off-Road Sources sector emissions decreased while Residential Energy and Wastewater sectors increased emissions from 2005 to 2012.
- Energy-related emissions account for about 40% of the total community emissions.
- Under the Adjusted Business-as-Usual (BAU) forecast, emissions will be 111,690 MT CO_2e in 2020 and 94,162 MT CO_2e in 2035. These emissions levels are 19% lower in 2020 than 2005 and 31% lower than 2005 by 2035.
- The City should choose a reduction target that is feasible and ambitious. The State recommends a 15% reduction below 2005 levels by 2020, which would be achieved under the Adjusted BAU scenario.
- To continue reductions consistent with the State's long-term emissions reduction goal of lowering emissions 80% below 1990 levels by 2050, the City would need to reduce emissions in 2035 by 24,210 MT CO_2e from an Adjusted BAU forecast. This is a 24% reduction from the Adjusted BAU emissions level and would achieve a 49% reduction from 2005 levels.

Municipal

- Municipal emissions have decreased 9% from 2005 to 2012, from 1,501MT CO_2e to 1,372 MT CO_2e.
- Emissions in all sectors decreased between 2005 and 2012 except for the Vehicle Fleet & Equipment and SCE-Owned Outdoor Lights.
- Municipal energy use accounts for approximately 1% of all emissions.
- Under the Adjusted BAU forecast, emissions will be 1,751 MT CO_2e in 2020 and 1,872 MT CO_2e in 2035. These emissions levels are 17% higher in 2020 than 2005 and 25% higher than 2005 by 2035.
- The City would need to reduce emissions by 1,751 MT CO_2e from the 2020 Adjusted BAU emissions level to meet its carbon neutrality goal by 2020.

Introduction

The Greenhouse Gas (GHG) Inventories, Long-Term Forecasts, and Target-Setting (IFT) Report contains the first steps toward the City of Hermosa Beach (City) identifying energy-efficiency measures in an Energy Efficiency Climate Action Plan (EECAP). The inventories describe historic energy use and GHG emissions and the forecasts describe projected future emissions in the City. The target-setting section describes GHG reduction recommendations that are consistent with State goals and may assist the City in establishing local GHG reduction targets. The inventories and recommended reduction targets will help the City in the next step of the EECAP, which is to identify energy efficiency and GHG reduction measures that are relevant, meaningful, and feasible.

Specifically, the IFT Report includes (words and phrases in bold are described in Table 1):

- Historic GHG emissions in **community inventories** and **municipal inventories** for 2005, 2007, 2010, and 2012;
- Future GHG emissions for 2020 and 2035 under a **business-as-usual** forecast scenario and **adjusted business-as-usual** forecast scenario; and
- Recommended GHG **reduction targets** for 2020 and 2035.

Table 1. Key Terms in the Report[1]

Term	Definition
Adjusted business-as-usual	A GHG forecast scenario that accounts for known policies and regulations that will affect future emissions. Generally, these are state and federal initiatives that will reduce emissions from the business-as-usual scenario.
Baseline year	The inventory year used for setting targets and comparing future inventories against.
Business-as-usual	A GHG forecast scenario that assumes no change in policy affecting emissions since the most recent inventory. Changes in emissions are driven primarily through changes in demographics.
Community Inventory	GHG emissions that result from the activities by residents and businesses in the city. An inventory reports emissions that occur over a single calendar year.
Emission factors	The GHG-intensity of an activity.
Municipal Inventory	GHG emissions that result from the activities performed as part of the government operations in the city and are a subset of the community inventory. An inventory reports emissions that occur over a single calendar year.
Reduction targets	GHG emissions levels not to be exceeded by a specific date. Local reduction targets are often informed by state recommendations and different targets may be established for different years.
Sector	A subset of the emissions inventory classified by a logical grouping such as economic or municipal-specific category.

[1] A glossary of terms is also included as Appendix A.

GHG Emissions Inventories

GHG emissions inventories are the foundation of planning for future reductions. Establishing an existing inventory of emissions helps to identify and categorize the major sources of emissions currently being produced. In this report, four years of historic inventories are presented to show not only the major sources of emissions in the City, but also how those sources vary over time. For both the community and municipal inventories, the years 2005, 2007, 2010, and 2012 are presented. The 2005 inventory (for both community and municipal operations) is considered the **baseline year**. A baseline year is established as a starting point against which other inventories may be compared and targets may be set, and is generally the earliest year with a full emissions inventory. The most recent inventory (2012) has the most relevant data for planning purposes, while the interim years (2007 and 2010) provide context and may help identify trends or anomalies.

Emissions Reporting

The primary GHGs from the community and municipal operations are from carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Because each of these gases has a different capacity for trapping heat in the atmosphere, known as its global warming potential (GWP), a method of reporting is needed to be able to compare gases in the same terms. As a result, emissions are reported in carbon dioxide equivalents, or CO_2e, with each GHG normalized and calculated relative to CO_2 using its GWP. Table 2 describes the GHGs analyzed in this report, their symbol, GWP, and primary community sources of emissions. While N_2O has the highest GWP and may be considered the most dangerous on a per-molecule basis, CO_2 is by far the most prevalent, accounting for 88% of statewide emissions in 2005 (CARB 2011).

Table 2. GHGs Analyzed in the Inventories

Greenhouse Gas	Symbol	Global Warming Potential	Primary Community Sources
Carbon Dioxide	CO_2	1	Fossil fuel combustion
Methane	CH_4	25	Fossil fuel combustion, landfills, wastewater treatment
Nitrous Oxide	N_2O	298	Fossil fuel combustion, wastewater treatment

Source: IPCC Fourth Assessment Report, 2007.

Emissions Sectors

The inventories identify the major sources of GHGs emissions caused by activities in sectors that are specific to community or municipal activities. A **sector** is a subset of the economy, society, or municipal operations whose components share similar characteristics. An emissions sector can also contain subsectors that provide more specificity about the source of emissions (e.g., natural gas and electricity are subsectors of the energy sector).

As mentioned above, inventories were completed for the community and municipal operations. Because the majority of municipal activities occur within the boundaries of the City and therefore contribute to the overall emissions of the community, both inventories are interconnected, with the municipal inventory considered a subset of the community inventory. As a result, municipal emissions are included in numbers reported for the community. The municipal inventory is separated to highlight areas of emissions that the City has more direct control over and to identify where they can begin to set examples for the community on how reduction strategies can be implemented.

The following subsections describe the sectors used in the community and municipal inventories. It is important to note that both inventories capture similar types of information but may be categorized differently. For example, energy is reported in both the community and municipal inventory, but community level energy emissions are reported as “Residential” and “Non-residential”, whereas municipal energy emissions are more logically reported as “Buildings & Facilities” and “Streetlights”.[2]

Community Sectors

The community inventory is categorized by sectors based on the sector’s ability to be affected through regional and local programs, incentives, zoning, and other policies. The City’s community inventories were divided into the following sectors:

- **Energy** in the Community Inventory is further broken down into two sectors:
  - **Commercial/Industrial Energy** includes emissions from electricity and natural gas consumption in non-residential buildings and facilities (including outdoor lighting) in the City.
  - **Residential Energy** includes emissions from electricity and natural gas consumption in residential buildings in the City.
- **On-road Transportation** includes emissions from vehicle fuel use in trips wholly within the City (in-boundary) and trips that either originate or end in the City (cross-boundary). Emissions from in-boundary trips are fully accounted for in the inventory, whereas only half of the emissions from cross-boundary trips are accounted for. Trips that pass-through the City, (such as on State Route 1) are not accounted for in the inventory because the City has little or no control of these emissions. As a result, this methodology reflects only trips or parts of trips within City borders that the City has the ability to affect.
- **Solid Waste** includes emissions from waste that is generated in the community and sent to landfills.
- **Water** includes emissions from the electricity used to source, treat, and deliver imported water in the community that is not accounted for in the community utility data.
- **Wastewater** includes emissions from treating wastewater generated in the community.

[2] Streetlights are further categorized as SCE-owned or City-owned as described later.

- **Off-road Sources** include emissions from operating equipment for construction, commercial, light industrial and agricultural activities; lawn and garden equipment; and recreational vehicles such as all-terrain vehicles.

Municipal Sectors

Sources of municipal emissions are divided into the following sectors:

- **Energy** in the municipal inventory is further broken down into four sectors:
  - **Buildings and Facilities** includes energy use by the government, including electricity and natural gas.
  - **SCE-owned Outdoor Lighting** includes energy for streetlights on fixtures owned by SCE and outdoor lighting.
  - **City-owned Outdoor Lighting** includes energy for streetlights on fixtures owned by the City, traffic control signals, and outdoor lighting.
  - **Water Pumping & Irrigation** includes energy for water pumping and irrigation.
- **Vehicle Fleet & Equipment** includes emissions from vehicles owned or operated by the government or contracted by the City for services such as street cleaning. It also includes equipment, such as emergency generators.
- **Employee Commute** includes emissions from fuel use in vehicle trips by municipal employees commuting to and from work in the City.
- **Solid Waste** includes emissions from waste generated by municipal employees or at municipally owned facilities.

Calculation Methodology

GHG emissions were calculated using activity data available (e.g., kilowatt-hours of electricity) for each sector and protocols for converting activity data to emissions output using relevant **emission factors**. Emission factors relate the activity to GHG emissions and may vary by year (e.g., for electricity) and often are not affected by local actions or behavior, unlike activity data. The U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions (ICLEI 2012) and the Local Government Operations Protocol for the Quantification and Reporting of GHG Emissions Inventories (LGOP) (CARB 2010) were the primary protocols used for developing the community and municipal inventories, respectively. Activity data are reported in the community and municipal emissions subsections below, and emission factors are detailed in Appendix B.

Community Emissions

The community inventory includes the GHG emissions that result from activities within City boundaries. This section presents the findings of the community inventory for four years: 2005 (baseline year), 2007, 2010, and 2012. It also provides more specific detail and findings on the energy sectors, which will form the basis of the reduction targets and reduction measures the City identifies in the EECAP.

2005—2012 Emissions Summary

- **The City of Hermosa Beach reduced emissions 7.7% from 2005 to 2012, from 137,160 MT CO_2e to 126,611 MT CO_2e.**
- **On-Road Transportation, Commercial Energy, Solid Waste, Water, and Off-Road Sources sector emissions decreased while Residential Energy and Wastewater sectors increased emissions from 2005 to 2012.**

As shown in Figure 1 and Table 3, the On-Road Transportation sector was the largest contributor to emissions in both 2005 (54%) and 2012 (54%) by producing 73,567 MT CO_2e in 2005 and 68,235 MT CO_2e in 2012. This change represents a 7.2% decrease in emissions from 2005 to 2012. Residential energy is the second-largest contributor to emissions, accounting for 23% of emissions in 2005 and 27% in 2012. This change represents a 4.7% increase from 2005 to 2012, from 32,293 MT CO_2e to 33,808 MT CO_2e. The proportion of emissions from the Commercial sector decreased 12.7% from 2005 to 2012, from 20,280 MT CO_2e to 17,830 MT CO_2e. Solid waste comprised 4% of the total (6,015 MT CO_2e) in 2005, but accounted for 3% of the total (3,334 MT CO_2e) in 2012. Water, Wastewater, and Off-road sources made up the remaining emissions in each year. Water and Off-Road Transportation emissions declined from 2005 to 2012; however, Wastewater sources increased 13.5% (from 52 to 59 MT CO_2e) in the same period.

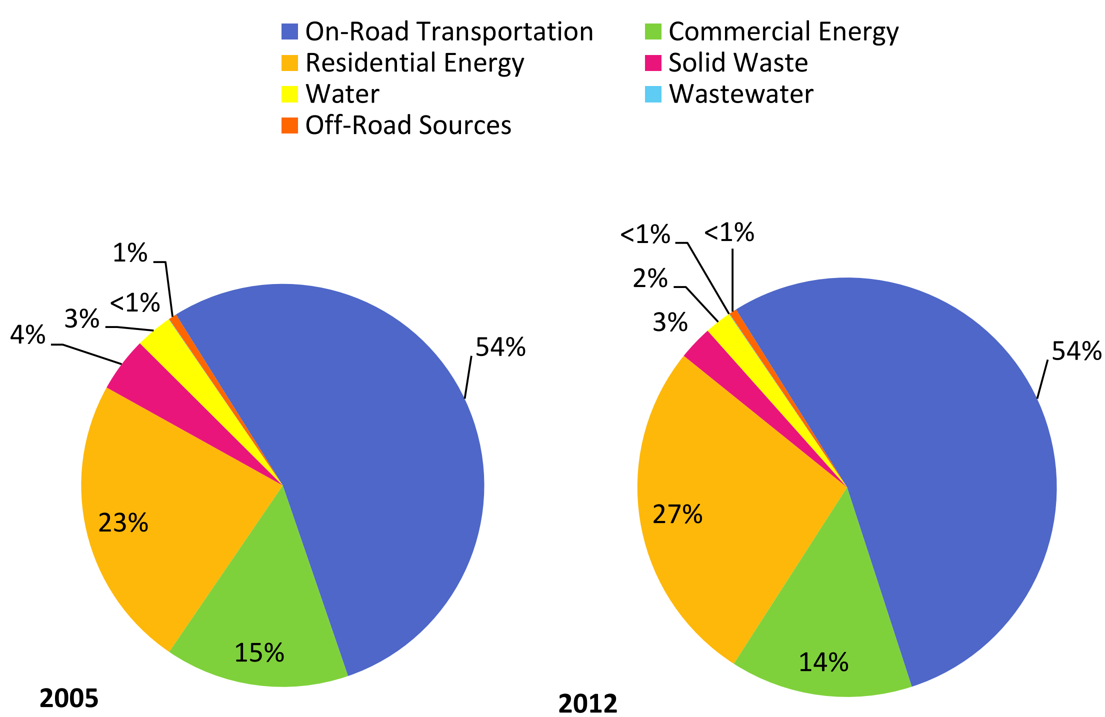


Figure 1. Community-Wide GHG Emissions by Sector for 2005 and 2012

Table 3. Community-Wide GHG Emissions by Sector for 2005 and 2012

Sector	2005 (MT CO_2e)	2012 (MT CO_2e)	% Change 2005 to 2012
On-Road Transportation	73,567	68,235	-7.2%
Residential Energy	32,293	33,808	4.7%
Commercial Energy	20,280	17,830	-12.1%
Solid Waste	6,015	3,334	-44.6%
Water	4,065	2,600	-36.0%
Off-Road Sources	888	745	-16.1%
Wastewater	52	59	13.5%
Total	137,160	126,611	-7.7%

2005, 2007, 2010, and 2012 Inventories

Figure 2 and Table 4 show the GHG emissions by sector for all inventory years. Emissions are variable among the inventory years, and may reflect changes in the economy, weather, and programs implemented to reduce emissions. The table also lists the percentage of each sector relative to total emissions and shows that the proportion of each sector does not vary greatly by year.

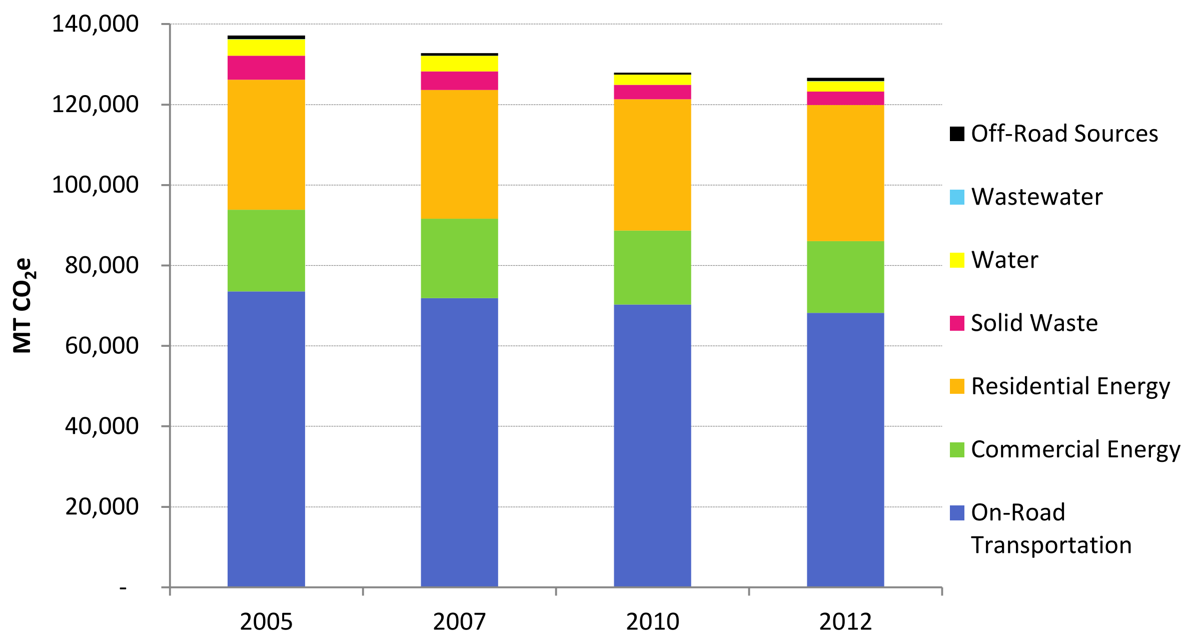


Figure 2. Community GHG Emissions for 2005, 2007, 2010, and 2012

Table 4. Community GHG Emissions for 2005, 2007, 2010, and 2012

Sector	2005 (MT CO_2e)	% of Total	2007 (MT CO_2e)	% of Total	2010 (MT CO_2e)	% of Total	2012 (MT CO_2e)	% of Total
On-road Transportation	73,567	54%	71,863	54%	70,277	55%	68,235	54%
Residential Energy	32,293	24%	31,964	24%	32,700	26%	33,808	27%
Commercial Energy	20,280	15%	19,792	15%	18,372	14%	17,830	14%
Solid Waste	6,015	4%	4,584	3%	3,510	3%	3,334	3%
Water	4,065	3%	3,942	3%	2,552	2%	2,600	2%
Off-Road Sources	888	1%	588	<1%	419	<1%	745	1%
Wastewater	52	<1%	35	<1%	59	<1%	59	<1%
Total	137,160		132,768		127,889		126,611	
% Change from 2005	--		-3.2%		-6.8%		-7.7%	

Activity data can provide more insight into behavioral changes in the community, as these data are not affected by emission factors. Table 5 summarizes activity data for each sector and subsector. The activity data show that residential electricity, natural gas (residential and non-residential), wastewater, industrial off-road sources, and light commercial off-road sources increased from 2005 to 2012, while on-road transportation, commercial electricity, solid waste, water, recycled water, and off-road sources (lawn & garden, construction, recreation, and agriculture) decreased from 2005 to 2012. Wastewater and Off-road emissions use indicator data to attribute county-level emissions to the City and the indicator data are also shown in Table 5.

Demographic data also help provide perspective to changes in emissions over time. Table 6 shows the number of households, jobs, population, and service population (jobs + population) for each inventory year. Energy emissions in particular often reflect trends in demographic data. For example, the slight increase in population and households between 2005 and 2012 may explain some of the increase in Residential Energy emissions.

Table 5. Activity Data used in 2005, 2007, 2010, and 2012 Community Inventories

Sector	2005	2007	2010	2012	% Change 2005 to 2012
On-road Transportation					
Total Vehicle Miles Traveled	140,684,101	138,727,165	139,197,605	138,350,955	-1.7%
Residential Energy					
Electricity (kWh)	47,843,215	49,976,195	49,906,427	49,778,450	4.0%
Natural Gas (therms)	3,339,783	3,305,637	3,448,010	3,364,392	0.7%
Commercial Energy					
Electricity (kWh)	51,741,467	52,130,513	48,545,739	41,191,832	-20.4%
Natural Gas (therms)	857,687	900,024	827,116	875,986	2.1%
Solid Waste					
Landfilled (tons)	24,578	18,490	14,230	13,511	-45.0%
ADC (tons) [1]	246	180	50	48	-80.7%
Water and Wastewater					
Water (MG)	760.2	760.2	687.7	700.3	-7.9%
Recycled Water (MG)	30.9	30.9	26.4	27.7	-10.3%
Wastewater (City portion of countywide residents)	0.20%	0.20%	0.20%	0.20%	0.5%
Off-road sources[2] (% of LA County emissions attributed to the City)					
Lawn & Garden (% Households)	0.30%	0.29%	0.29%	0.29%	-1.7%
Construction (% Building permits)	0.32%	0.20%	0.13%	0.24%	-25.7%
Industrial (% Manufacturing Jobs)	0.03%	0.03%	0.03%	0.03%	4.3%
Light Commercial (% Other jobs)	0.17%	0.17%	0.17%	0.18%	5.9%
Recreation (Population weighted by income)	0.36%	0.36%	0.35%	0.34%	-6.3%
Agriculture (% Ag. Jobs)	0.10%	0.11%	0.06%	0.08%	-17.6%

1 ADC is Alternative Daily Cover, which is green waste (grass, leaves, and branches) that is used to cover landfill emissions. They are reported separately by CalRecycle and therefore shown separately here.

2 Off-road emissions are available at the county level through CARB's OFFROAD model. Emissions attributable to the City were derived using indicator data related to the off-road source. For example, the percentage of households in the City compared to the county was used to attribute the same percentage of lawn & garden equipment emissions to the City. See Appendix B for more methodology details.

Table 6. Demographic Data for 2005, 2007, 2010, and 2012

	2005	2007	2010	2012	% Change 2005-2012
Service Population (Population + Jobs)	26,199	26,421	26,173	26,419	0.8%
Population	19,340	19,174	19,477	19,574	1.2%
Households	9,507	9,457	9,550	9,548	0.4%
Jobs	6,859	7,247	6,696	6,845	-0.2%

Energy

The EECAP ultimately will focus on increasing energy efficiency and reducing GHG gases from energy; therefore, it is important for the City to understand its current energy consumption to make informed decisions for reducing energy-related emissions. Energy use consists of electricity and natural gas. Emissions from Commercial/Industrial and Residential energy use account for about 40% of the total community emissions in 2005 and 2012. Table 7 shows the breakdown in activity (kWh or therms) and GHG emissions by sector and energy source.

Table 7. Activity Data and GHG Emissions of Energy in 2005 and 2012

Sector	2005		2012		% Change in Activity 2005-2012	% Change in Emissions 2005-2012
	Activity (kWh or therms)	Emissions (MT CO_2e)	Activity (kWh or therms)	Emissions (MT CO_2e)		
Commercial/ Industrial						
Electricity	51,741,467	15,719	41,191,832	13,172	-20.4%	-16.2%
Natural Gas	857,687	4,561	875,986	4,658	2.1%	2.1%
Residential						
Electricity	47,843,215	14,534	49,778,450	15,918	4.0%	9.5%
Natural Gas	3,339,783	17,759	3,364,392	17,890	0.7%	0.7%
Total (MT CO_2e)		52,573		51,638		-1.8%

Commercial electricity use decreased 20.4% between 2005 and 2012; emissions decreased by more than 16%. Residential electricity use increased by about 4% but emissions increased by more than 9%. These changes are due to the emission factor used for electricity for 2005 and 2012. Emission factors convert activity data into GHG emissions and electricity emission factors vary annually based on how electricity is generated by the electricity provider (i.e., the amount of renewables, natural gas, coal, etc.). In 2005, Southern California Edison (SCE) generated electricity that resulted in an emission factor of 669.7 CO_2e. In 2012, SCE's electricity generation resulted in an emission factor of 705.0 CO_2e. Therefore, a kilowatt-hour of electricity used in 2012 emitted more GHGs than a kilowatt-hour of electricity used in 2005. Future emissions could increase or decrease based on changes to SCE's emission factors, which the City cannot directly affect, or through changes in usage, which can be affected by changes in local policy, outreach, or incentive programs.

Electricity-Related Emissions

All emissions are comprised of activity data and the emission factor, or GHG-intensity, of that activity. For electricity, the activity data are the kilowatt-hours (kWh) used by the city's residents and businesses and the energy intensity is based on the sources of power that Southern California Edison uses to generate electricity. Changes to either component can affect the GHG emissions from electricity in the City.

Unlike electricity, the emission factor for natural gas is estimated on a national basis and remains fairly constant over time. Therefore, the natural gas GHG emissions follow the same trend as usage. In Hermosa Beach, Commercial/Industrial natural gas consumption (therms) decreased by 2.1% from 2005 to 2012; therefore the emissions also declined 2.1%. Residential natural gas therms used and GHG emissions declined nearly 0.7% from 2005 to 2012. Figure 3 shows the trend in electricity and natural gas emissions from 2005 to 2012 for the Commercial/Industrial and Residential sectors.

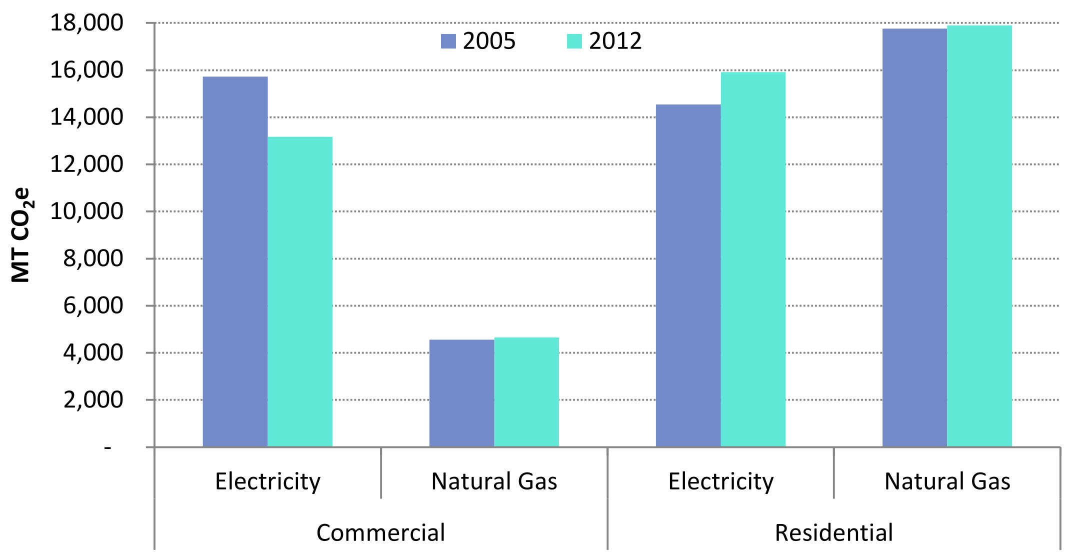


Figure 3. GHG Emissions for Community Electricity and Natural Gas, by Sector

Municipal Emissions

As described earlier, a municipal GHG emissions inventory is a subset of the community inventory. The municipal inventory includes emissions from activities conducted as part of government operations in the City. While emissions from government operations are normally a fraction of the overall community emissions, the City has the most direct control over municipal emissions and the City can demonstrate leadership in the community by adopting and implementing energy and GHG reduction strategies. This section presents the findings of the municipal inventory for 2005 (the baseline year), 2007, 2010, and 2012. It also provides more specific detail and findings on the energy sectors, which will form the basis of the reduction measures the City identifies in the EECAP.

2005—2012 Emissions Summary

- **Municipal emissions have decreased nearly 9% from 2005 to 2012, from 1,501 MT CO_2e to 1,372 MT CO_2e.**
- **The sector with the greatest reductions was Employee Commute, which decreased 130 MT CO_2e between 2005 and 2012.**
- **Emissions from municipal operations account for 1% of community emissions.**

The City's Employee Commute is the sector with the largest percentage of emissions in 2005 (23%) and decreased to the third-largest contributor in 2012 (16%) as emissions from this sector decreased 37% over the period (Figure 4). The second largest-emitting sector for 2005 and 2012 was Buildings & Facilities, accounting for 20% of emissions in 2005 and 22% of emissions in 2012 (increasing from 301 MT CO_2e to 305 MT CO_2e). The Fleet & Equipment sector contributed 227 MT CO_2e (15% of total emissions) in 2005 and increased by 44% 2012 (to 328 MT CO_2e, or 24% of total emissions), making this sector the largest emissions sector in 2012. Emissions from Solid Waste declined 25% over the period (from 215 to 162 MT CO_2e). Emissions from SCE-owned Outdoor Lights increased 4% from 2005 to 2012, while City-owned Outdoor Lights emissions decreased by 19% from 2005 to 2012. The smallest sector, Water Pumping & Irrigation, decreased emissions from 5 MT CO_2e in 2005 to less than 1 MT CO_2e between 2005 and 2012. The 2005 and 2012 emissions and changes are detailed in Table 8.

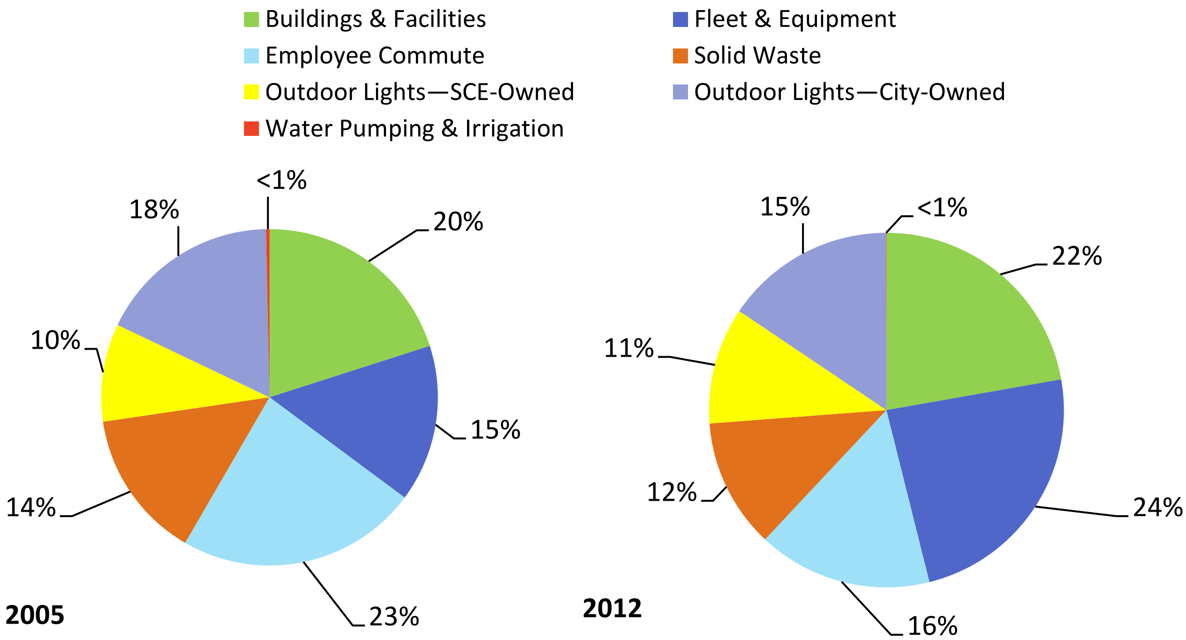


Figure 4. Municipal GHG Emissions by Sector for 2005 and 2012

Table 8. Municipal GHG Emissions by Sector for 2005 and 2012

Sector	2005 (MT CO_2e)	2012 (MT CO_2e)	% Change 2005 to 2012
Employee Commute	348	218	-37%
Buildings & Facilities	301	305	1%
Outdoor Lights—City-Owned	264	213	-19%
Fleet & Equipment	227	328	44%
Solid Waste	215	162	-25%
Outdoor Lights—SCE-Owned	141	146	4%
Water Pumping & Irrigation	5.0	0.6	-87%
Total	1,501	1,372	-8.6%

Note: City-Owned Outdoor Lights includes streetlights, traffic signals, and area lighting. SCE-Owned Outdoor Lights includes streetlights and outdoor lighting.

2005, 2007, 2010, and 2012 Inventories

Figure 5 and Table 9 show the municipal GHG emissions by sector for all four inventory years. Emissions peaked in 2007 (1,541 MT CO_2e) and were the lowest in 2010 (1,340 MT CO_2e).

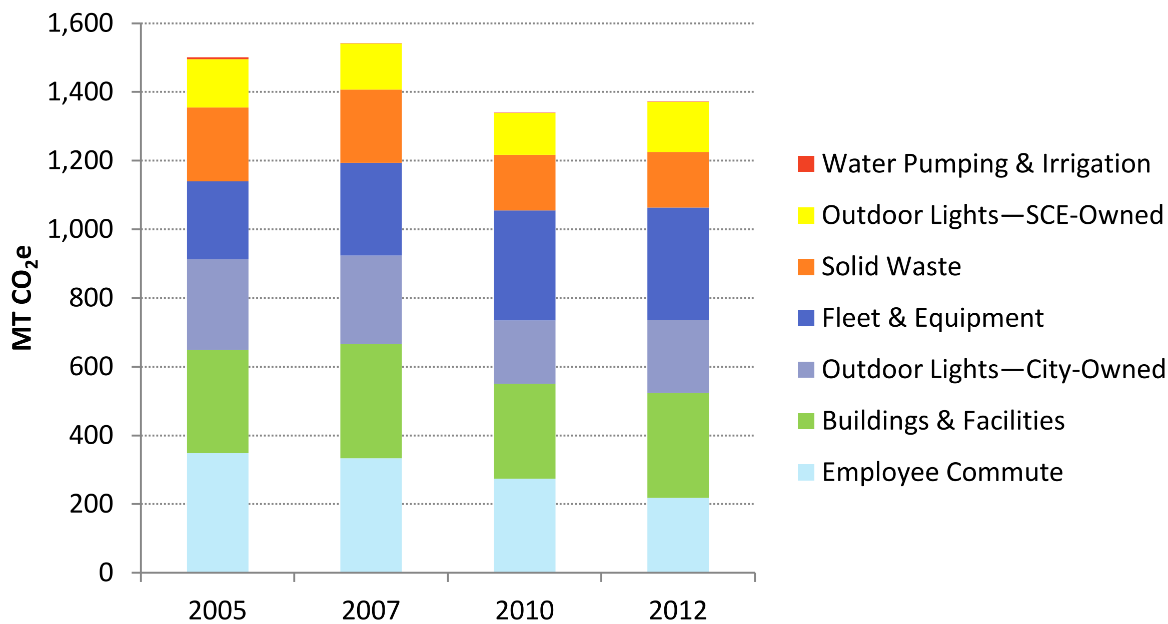


Figure 5. Municipal GHG Emissions for 2005, 2007, 2010, and 2012

Table 9. Municipal GHG Emissions for 2005, 2007, 2010, and 2012

Sector	2005 (MT CO_2e)	% of Total	2007 (MT CO_2e)	% of Total	2010 (MT CO_2e)	% of Total	2012 (MT CO_2e)	% of Total
Employee Commute	348	23%	333	22%	274	20%	218	16%
Buildings & Facilities	301	20%	333	22%	276	21%	305	22%
Outdoor Lights—City-Owned	264	18%	258	17%	185	14%	213	16%
Fleet & Equipment	227	15%	270	18%	320	24%	328	24%
Solid Waste	215	14%	213	14%	162	12%	162	12%
Outdoor lights—SCE-Owned	141	9%	134	9%	122	9%	146	11%
Water Pumping & Irrigation	5.0	0%	0.49	0%	0.55	0%	0.64	0%
Total	1,501		1,541		1,340		1,372	

Table 10 summarizes activity data for each sector and subsector. City-Owned Fleet showed significant increases in compressed natural gas (CNG) and diesel fuel used, which reflects the increase in Fleet & Equipment emissions. The significant decrease in Employee Commute reflects the change in City employees from 2005 to 2012, which decreased 34%.

Table 10. Activity Data used in 2005, 2007, 2010, and 2012 Municipal Inventories

Sector	2005	2007	2010	2012	% Change 2005 to 2012
Buildings & Facilities					
Electricity (kWh)	895,746	932,207	883,858	915,327	2%
Natural Gas (therms)[1]	5,383	11,977	4,621	2,542	-53%
Outdoor Lights					
City-Owned Electricity (kWh)	868,589	895,841	643,360	664,636	-23%
SCE-Owned Electricity (kWh)	464,752	466,608	424,794	455,210	-2%
Fleet & Equipment					
City-Owned Fleet					
Gasoline (gallons)	12,665	17,406	20,481	20,341	61%
Diesel (gallons)	2,584	2,584	4,121	5,502	113%
LPG (gallons)	-	-	36	23	NA
CNG (standard cubic feet)	13,377	13,377	81,114	98,658	638%
Contracted[2]					
Gasoline (gallons)	3,640	3,640	3,640	3,640	0%
Diesel (gallons)	2,057	2,057	2,057	2,057	0%
LPG (gallons)	5,127	5,127	5,127	5,127	0%
Employee Commute					
Gasoline (gallons)	794,170	760,056	634,526	506,797	-36%
Diesel (gallons)	26,784	35,852	25,110	20,055	-25%
# Full Time Employee Equivalents	186	184	154	123	-34%
Solid Waste[2]					
Generated Waste (tons)	666	660	660	660	-1%
Water Pumping & Irrigation					
Electricity (kWh)	17,033	1,712	1,907	1,999	-88%

1 Contracted fuel use was not available for 2010 and 2012. Data from 2007 were used.

2 Solid Waste data for 2010 and 2012 assumed 2007 values.

Energy

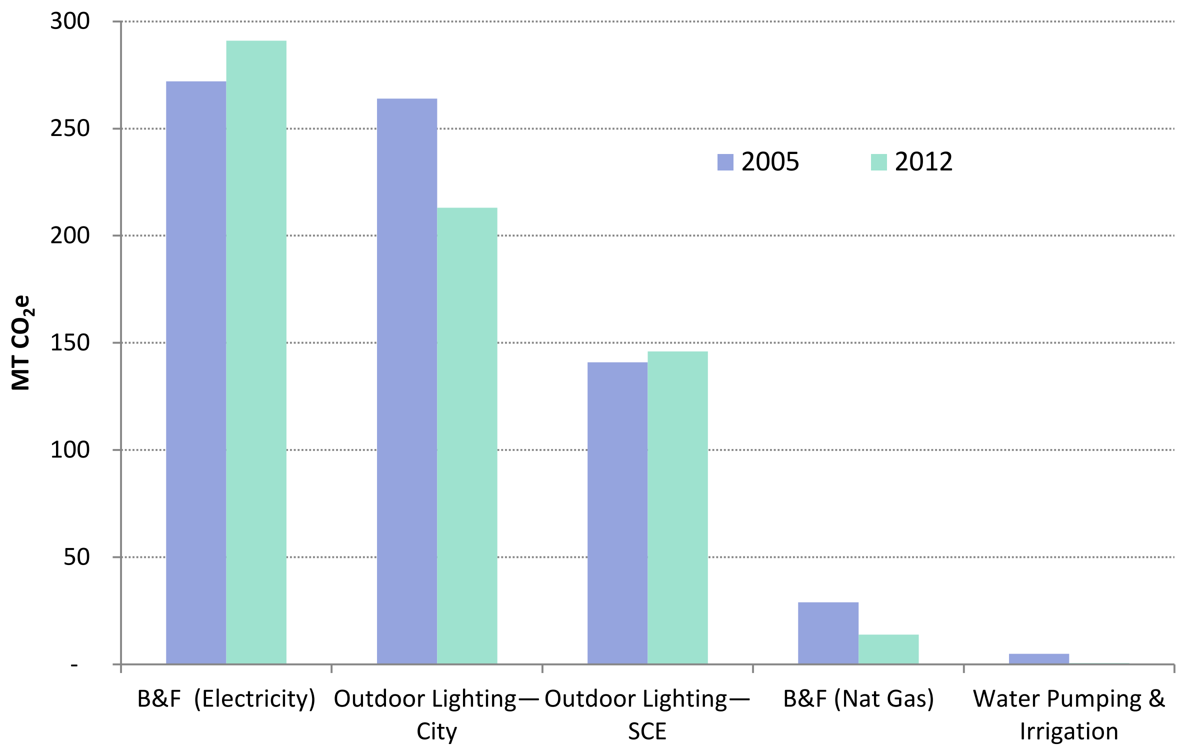
As with the community emissions, the EECAP will focus on increasing energy efficiency and reducing GHG gases from energy within municipal operations. The City has more direct control over energy-related emissions than other sectors, such as employee commute. Municipal energy use includes Buildings & Facilities, SCE-owned Outdoor Lighting, City-owned Outdoor Lighting, and Water Pumping & Irrigation. Energy accounted for 47% of total emissions in 2005 and 48% in 2012. While both electricity and natural gas are used for Building & Facilities, Outdoor Lighting and Water Pumping & Irrigation only use electricity. Emissions from energy declined 7% from 2005 to 2012; electricity-based emissions declined almost 5% and natural gas related emissions decreased 52% (Table 11). As with community energy, municipal emissions use variable electricity emission factors and constant natural gas emission factors.

Table 11. Activity Data and GHG Emissions of Energy in 2005 and 2012

Sector	2005		2012		% Change in Activity 2005-2012	% Change in Emissions 2005-2012
	Activity (kWh or Therms)	Emissions (MT CO_2e)	Activity (kWh)	Emissions (MT CO_2e)		
B&F (kWh)	895,746	272	915,327	291	2%	7%
Outdoor Lighting—City (kWh)	868,589	264	664,636	213	-23%	-19%
Outdoor Lighting—SCE (kWh)	464,752	141	455,210	146	-2%	4%
Water Pumping & Irrigation (kWh)	17,033	5	1,999	0.64	-88%	-87%
B&F (therms)	5,383	29	2,542	14	-53%	-52%
Total	2,251,503	711	2,039,714	665	-9%	-7%

Note: B&F is Buildings and Facilities.

Figure 6 shows the trend in electricity and natural gas emissions from 2005 to 2012 for the municipal energy sectors.



Note: B&F is Buildings and Facilities.

Figure 6. GHG Emissions for Municipal Electricity and Natural Gas, by Sector

Inventory Forecasts

GHG emissions are forecast using two scenarios: a Business-as-Usual (BAU) and an Adjusted BAU scenario. The BAU scenario describes emissions based on projected growth in population and employment and does not consider policies that will reduce emissions in the future (that is, the policies in place in 2012 are assumed to remain constant through 2035). The Adjusted BAU scenario describes emissions based on projected growth *and* considers policies that will achieve GHG reductions in the future. Policies, described in detail below, include State-adopted or approved legislation that will affect future emissions. By evaluating the two scenarios, the City can see the effect that existing policies may have on future emissions and be better able to determine how local measures can provide additional reductions. Two future years are forecasted for each scenario: 2020 and 2035. The 2020 forecast year is consistent with the goals identified in Assembly Bill (AB) 32, which identifies a statewide GHG reduction target by 2020. The 2035 forecast year will allow the City to develop long-term strategies to continue GHG reductions beyond 2020.

Business-as-Usual Forecasts

The BAU forecasts estimate future emissions using current (2012) consumption patterns and emission factors with the anticipated growth in the City. Anticipated growth is estimated using data from regional planning scenarios developed by the Southern California Association of Governments (SCAG), the City, and other relevant sources (Table 12). The most relevant growth factors are used to project emissions by sector. For example, future Residential Energy emissions were developed using current energy use per household (from the 2012 inventory) and the anticipated number of households in the future. Actual energy use is a function of several variables, not only the number of households; however, this approach is supported by current protocols and best practices within the State and provides a consistent approach to forecasting. Compound annual growth rates were developed using the growth projections from 2012 to 2020 and from 2021 to 2035, as shown Table 12.

In general, the City is expecting modest growth to 2020 and 2035 as population and jobs are expected to increase. SCAG is projecting fewer vehicle miles traveled from 2012 to 2020 despite population and job growth, but that trend is reversed after 2020, when vehicle miles traveled will again increase. Due to the relatively low growth, the City does not anticipate major staffing changes in its government services.

Table 12. Growth Factors for 2012, 2020, and 2035

Sector	Demographic Indicator	2012	2020	2035	2012-2020 CAGR[1]	2020-2035 CAGR[1]
Transportation	Vehicle Miles Traveled	138,350,955	126,238,272	129,742,671	-1.14%	0.18%
Solid Waste, Water, Wastewater, Off-Road Sources	Service Population (Population + Jobs)	26,419	26,900	27,400	0.23%	0.12%
NA[2]	Population	19,574	19,600	19,700	0.02%	0.03%
Residential Energy	Households	9,548	9,600	9,600	0.07%	0.00%
Commercial/ Industrial Energy	Jobs	6,845	7,300	7,700	0.81%	0.36%
Municipal Jobs	Municipal Emissions[3]	106 F/T 34 P/T	137 F/T 60 P/T	146 F/T 65 P/T	3.9%	0.45%

Source: SCAG 2012.

F/T: Full-time employees; P/T: Part-time employees

1 Compound annual growth rate.

2 Not Applicable. Population data are shown for informational purposes but are not used for forecasting any sector.

3 The number of jobs in the City is used as an indicator for all municipal operation emissions.

Community Business-as-Usual Forecast

- **BAU community emissions are expected to decrease 8.1% from baseline levels by 2020 and 5.8% by 2035.**

The City's BAU emissions in 2020 are estimated to be 125,982 MT CO_2e, or an 8.1% decrease from baseline (2005) emissions. By 2035, emissions are estimated to decrease 5.8% from the baseline level to 129,157 MT CO_2e (Table 13).

Table 13. Community BAU Forecast

Sector	2005 (MT CO_2e)	2012 (MT CO_2e)	2020 (MT CO_2e)	% Change 2012-2020	2035 (MT CO_2e)	%Change 2012-2035
On-Road Transportation	73,567	68,235	66,150	-3%	67,986	0%
Residential Energy	32,293	33,808	33,969	0%	33,969	0%
Commercial Energy	20,280	17,830	18,930	6%	19,967	12%
Solid Waste	6,015	3,334	3,391	2%	3,454	4%
Water	4,065	2,600	2,645	2%	2,694	4%
Off-Road Sources	888	745	837	12%	1,026	38%
Wastewater	52	59	60	2%	61	3%
Total	137,160	126,611	125,982	0%	129,157	2%
% Change from 2005		-7.7%	-8.1%		-5.8%	

Municipal Business-as-Usual Forecast

- **BAU municipal emissions are expected to be 20% higher than baseline levels in 2020 and 28% higher than baseline levels in 2035.**

The City is anticipating significant growth in city employees by 2020 or 2035 from current (2012) levels—36% more full-time equivalent employees in 2020 compared with 2012, and 45% more employees in 2035 compared with 2012. Therefore, the activity data for municipal services is also expected to increase relative to 2012.

Table 14. Municipal BAU Forecast

	2005 (MT CO_2e)	2012 (MT CO_2e)	2020 (MT CO_2e)	% Change 2012-2020	2035 (MT CO_2e)	% Change 2012-2035
Buildings & Facilities	301	305	400	31%	428	40%
Employee Commute	348	218	286	31%	306	40%
Solid Waste	215	162	213	31%	227	40%
Outdoor Lighting	405	359	471	31%	504	40%
Vehicle Fleet	227	328	430	31%	460	40%
Water Pumping & Irrigation	5.0	0.64	1	56%	1	56%
Total	1,501	1372	1801	31%	1926	40%
% Change from 2005		-9%	20%		28%	

Adjusted Business-as-Usual Forecasts

State legislation has been approved and/or adopted that will reduce GHG emissions in the City. These policies do not require additional local action, but should be accounted for in the City's emissions forecasts to provide a more accurate picture of future emissions and the level of local action needed to reduce emissions to levels consistent with State recommendations. This forecast is called the Adjusted BAU forecast. The measures are described briefly below.

Low Carbon Fuel Standard. The Low Carbon Fuel Standard (LCFS) was developed as a result of Executive Order S-1-07, which mandates that the carbon intensity of transportation fuels in California are lowered 10% by 2020. The State is currently implementing this standard, which is being phased in and will achieve full implementation in 2020.

Assembly Bill (AB) 1493 and Advanced Clean Cars. AB 1493 directed CARB to adopt GHG standards for motor vehicles through model year 2015 that would result in reductions in GHG emissions by up to 25% in 2030. In addition, the State's Advanced Clean Cars program includes additional components that will further reduce GHG emissions statewide, including more stringent fuel efficiency standards for model years 2017—2025 and support infrastructure for the commercialization of zero-emission vehicles. CARB anticipates additional GHG reductions of 3% by 2020, 27% by 2035, and 33% by 2050[3]. These are also known as “Pavley I” and “Pavley II” regulations.

California Building Code Title 24. California’s building efficiency standards are updated regularly to incorporate new energy efficiency technologies. The code was most recently updated in 2013 and went into effect for new development in 2014. For projects implemented after January 1, 2014, the California Energy Commission estimates that the 2013 Title 24 energy efficiency standards will reduce consumption by an estimated 25% for residential buildings and 30% for commercial buildings, relative to the 2008 standards. These percentage savings relate to heating, cooling, lighting, and water heating only; therefore, these percentage savings were applied to the estimated percentage of energy use by Title 24.

Renewable Portfolio Standard. The Renewable Portfolio Standard (RPS) requires energy providers to derive 33% of their electricity from qualified renewable sources. This is anticipated to lower emission factors (i.e., fewer GHG emissions per kilowatt-hour used) statewide. Therefore, reductions from RPS are taken for energy embedded in water, which uses energy sources throughout the state to move from the water source area to the City. However, no credit was taken for this measure for the SCE service region (i.e., for residential and commercial electricity used in the City supplied by SCE). Analysis of SCE’s current portfolio and the sources needed to replace the nuclear generation that has been taken out of service has revealed great uncertainty in how SCE’s emission factors may change over time. Therefore, the emission factor used in the 2012 inventory and the BAU forecast was also used in the Adjusted BAU forecast.

Senate Bill X7-7. California’s SB X7-7 requires water suppliers to reduce urban per capita water consumption 20% from a baseline level by 2020. The City is supplied by California Water Service and the reductions in GHG emissions from SB X7-7 were calculated by applying the reduction goals established by California Water Service to the City’s population in 2020 and 2035.

Community Adjusted Business-as-Usual Forecast

- **Emissions are expected to decrease under the Adjusted BAU forecast and will be 19% lower in 2020 than 2005 and 31% lower than 2005 levels by 2035.**

The City’s Adjusted BAU emissions in 2020 are estimated to be 111,690 MT CO_2e in 2020 and 94,162 MT CO_2e in 2035 (Table 15). This change represents an 18.6% reduction from 2005 by 2020 and 31% reduction by 2035. Due to the stringent State vehicle standards, the emissions from the Transportation sector are expected to decrease significantly over time, while the proportion of emissions from Residential and Non-residential Energy will increase. Emissions from Solid Waste are expected to increase while emissions from Water and Wastewater will remain steady over time, but all account for less than 10% of total emissions.

[3] CARB Advanced Clean Cars Summary Sheet

Table 15. Community Adjusted BAU Emissions

Sector	2005 (MT CO_2e)	2012 (MT CO_2e)	2020 (MT CO_2e)	2020 % of Total	2035 (MT CO_2e)	2035 % of Total
Transportation & Mobile Sources	74,455	68,980	53,857	49%	35,533	38%
Non-Residential Energy	20,280	17,830	18,742	17%	19,564	21%
Residential Energy	32,293	33,808	33,953	30%	33,953	36%
Solid Waste	6,015	3,334	3,391	3%	3,454	4%
Water & Wastewater	4,117	2,659	1,747	2%	1,658	2%
Total	137,160	126,611	111,690	100%	94,162	100%
% Change from 2005		-8%	-19%		-31%	

Municipal Adjusted Business-as-Usual Forecast

- **Emissions are expected to increase under the Adjusted BAU forecast and are estimated to be 17% higher in 2020 and 25% higher in 2035 relative to 2005 levels.**
- **The City will need to reduce emissions by 475 MT CO_2e in 2020 from the forecasted level to meet a state-aligned target of 15% below 2005 levels.**

The City's Municipal Adjusted BAU emissions in 2020 are estimated to be 1,751 MT CO_2e, which is 17% above the 2005 baseline level (Table 16). By 2035, the level of reductions is anticipated to be 25% above 2005 levels, or 1,872 MT CO_2e. The Adjusted BAU emissions are slightly lower than the BAU emissions due to the Low Carbon Fuel Standard measure described earlier. The Low Carbon Fuel Standard would lower the carbon intensity of fuels used in both the City's Vehicle Fleet and Employee Commute sectors.

Table 16. Municipal Adjusted BAU Emissions

Sector	2005 (MT CO_2e)	2012 (MT CO_2e)	2020 (MT CO_2e)	2020 % of Total	2035 (MT CO_2e)	2035 % of Total
Buildings & Facilities	301	305	400	23%	428	23%
Employee Commute	348	218	266	15%	284	15%
Solid Waste	215	162	213	12%	227	12%
Outdoor Lighting	405	359	471	27%	504	27%
Vehicle Fleet	227	328	400	23%	428	23%
Water Pumping & Irrigation	5	0.64	0.64	<1%	0.64	<1%
Total	1,501	1,373	1,751	100%	1,872	100%
% Change from 2005		-9%	17%		25%	

Reduction Targets

The State has set goals for reducing GHG emissions by 2020 and 2050 through AB 32 and Executive Order (EO) S-3-05, respectively. The State has also provided guidance to local jurisdictions as "essential partners" in achieving the State's goals by identifying a 2020 recommended reduction goal. That goal, stated in the AB 32 Scoping Plan, was for local governments to achieve a 15% reduction below 2005 levels by 2020, which aligns with the State's goal of not exceeding 1990 emissions levels by 2020[4]. The State's long term target is to emit no more than 20% of 1990 levels by 2050 (or, a reduction of 80% below 1990 levels by 2050). The State has not provided an interim target, nor has it provided guidance to local governments beyond the 2020 emissions target recommendations. It is however clear that the issue of climate change will not end in 2020 and continued reductions should be achieved to keep the State on a path toward the 2050 goal. A straight-line projection from the 2020 to 2050 goals would result in a reduction goal of 49% below 2005 levels by 2035 midpoint.

Ultimately, the City will determine the level of reductions that it can and should achieve. The recommended targets provided below are guidance based on consistency with the State's goals.

Recommended Community Targets

In 2020, the City will meet the reduction target through existing efforts. In 2035, the City would need to reduce 24,210 MT CO_2e emissions below the Adjusted BAU scenario to meet the State-aligned target (Table 17 and Figure 7).

Table 17. State-Aligned GHG Reduction Targets

Sector	2005	2012	2020	2035
BAU Emissions (MT CO_2e)	137,160	126,611	125,982	129,157
Adjusted BAU Emissions (MT CO_2e)	137,160	126,611	111,690	94,162
State-Aligned Target(% change from 2005)			-15%	-49%
State-Aligned Target (% change from 2012)			-8%	-45%
State-Aligned Emissions Goal (MT CO_2e)			116,586	69,952
Reductions from Adjusted BAU needed to meet the Target (MT CO_2e)			Target Met	24,210

4 In an analysis, the State concluded that a 15% reduction in emissions from 2005 levels by 2020 would be equivalent to achieving 1990 emissions levels.

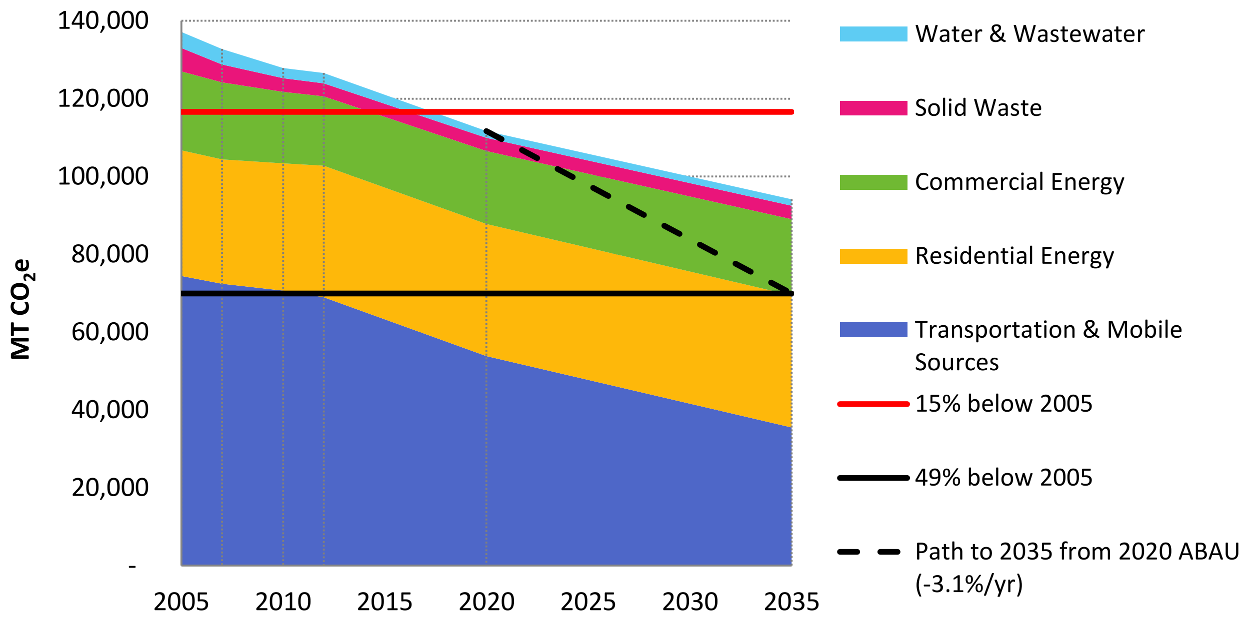


Figure 7. Community Emissions Inventories, Projections, and Targets

Municipal Targets

In 2010, the Hermosa Beach City Council declared its goal to become carbon neutral. The City is hoping to achieve this goal by 2020. Without this goal, the City's emissions are anticipated to be 1,751 MT CO_2e in 2020 and 1,872 MT CO_2e in 2035. Therefore, the City must reduce emissions by 1,751 from the Adjusted BAU forecast to meet the 2020 goal and maintain this level in the future (Table 18 and Figure 8).

Table 18. State-Aligned Municipal GHG Reduction Targets

	2005	2012	2020	2035
BAU Emissions (MT CO_2e)	1,501	1,372	1,801	1,926
Adjusted BAU Emissions (MT CO_2e)	1,501	1,372	1,751	1,872
Carbon Neutrality Target (% Reduction from 2005)			-100%	-100%
Carbon Neutrality Emissions (MT CO_2e)			0	0
Reductions from Adjusted BAU needed to meet the Target (MT CO_2e)			1,751	1,872

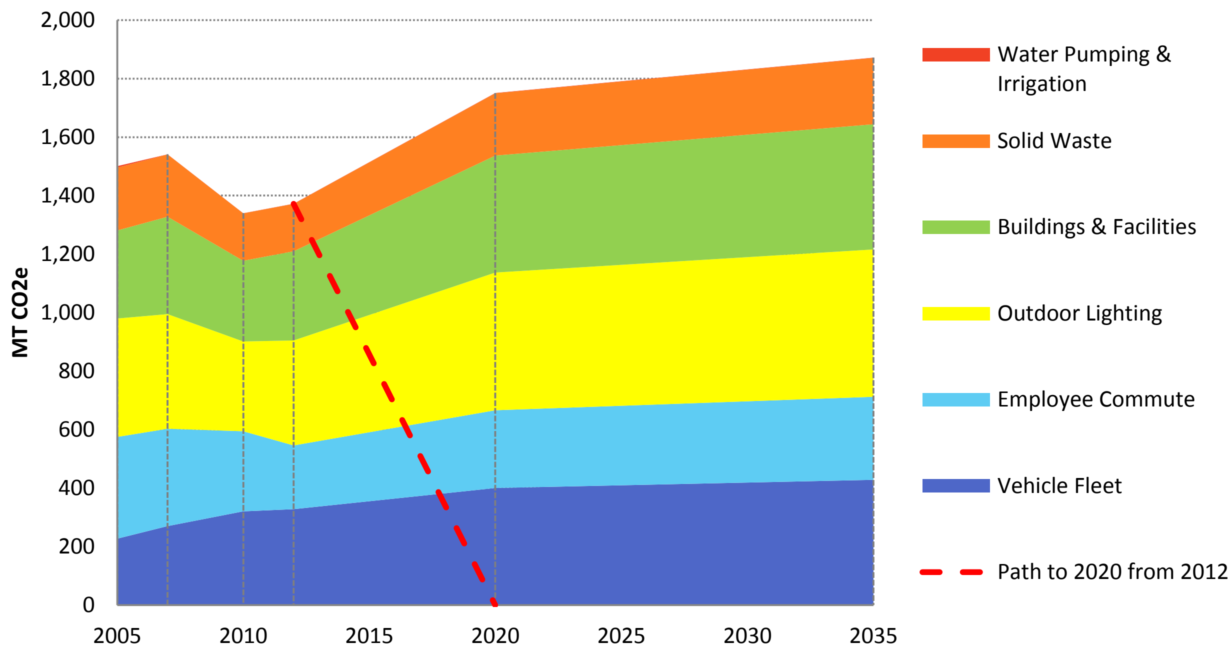


Figure 8. Municipal Emissions Inventories, Projections, and Targets

Conclusions and Next Steps

This Report presents the City's community and municipal inventories, forecasts, and recommended reduction targets. It is the foundation of the EECAP and provides the City a first look at what will be needed to meet emissions reductions that are aligned with the State and to mitigate the City's impacts on climate change. This Report also helps to guide the City in determining feasible energy efficiency reduction opportunities by detailing energy-related emissions, including electricity and natural gas from Residential and Non-residential sectors.

The next steps in the EECAP process are to review the information provided in this Report and to determine preliminary GHG reduction targets for the community and municipal operations. The South Bay Cities Council of Governments will also begin to work with the City to identify local and subregional energy efficiency measures that could be implemented to reach the City's emissions targets.

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Appendix A: Glossary of Terms

Adjusted Business-as-Usual: A GHG forecast scenario that accounts for known policies and regulations that will affect future emissions. Generally, these are state and federal initiatives that will reduce emissions from the business-as-usual scenario.

Baseline Year: The inventory year used for setting targets and comparing future inventories against.

Business-as-Usual (BAU): A GHG forecast scenario used for the estimation of greenhouse gas emissions at a future date based on current technologies and regulatory requirements and in the absence of other reduction strategies.

Carbon Dioxide Equivalent (CO_2e): This is a common unit for normalizing greenhouse gases with different levels of heat trapping potential. For carbon dioxide itself, emissions in tons of CO_2 and tons of CO_2e are the same, whereas one ton of nitrous oxide emissions equates to 298 tons of CO_2e and one ton of methane equates to 25 tons of CO_2e. The values are based on the gases' global warming potentials.

Community Inventory: GHG emissions that result from the activities by residents and businesses in the city. An inventory reports emissions that occur over a single calendar year.

Emissions Factor: A coefficient used to convert activity data into greenhouse gas emissions. The factor is a measure of the greenhouse gas intensity of an activity, such as the amount of CO_2 in one kilowatt-hour of electricity.

Global Warming Potential (GWP): The relative effectiveness of a molecule of a greenhouse gas at trapping heat compared with one molecule of CO_2.

Metric Ton (MT): Common international measurement for the quantity of greenhouse gas emissions. A metric ton is equal to 2205 lbs. or 1.1 short tons.

Municipal Inventory: GHG emissions that result from the activities performed as part of the government operations in the city and are a subset of the community inventory. An inventory reports emissions that occur over a single calendar year.

Reduction targets: GHG emissions levels not to be exceeded by a specific date. Reduction targets are often informed by state recommendations and different targets may be established for different years.

Sector: A subset of the emissions inventory classified by a logical grouping such as economic or municipal-specific category.

Appendix B: Methodology

This appendix provides a detailed description of the data sources, emission factors, policies, and assumptions used to develop the greenhouse gas (GHG) emissions inventories, forecasts under a business-as-usual (BAU) scenario, forecasts under an Adjusted BAU scenario, and the recommended GHG reduction targets.

Protocols

The GHG inventories for 2005, 2007, 2010, and 2012 were calculated using tools and guidance documents developed or supported by government agencies. Calculation protocols have been developed to ensure consistency among community and municipal inventories. Specifically, the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (Community Protocol) (ICLEI 2012) and the California Supplement (AEP 2013) were used for the community inventories and the Local Government Operations Protocol (LGOP) was used for the municipal inventories (CARB 2010). These protocols often have multiple calculation methods for a single emission source depending on the data available. There are two broad approaches for calculating emissions: "bottom-up" and "top-down". A bottom-up approach relies on end-use data, such as the city-level electricity usage. A top-down approach relies on aggregated data that is allocated to the city based on population, employment, or other relevant indicator. Bottom-up calculations were performed whenever possible to provide the most detailed and likely accurate picture of emissions within a jurisdiction; however, when detailed data were not available, other appropriate methods were used and are described in this appendix. Data were also calculated and managed to best fit the GHG inventory and planning software tool used for this project, called ClearPath. ClearPath was developed by the Statewide Energy Efficiency Collaborative (SEEC) which is a partnership between several statewide agencies, utilities, and non-profits to assist cities and counties in climate mitigation planning. ClearPath is further described at californiaseec.org. In addition, a South Bay Cities Council of Governments (SBCCOG) User's Guide is being developed as part of this project to help cities and SBCCOG to maintain the data and provide for consistent reporting of emissions over time.

Global Warming Potential Factors

The inventories include the three GHGs most relevant to community and municipal emissions: CO_2, CH_4, and N_2O. Each GHG differs in its ability to absorb heat in the atmosphere based on their molecular properties and expected lifetime in the atmosphere, and it is useful to describe emissions in one unit of measurement. That unit of measurement is a CO_2-equivalent, or CO_2e and Global Warming Potential (GWP) factors are used to standardize emissions from various GHGs. GWP factors, developed by the Intergovernmental Panel on Climate Change (IPCC), represent the heat-trapping ability of each GHG relative to that of CO_2. For example, the GWP factor of CH_4 is 25 because one metric ton (MT) of CH_4 has 25 times the heat-trapping capacity as one MT CO_2 (over a 100-year period). IPCC periodically updates the GWP factors of GHGs based on new science and updated background mixing ratios of CO_2. CO_2 always has a GWP factor of 1 and the other GHGs are calculated relative to CO_2. The California Air Resources Board (CARB) recently updated their GWP factors to align with the IPCC's Fourth Assessment Report, as shown in Table B-1. GWP factors are unitless. Emissions in the inventories are reported in units of CO_2e.

Table B-1. Global Warming Potentials

	CO_2	CH_4	N_2O
GWP	1	25	298

Source: IPCC Fourth Assessment Report, 2007.

Activity Data

Activity data is the end-use consumption amount of a sector, such as kilowatt hours of electricity, therms of natural gas, and vehicle miles traveled for on-road transportation. In estimating the City's historic GHG emissions, activity data at the City level were obtained when possible (a "bottom-up" approach). When not available, other data sources were used, generally at the county level (a "top-down" approach). Municipal data for 2005 and 2007 were obtained from the City's previous inventory report. Other data were provided by the sources as identified Table B-12.

TableB-12. Activity Data Sources

Data	Data Source	Notes
Community Electricity	Southern California Edison	
Municipal Electricity	Southern California Edison	Maintained by SBCCOG
Community Natural Gas	Southern California Gas Company	
Municipal Natural Gas	Southern California Gas Company	
Community Water	California Water Service	
Vehicle Miles Traveled	Southern California Association of Governments (SCAG)	Origin-destination approach, described below
Demographic Data	SCAG	
Vehicle Fleet	City	
Employee Commute	City	
Off-Road Emissions	OFFROAD Model	County-level data
Waste	CalRecycle	

Origin-Destination VMT

For the community inventory, activity data (vehicle miles traveled) were based on an origin-destination approach used by the State in developing emissions target for metropolitan planning organizations under SB 375. This approach has also been the typical approach used in estimating emission within a city. This approach accounts for:

- Half of the emissions where one endpoint is in the City, for example either the origin or destination of the trip.
- All of the emissions where the trip begins and ends within the City.
- None of the emissions that are "pass-through"; that is, a trip passes through the City but does not begin or end within its boundary.

This approach is used to account for trips or portions of trips that the city may have some control over.

Community Activity Data

Community activity data are shown in Table B-13, except for off-road emissions, which are shown in Table B-14 for Los Angeles County.

Table B-13. Activity Data used in 2005, 2007, 2010, and 2012 Community Inventories

Sector	2005	2007	2010	2012	% Change 2005 to 2012
On-road Transportation					
Total Vehicle Miles Traveled	140,684,101	138,727,165	139,197,605	138,350,955	-1.7%
Residential Energy					
Electricity (kWh)	47,843,215	49,976,195	49,906,427	49,778,450	4.0%
Natural Gas (therms)	3,339,783	3,305,637	3,448,010	3,364,392	0.7%
Commercial Energy					
Electricity (kWh)	51,741,467	52,130,513	48,545,739	41,191,832	-20.4%
Natural Gas (therms)	857,687	900,024	827,116	875,986	2.1%
Solid Waste					
Landfilled (tons)	24,578	18,490	14,230	13,511	-45.0%
ADC (tons) [1]	246	180	50	48	-80.7%
Water and Wastewater					
Water (MG)	760.2	760.2	687.7	700.3	-7.9%
Recycled Water (MG)	30.9	30.9	26.4	27.7	-10.3%
Wastewater (City portion of countywide residents)	0.20%	0.20%	0.20%	0.20%	0.5%
Off-road sources[2] (% of LA County emissions attributed to the City)					
Lawn & Garden (% Households)	0.30%	0.29%	0.29%	0.29%	-1.7%
Construction (% Building permits)	0.32%	0.20%	0.13%	0.24%	-25.7%
Industrial (% Manufacturing jobs)	0.03%	0.03%	0.03%	0.03%	4.3%
Light Commercial (% Other jobs)	0.17%	0.17%	0.17%	0.18%	5.9%
Recreation (Population weighted by income)	0.36%	0.36%	0.35%	0.34%	-6.3%
Agriculture (% Ag. Jobs)	0.10%	0.11%	0.06%	0.08%	-17.6%

Table B-14. Emissions from Off-road Categories for Los Angeles County

Off-road Class	GHG Type	2005 (MT CO_2e /yr)	2007 (MT CO_2e /yr)	2010 (MT CO_2e /yr)	2012 (MT CO_2e /yr)
Agricultural Equipment	CO_2	921.79	910.27	893.24	882.09
	CH_4	0.19	0.17	0.14	0.12
	N_2O	0.01	0.01	0.01	0.01
Construction and Mining Equipment	CO_2	268,646.23	277,541.76	290,911.26	299,875.79
	CH_4	34.12	31.44	28.24	26.28
	N_2O	0.22	0.24	0.25	0.26
Industrial Equipment	CO_2	8,099.90	8,562.29	9,255.58	9,870.65
	CH_4	7.16	6.2	4.46	3.89
	N_2O	0.69	0.63	0.56	0.55
Lawn and Garden Equipment	CO_2	2,581.13	2,737.30	2,968.71	3,215.02
	CH_4	4.98	4.87	4.76	4.96
	N_2O	2.01	2.01	2.01	2.13
Light Commercial Equipment	CO_2	5,300.36	5,572.36	5,979.92	6,387.77
	CH_4	2.83	2.54	2.18	2.05
	N_2O	0.91	0.97	1.02	1.07
Recreational Equipment	CO_2	286.54	309.8	343.68	369.04
	CH_4	2.14	2.32	2.58	2.77
	N_2O	0.52	0.57	0.64	0.68

Municipal Activity Data

Municipal activity data are shown in Table B-15.

Employee Commute

Data for Employee Commute in ClearPath are entered as gasoline or diesel. Annual vehicle miles traveled is entered as is the percent of miles traveled by passenger cars, light trucks, and heavy trucks. The City conducted a ridership survey in 2013 through SurveyMonkey.com and presented the results in a 2014 report titled “The City of Hermosa Beach Employee Commute Survey: 2013 & Greenhouse Gas Emissions Reduction Strategies”. 108 employees completed the survey, representing 76% of employees. The results were summarized and extrapolated to the total number of City employees in 2010 and 2012. Employee commute vehicle miles traveled by fuel type for 2005 and 2007 were taken from the City’s previous GHG inventories. The number of employees for 2010 was assumed to be the same as in 2012.

Table B-15. Activity Data used in 2005, 2007, 2010, and 2012 Municipal Inventories

Sector	2005	2007	2010	2012	% Change 2005 to 2012
Buildings & Facilities					
Electricity (kWh)	895,746	932,207	883,858	915,327	2%
Natural Gas (therms)[1]	5,383	11,977	4,621	2,542	-53%
Outdoor Lights					
City-Owned Electricity (kWh)	868,589	895,841	643,360	664,636	-23%
SCE-Owned Electricity (kWh)	464,752	466,608	424,794	455,210	-2%
Fleet & Equipment					
City-Owned Fleet					
Gasoline (gallons)	12,665	17,406	20,481	20,341	61%
Diesel (gallons)	2,584	2,584	4,121	5,502	113%
LPG (gallons)	-	-	36	23	NA
CNG (standard cubic feet)	13,377	13,377	81,114	98,658	638%
Contracted[2]					
Gasoline (gallons)	3,640	3,640	3,640	3,640	0%
Diesel (gallons)	2,057	2,057	2,057	2,057	0%
LPG (gallons)	5,127	5,127	5,127	5,127	0%
Employee Commute					
Gasoline (gallons)	794,170	760,056	634,526	506,797	-36%
Diesel (gallons)	26,784	35,852	25,110	20,055	-25%
# Full Time Employee Equivalents	186	184	154	123	-34%
Solid Waste[2]					
Generated Waste (tons)	666	660	660	660	-1%
Water Pumping & Irrigation					
Electricity (kWh)	17,033	1,712	1,907	1,999	-88%

1 Contracted fuel use was not available for 2010 and 2012. Data from 2007 were used.
2 Solid Waste data for 2010 and 2012 assumed 2007 values.

Emission Factors

Emissions factors are used to convert activity data to GHG emissions. An emission factor is defined as the average emission rate of a given GHG for a given source, relative to units of activity. By definition, an emission factor is related to activity data. The emission factors used in the inventories are described by sector below.

Electricity

California utilities report the average CO_2 content per output of electricity on an intermittent basis. The CO_2-intensity of electricity varies by utility and year, due to changes in supply, renewable generation, and other factors. The community and municipal operations use electricity provided by SCE except for embedded energy in water, which travels throughout the state and therefore utilizes electricity from multiple utilities (and are shown under the Water Sector).

Southern California Edison

SCE reported CO_2 factors for 2005 and 2007 through the Climate Registry, and a CO_2e factor for 2012 in their 2012 Corporate Responsibility & Sustainability Report. When an emission factor is unknown for a certain year, it is standard to use the most recently-reported historic factor until (and if) there is an updated factor. There is no published SCE emission factor for 2010; therefore the factor for 2007 was used for SCE electricity-related emissions calculations in 2010 (Table B-2).

Table B-2. Southern California Edison Electricity Emission Factors

Year	CO_2	CH_4	N_2O	Proxy Year	Data Source
2005	665.72	0.03	0.011	NA	CO_2: Climate Registry. CH_4 and N_2O: U.S. Community Protocol
2007	630.89	0.029	0.010	NA	CO_2: Climate Registry. CH_4 and N_2O: U.S. Community Protocol
2010	630.89	0.029	0.010	2007	CO_2: Climate Registry. CH_4 and N_2O: U.S. Community Protocol
2012	705[1]	NA	NA	NA	2012 Corporate Responsibility & Sustainability Report

NA: Not Applicable.

1 The 2012 factor was reported as CO_2e; therefore, there are no CH_4 and N_2O factors.

Natural Gas Combustion

Emission factors for natural gas do not vary greatly over time or by supplier. Therefore, emission factors are U.S. averages as listed in the Community Protocol and are applied for all years (TableB-4).

Table B-4. Natural Gas Emission Factors

	CO_2	CH_4	N_2O	Data Source
kg /MMBtu	53.02	0.005	0.0001	U.S. Community Protocol

Transportation and Mobile Sources

EMFAC Model

CO_2 emission factors for transportation and mobile sources are calculated using the State-developed Emissions Factor (EMFAC) model, which can be downloaded at http://www.arb.ca.gov/emfac/. Emissions are available at the county level and emission factors were developed and applied to vehicle miles traveled specific to each inventory year. Data are aggregated as annual emissions for all vehicle model years and speeds, but separated by vehicle category. Vehicle categories include light-duty autos, light-duty trucks, medium-duty vehicles, heavy-duty trucks, and motorcycles.[1] These categorizations are used to develop an emissions factor for gasoline and diesel vehicles. Emission factors were developed using total CO_2 exhaust, which includes emissions from vehicles in motion, idling, and ignition. While emissions from idling and ignitions are not directly related to mileage, they were included so that reductions from measures that may decrease idling could be accounted for in future inventories.

On-Road Transportation

Emissions were converted to emission factors as grams of CO_2 per mile for gasoline and diesel vehicle using EMFAC and a 3-step process (for each inventory year):

1. Calculate the vehicle-class average fuel efficiency (miles/gallon) using EMFAC vehicle miles traveled and gallons of fuel consumed for Los Angeles County;
2. Calculate the vehicle-class average CO_2 emission factor using EMFAC CO_2 emissions[2] and gallons of fuel consumed for Los Angeles County;
3. Calculate the average grams CO_2/mile traveled factor weighted by vehicle class miles traveled for Los Angeles County.

EMFAC does not provide emissions for CH_4 and N_2O; therefore, factors from the Community Protocol were used (Table B-5).

Table B-5. Fleet-Average Emission Factors

	Gasoline On Road Average Factor (grams/mile)			Diesel On Road Average Factor (grams/mile)		
	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
2005	466.062	0.030	0.034	1329.797	0.001	0.001
2007	464.019	0.028	0.029	1331.634	0.001	0.001
2010	458.638	0.028	0.029	1280.045	0.001	0.001
2012	442.657	0.028	0.029	1302.653	0.001	0.001

Employee Commute

Emissions from employee commute in the municipal operations are calculated using annual vehicle miles traveled for gasoline and diesel. CO_2 emissions are estimated using a default emission factor of 8.78 and 10.21 kg/gallon for gasoline and diesel, respectively[3] and fuel economy, which is based on EMFAC outputs for each inventory year and vehicle class. Vehicle miles traveled are converted to CH_4

[1] Vehicle categories may use either EMFAC2007 or EMFAC2011 categorizations and result in the same data for the purposes of these inventories; EMFAC2007 categories were used here EMFAC2011 further disaggregates medium heavy-duty vehicles and heavy heavy-duty vehicles into 29 vehicle categories. This level of detail is not needed for these inventories. More information on vehicle categories is available at http://www.arb.ca.gov/msei/vehicle-categories.xlsx.

[2] For 2010 and 2012, the emissions accounting for the effects of existing policies (Pavley and Low Carbon Fuel Standard) were used. These standards did not exist in 2005 and 2007.

[3] Information from ClearPath developers e-mail dated June 19, 2014.

and N_2O emissions using emission factors from the Community Protocol. Table B-6 shows the miles per gallon and grams (CH_4 and N_2O) per mile used to estimate emissions from employee commute by vehicle class.

Vehicle Fleet

Vehicle fleet consists of City-owned and contracted vehicles used to perform City services. Vehicle Fleet requires input of gallons of fuel used by fuel type to estimate CO_2 emissions. Vehicle miles traveled are used to estimate CH_4 and N_2O. The factors used for the City are shown in Table B-6.

Table B-6. Employee Commute and Vehicle Fleet Emission Factors

		2005	2007	2010	2012
Gasoline					
Passenger Vehicle	MPG	21.700	21.875	22.027	22.064
	g CH_4/mi	0.030	0.028	0.028	0.028
	g N_2O/mi	0.034	0.029	0.029	0.029
Light Truck	MPG	16.575	16.666	16.795	16.823
	g CH_4/mi	0.035	0.031	0.031	0.031
	g N_2O/mi	0.049	0.043	0.043	0.043
Heavy Truck	MPG	12.754	12.806	12.854	12.856
	g CH_4/mi	0.033	0.033	0.033	0.033
	g N_2O/mi	0.013	0.013	0.013	0.013
Diesel					
Passenger Vehicle	MPG	27.558	27.662	29.006	29.889
	g CH_4/mi	0.001	0.001	0.001	0.001
	g N_2O/mi	0.001	0.001	0.001	0.001
Light Truck	MPG	27.032	27.251	27.705	28.498
	g CH_4/mi	0.001	0.001	0.001	0.001
	g N_2O/mi	0.001	0.001	0.001	0.001
Heavy Truck	MPG	17.343	17.588	18.797	18.858
	g CH_4/mi	0.005	0.005	0.005	0.005
	g N_2O/mi	0.005	0.005	0.005	0.005

Note: MPG is miles per gallon and is derived from EMFAC at the county level. CH_4 and N_2O emission factors are from the Community Protocol; Passenger Vehicle and Light Truck emission factors have data for 2005 and later; Heavy Truck only have 2010 data.

Off-Road

Off-road emissions include emissions from agriculture, construction, industrial, lawn and garden, light commercial, and recreational equipment. Annual emissions of CO_2, CH_4, and N_2O are available at the county level from the State's OFFROAD model. To estimate values for each city, relevant indicator data are used to estimate the proportion of county-level emissions attributable to the city. Table B-7 lists the indicator used to estimate the City's portion of emissions for each category and Table B-8 shows City-specific data. City- and county-level indicator data were obtained from SCAG.

Table B-7. Off-road Emissions Indicators

Category	Indicator
Agriculture Equipment	Agriculture Jobs
Construction Equipment	Building Permits Issued
Industrial Equipment	Manufacturing Jobs
Lawn and Garden Equipment	Households
Light Commercial Equipment	Non- Manufacturing or Agriculture Jobs
Recreational Equipment	Population, Weighted by Median Income

Table B-8. Off-road Emissions Indicator Data

		Ag. Jobs	Building Permits	Mfg. Jobs	Households	Other Jobs[1]	Population	Income ($)
2005	City	3.786	1	136	2,884	3,646	8,058	123,702
	County	13,562	25,623	461,099	3,178,736	4,045,922	9,816,200	48,606
	%	0.03%	0.00%	0.03%	0.09%	0.09%		0.21%
2007	City	4.002	59	144	2,902	3,854	7,939	130,825
	County	13,562	20,303	461,099	3,224,053	4,045,922	9,780,800	51,439
	%	0.03%	0.29%	0.03%	0.09%	0.10%		0.21%
2010	City	3.69	2	114	3,100	3,572	8,064	142,286
	County	10,598	7,466	362,157	3,454,093	3,758,244	9,818,605	56,000
	%	0.03%	0.03%	0.03%	0.09%	0.10%		0.21%
2012	City	3	3	116	3,100	3,660	8,097	117,305
	County	10,798	18,926	369,005	3,454,093	3,829,313	9,889,632	53,880
	%	0.03%	0.02%	0.03%	0.09%	0.10%		0.18%

Note: Some percentages may appear off due to rounding. Ag. = Agriculture. Mfg. = Manufacturing.
1 Other indicates non-manufacturing and non-agricultural.

Water

Emissions from water are indirect. Water requires energy to move from its source to final treatment and the energy for most of these processes is not captured in local utility data (i.e., the portion that is used in a home or business and therefore contained in the owner's utility bill). This portion is termed the "embedded energy" in water and particularly for southern California, the energy embedded in water is high and should be accounted for in a community inventory. The California Energy Commission (CEC) developed a report, titled Refining Estimates for Water-Related Energy Use in California, which estimates the energy required to supply, convey, distribute, and treat water in northern and southern California. Recycled water is less energy-intensive because it does not require the supply and conveyance energy. Outdoor water infiltrates into the ground and therefore does not have the wastewater energy treatment component. Therefore, the emission factors are adjusted to account for the proportion of recycled and outdoor water. The amount of water used for indoor or outdoor use was not available at the City level; however, the 2010 Los Angeles Department of Water & Power, Urban Water Management Plan states that 61% of water is for indoor use for the City of Los Angeles. The water usage is assumed to be similar for the South Bay sub-region. Therefore, the embedded energy in a million gallon (MG) of water in the City is estimated in Table B-9 using the CEC report and estimated indoor vs. outdoor water usage in the region.

Table B-9. Energy Embedded in Water

	Conventional[1] (kWh/MG)	Recycled (kWh/MG)
Supply and Convey	9,727	--
Treatment	111	111
Distribution	1,272	1,272
Wastewater Treatment	1,911	1,911
Total	13,022	3,294
South Bay Factor	12,275.71	2,548.71

1 From CEC's 2006 Refining Estimates for Water-Related Energy Use in California, for Indoor water use in southern California.

Statewide Average Electricity

For energy embedded in water, a statewide average emission factor is applied because water in the South Bay sub-region is supplied from various regions in the State (Table B-3). Similar to SCE data, statewide emission factors are not available for each inventory year. For 2010 and 2012, the 2009 statewide emission factors were used as the proxy year.

Table B-3. California Statewide Electricity Emission Factors

Year	CO_2	CH_4	N_2O	Proxy Year	Data Source
2005	948.28	0.03	0.011	NA	U.S. Community Protocol
2007	919.64	0.029	0.010	NA	U.S. Community Protocol
2010	658.68	0.029	0.006	2009	U.S. Community Protocol
2012	658.68	0.029	0.006	2009	U.S. Community Protocol

NA: Not Applicable.

Wastewater

The emissions for wastewater include the CH_4 and N_2O emissions from processing which consist of three sources: **stationary**, **process**, and **fugitive** emissions.

Stationary emissions are derived from combustion of digester gas at a centralized treatment facility. The City is served by the Los Angeles County Sanitation District's Joint Water Pollution Control Plant (JWPCP). JWPCP is a centralized treatment facility that uses an anaerobic digester process and does not employ a formal nitrification/denitrification (N/DN) system. Detailed information regarding the amount of digester gas produces was not available, so an alternative method using City population information was used. Default factors from the Community Protocol were applied to estimate CH_4 and N_2O emissions for stationary emissions. Although CO_2 emissions are also produced, the fuel source is considered a biofuel, and the resulting CO_2 emissions are considered "biogenic" and are not reported[4].

Process emissions include N_2O emissions as a result of N/DN processes at the treatment facility. All wastewater facilities have emissions from N/DN—some facilities have a formal N/DN process, which would result in greater N/DN emissions, but for the JWPCP, N/DN emissions are solely a result of natural processes. The recommended approach to estimating these emissions is through the population served and default factors listed in the Community Protocol. In an advanced, centralized treatment facility, stationary and process emissions are relatively small compared to fugitive emissions. The Community Protocol, and likewise ClearPath, recommends multiplying the population-derived emissions by 1.25 to account for commercial and industrial discharges to the system. Regions without any commercial and industrial sources should use a factor of 1.0. Because the City is largely residential, a factor of 1.0 was applied to these emissions.

Fugitive emissions occur from inflow (septic systems) and effluent discharge. JWPCP reports facility-wide effluent, and effluent nitrogen content, which are factors used in estimating fugitive emissions (Table B-10). The City's portion was determined by estimating the proportion of the population served by JWPCP. The ClearPath tool requires the daily N load in kg N per day. This is calculated using the factors listed in Table B-9 and the Community Protocol Equation WW.12:

Daily N Load for the City (kg N/day) = Effluent X Effluent Nitrogen Content X gallons/liter
X City Population/Service Population,

Where Effluent is the facility-wide discharge in millions of gallons per day (MGD), Effluent Nitrogen Content is the average nitrogen content per volume (mg/L), and gallons/liter is a conversion factor (3.79). The Daily N Load entered into ClearPath was adjusted by a factor of 0.5 to account for the difference in emission factors for direct ocean discharge and stream/river discharge. In ClearPath, ocean discharge is not an option; however, the emissions are estimated to be ½ of those from discharge to a stream or river (see Community Protocol Appendix F). Therefore, the Daily N Load was adjusted by 0.5 to account for this difference.

Table B-10. Los Angeles County Joint Water Pollution Control Plant Data Used in Wastewater Fugitive Emissions

	2005	2007	2010	2012
Effluent (MGD)	403[a]	296[b]	237[c]	264[d]
Effluent Nitrogen content (mg/L)	40[a]	36.7[b]	39.7[e]	41.1[d]

a Default assumption based on influent.
b 2008 annual report data.
c 2011 annual report data.
d 2013 annual report data.
e Based on communication with Los Angeles County Sanitation District for 2009.

[4] Emissions from digester gas combustion are automatically calculated in ClearPath when population is entered.

Solid Waste

Emissions from solid waste are primarily in the form of fugitive emissions of methane from decomposition. Emission factors are derived from the Community Protocol, based on the type of waste disposed. The State conducts a Waste Characterization Study (Study) every 4 to 6 years to determine the amount of waste attributable to each waste type. The Study is conducted at the State level by economic sector; therefore, community-level characterizations are not available. For the community inventory, the overall composition of California's disposed waste stream was used to convert total tons into waste types (Table B-11). For the municipal inventory, the characterization for public administration was used (Table B-11). In addition to community-generated waste, some diverted green waste is used as landfill cover rather than importing landfill cover from other regions. This green waste is known as alternative daily cover (ADC) and is reported by CalRecycle for each community. The ADC characterization was determined through communication with the developers of ClearPath and does not vary by year or community. The emission factor to determine methane generation varies if the landfill operates a methane flare or generates electricity from methane capture. The Community Protocol recommends using an average factor of 75% recovery from landfill gas, although some landfills with have much higher gas recovery systems, and other landfills do not have any. Carbon dioxide generated by decomposition of waste in landfills is not considered anthropogenic because it would be produced through the natural decomposition process regardless of its disposition in the landfill. Nitrous oxide is not a by-product of decomposition and therefore no fugitive emissions of nitrous oxide are anticipated from this source. The waste characterizations and emission factors used to estimate emissions from solid waste are provided in Table B-11. The "Category in in the 2004 and 2008 Studies" detail which Study categories make up the ClearPath Category.

Table B-11. Waste Characterization and Emission Factors for Solid Waste

ClearPath Category	Category in 2004 and 2008 Studies	Alternative Daily Cover[1]	2004 Study[2]	2008 Study[3]	Public Administration	Emission Factor[1]
Newspaper	Newspaper	0%	2.2%	1.3%	5.5%	0.043
Office Paper	White/Colored Ledger Paper + Other Office Paper + Other Miscellaneous Paper	0%	5.4%	4.9%	13%	0.203
Cardboard	Uncoated Corrugated Cardboard + Paper Bags	0%	6.7%	5.2%	5.1%	0.120
Magazine/ Third Class Mail	Magazines and Catalogs + Remainder/ Composite Paper	0%	6.5%	5.9%	15.4%	0.049
Food Scraps	Food	0%	14.6%	15.5%	9.8%	0.078
Grass	Leaves and Grass	30%	2.1%	1.9%	8.05%	0.038
Leaves	Leaves and Grass	40%	2.1%	1.9%	8.05%	0.013
Lumber	Branches and Stumps + Prunings and Trimmings	0%	9.6%	14.5%	0.1%	0.062
Branches	Lumber	30%	2.6%	3.3%	5%	0.062

1 Breakdown from ClearPath Developers via e-mail dated June 19, 2014. Used for all inventory years.

2 2004 Waste Characterization Study for California, Overall Waste Stream. Used for 2005 inventory. Does not total 100% as not all waste is organic.

3 2008 Waste Characterization Study for California, Overall Waste Stream Used for 2007, 2010, 2012 inventories. Does not total 100% as not all waste is organic.

Forecasts

The forecasts are an estimate of what emissions in the City may be in 2020 and 2035. The forecasts were developed using standard methodologies under two scenarios: Business-as-Usual (BAU) and Adjusted BAU.

Business-as-Usual Forecasts

The BAU scenario uses current (2012) consumption patterns and predicted growth in the City in the absence of state and federal legislation that would reduce future emissions. The growth assumptions are those estimated by SCAG in their 2012 Regional Transportation Plan and are applied to emissions sectors based on their relevance. For example, future Residential Energy emissions were developed using current energy use per household (from the 2012 inventory) and the anticipated number of households in the future. Table B-16 shows the growth factors used to project emissions in the City.

Adjusted Business-as-Usual Forecasts

The Adjusted BAU scenario also uses growth estimates for the City, also accounts for legislation that will reduce emissions in the future, regardless of City actions. Table B-17 summarizes the legislation that will reduce the City's emissions in the future and which sectors the legislation applies to.

TableB-16. Emissions Sectors and Demographic Growth Indicators

Sector	Demographic Indicator
Residential Energy	Households
Commercial/ Industrial Energy	Jobs
Solid Waste, Water, Wastewater, Aviation, Off-Road Sources	Service Population (Population + Jobs)
Transportation	Vehicle Miles Traveled, modeled by SCAG
Municipal Jobs	Municipal Emissions[1]

SCAG: Southern California Association of Governments

1 The number of jobs in the City is used as an indicator for all municipal operation emissions except Aviation, which is forecast consistent with the community forecast (by change in service population).

Table B-17. Legislation Applied to Adjusted BAU Forecasts

Legislation	Description	Emissions Sector Affected
Low Carbon Fuel Standard	Reduce carbon intensity of transportation fuels 10% by 2020.	On-road Transportation, Employee Commute, Vehicle Fleet
AB 1493 and Advanced Clean Cars	Implement GHG standards for passenger vehicles, implement zero-emission vehicle program, support clean fuels outlet regulation.	On-road Transportation
California Building Code Title 24	Improved energy efficiency standards for new residential and non-residential construction.	Residential Energy, Non-residential Energy
Renewable Portfolio Standard[1]	Provide 33% of electricity from renewable sources by 2020.	Water
Senate Bill X7-7	Reduce urban per capita water consumption 20% by 2020.	Water

1 Potential GHG reductions from this legislation were not applied to the electricity in SCE's service territory due to the uncertainty in SCE's generation sources after the closure of the San Onofre Nuclear Generating Station.

Low Carbon Fuel Standard, AB 1493, and Advanced Clean Cars

Changes in on-road emissions in Los Angeles County were modeled using EMFAC, which models both the emissions with and without Low Carbon Fuel Standard and Pavley I. Additional modeling was conducted to estimate the change in emissions due to Advanced Clean Cars. The rate of reductions from on-road transportation measures through 2020 was assumed to be 0.0344% per year for gasoline and 0.0106% per year for diesel. After 2020, the rate of reductions was assumed to be 0.03452% per year for gasoline and 0.0251% per year for diesel.

California Building Code Title 24

Title 24 updates will raise the minimum energy efficiency standards for new buildings, thereby decreasing the expected energy consumption of future development in the City. Under the adjusted BAU scenario, it was assumed that the 2013 Title 24 standards that went into effect in 2014 will make new residential and non-residential buildings more efficient than they would be under the 2008 Title 24 standards for new residential buildings. The energy savings were estimated using analyses developed by the California Energy Commission and the applied to the expected new development in the City to 2020 and 2035. The rate of reductions was applied to the City's 2012 energy use (kWh or therms) per household (for Residential energy) or per job (for Commercial energy). Savings were applied to new development anticipated in the City. Detailed energy savings assumptions are below.

Residential

Residential electricity is estimated to be 32.6% lower under the new standards.[5] This percentage savings is relative to heating, cooling, lighting and water heating only and do not include other appliances, outdoor lighting that is not attached to buildings, plug loads, or other energy uses. Electricity consumption due to heating, cooling, lighting, and water heating accounts for 34% of total household electricity use.[6] Therefore, the percentage of total residential electricity that will be reduced as a result of the 2013 Title 24 standards is 11.1%.

Residential natural gas savings were estimated 5.8% lower under the new standards. Again, this percentage savings pertains only to the energy sources affected by Title 24 Standards. Natural gas consumption due to space and water heating accounts for 86% of total household natural gas use.[7] Therefore, the percentage of total residential natural gas that will be reduced as a result of the 2013 Title 24 standards is 5.0%.

Commercial

Commercial Electricity savings were estimated to be 21.8% lower under the new standards. Title 24-related measures would impact 77.2% of total electricity use in commercial buildings[8]; therefore, 16.8% reduction in electricity consumption may be expected in new commercial development.

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[5] CEC Impact Analysis, California's 2013 Building Energy Efficiency Standards, July 2013. CEC-400-2013-008.
[6] CEC 2009 California Residential Appliance Saturation Appliance Study, October 2010. CEC-200-2010-004.
[7] CEC 2009 California Residential Appliance Saturation Appliance Study, October 2010. CEC-200-2010-004.
[8] CEC 2006. California Commercial End-Use Survey. March 2006. CEC-400-2006-005.

Natural gas savings were estimated to be 16.8% under the new standards compared to the previous standards. Heating and cooling account for 69.7% of natural gas consumption in commercial facilities; therefore, 11.7% reduction in natural gas consumption may be expected from 2013 Title 24 standards applied to new commercial development.

Renewable Portfolio Standard

The Renewable Portfolio Standard will be fully implemented in 2020. The level of implementation varies by utility; however, ICLEI estimates that the average statewide level of implementation is 5% per year, compounded annually. As noted in the Report, this reduction is only taken for electricity used in the transport and treatment of water, which moves throughout the State. The reduction is not taken for electricity wholly within SCE's territory.

Senate Bill X7-7

SB X7-7 will be implemented by individual water districts. For the City's water provider, California Water Service Company, the level of implementation was estimated using an annualized reduction rate from the Company's baseline water consumption rate (141 gallons per capita per day, GPCD) to the target water consumption rate (126 GPCD).

Target Setting

The state-aligned targets are provided to assist the City in determining appropriate emission reduction goals. Recommended targets are based on existing California climate change legislation and State guidance relevant to establishing a GHG reduction target. While State goals are based on a 1990 baseline year, the City's baseline year is 2005. Therefore, the reduction targets are expressed as a percent reduction below 2005 levels. Targets are recommended for 2020 to align with AB 32 and 2035, which is a midpoint between the 2020 goal and the State's long-term 2050 goal. Planning beyond 2035 is considered speculative, as legislation and technology may change significantly before 2050. While it is important for continued reductions well beyond 2035, no local targets are recommended at this time.

Table B-18 provides a summary of the State's goals and the State's guidance to local governments regarding GHG reduction targets. This guidance applies to and communitywide emissions reductions efforts. The City has adopted a carbon neutrality goal for municipal operations by 2020.

Table B-18. Summary of State Reduction Targets and Guidance on Local Government Targets Aligned with State Targets

	2020	Interim Year Between 2020-2050	2050
State Targets (AB 32 and EO S-3-05)	1990 levels	NA	80% below 1990 levels
State Guidance on Local Government Targets (AB 32) Scoping Plan Recommended Target and Attorney General's Office Guidance	15% below 2005-2008 levels	Demonstrate a trajectory toward statewide 2050 levels (e.g., 49% below 2005 levels by 2035)	NA

Table B-19 demonstrates how the local targets are aligned with State targets.

Table B-19. Comparison of 1990 Baseline Targets vs. 2005 Baseline Targets

Target Year	Percent below 1990 Emission Levels	Percent below 2005 Emission Levels
2020	0.0%	15.0%
2021	2.7%	17.3%
2022	5.3%	19.5%
2023	8.0%	21.8%
2024	10.7%	24.1%
2025	13.3%	26.3%
2026	16.0%	28.6%
2027	18.7%	30.9%
2028	21.3%	33.1%
2029	24.0%	35.4%
2030	26.7%	37.7%
2031	29.3%	39.9%
2032	32.0%	42.2%
2033	34.7%	44.5%
2034	37.3%	46.7%
2035	40.0%	49.0%

E-3: HERMOSA BEACH CARBON PLANNING TOOL AND USER GUIDE

City of Hermosa Beach

COMMUNITY CARBON REDUCTION PLANNING TOOL USER'S GUIDE

Contents

Overview

Thanks for taking the time to plan for your community's future. The City of Hermosa Beach is taking steps to become a carbon-neutral organization by 2020, and is also committed to a low carbon future to reduce the city's impact on global climate change, improve resiliency, and to maximize economic opportunities.

We need your help in identifying the possible paths forward to achieve this vision of a low carbon future. This Carbon Reduction Planning Tool is educational decision-support tool for goal setting purposes. It walks you through the process of defining strategies that will reduce carbon emissions, estimating costs, savings, and implementation rates, and bundling them together into your carbon reduction plan.

The information from this tool will be used to support the General Plan update process through the evaluation of land use and transportation alternatives, helping to inform the selection of a preferred alternative while also helping to set community carbon goals, timelines and priorities

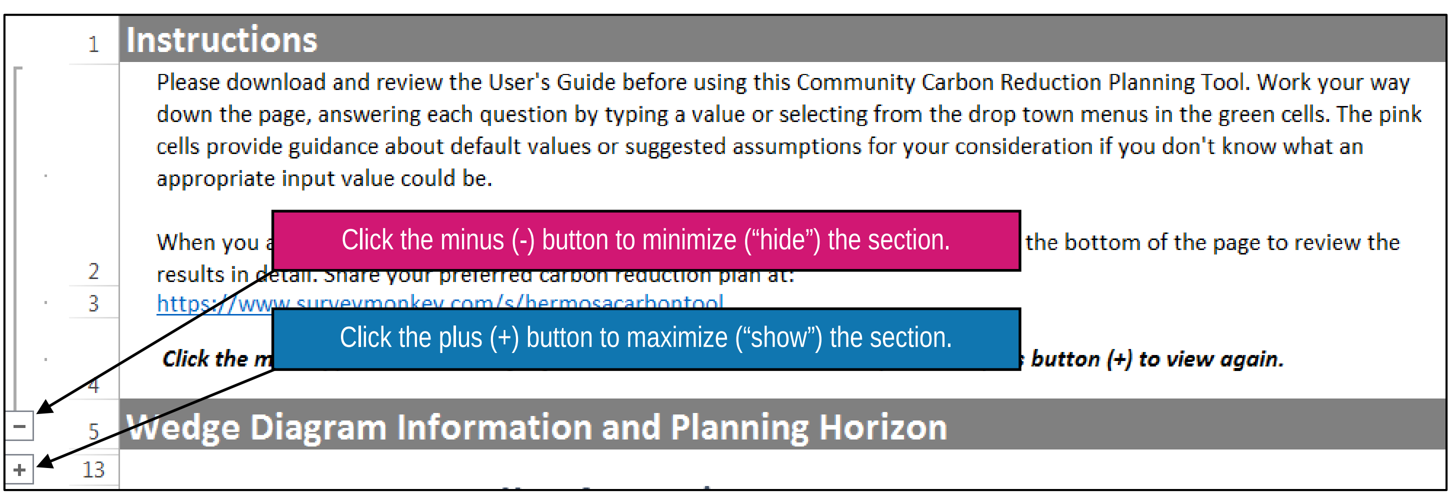
Using the Tool

This Carbon Reduction Planning Tool should be opened with Microsoft Excel® software. In addition to opening the tool file, it might be helpful to print out or have a digital copy of this User's Guide available for quick reference as you use the tool.

Navigation

When you open the Microsoft Excel file, you will see the Inputs Dashboard. This is where you will work through a series of prompts or questions to add your ideas and assumptions. The tool has a series of expandable sections (see illustration below). Once you work through the questions in each section, you might find it valuable to minimize the section for ease of viewing the next section.

Note that in order to see all of the information on the tool page, it may be helpful to adjust the view and the level of zooming using the slider bar at the bottom right corner of the Excel window.



Your Assumptions

Note that the green boxes ("cells") are where you should add your ideas either by typing in the box or selecting from a drop-down menu (when available). The pink boxes ("cells") provide guidance about default values or suggested assumptions for consideration if you don't know what an appropriate input value could be.

Your Assumption	*Default Value*
65%	*50%*

Your Carbon Reduction Plan

Near the top of the Inputs Dashboard page, you will see two charts ("wedge diagrams"). The chart on the left ("Your Carbon Reduction Plan") will update automatically as you make adjustments to the Inputs Dashboard. The chart on the right provides an illustration of the plan built using the default values. Note that the charts will remain near the top of the page as you scroll down through the various carbon reduction strategies for your easy reference to see the impacts of your responses on "Your Carbon Reduction Plan".

To read these charts, it is helpful to understand the parts:

- **Forecast:** This dark line represents the forecasted greenhouse gas emissions (GHG, or also commonly referred to as "carbon") from the scenario beginning to the end goal year. The forecast takes into account future growth of the community and associated emissions ("business as usual" conditions). It is also adjusted to account for future emissions reductions that will result from state and federal mandates, such as improved vehicle fuel efficiency ("adjusted business as usual" conditions).
- **Emissions Reduction Strategy Wedges:** The colored bands (or "wedges") on the chart represent different categories of potential emissions reduction strategies. The sizes of these colored wedges are proportionate to the level of emissions reductions that they will achieve. Together, these wedges illustrate how much impact on they will have on reducing total emissions below the forecast. The light yellow area represents remaining carbon emissions that are not reduced or offset through the strategies selected.

The long-term timeline on both charts is set to 2050 to encompass the full range of planning horizon options; however, the forecast and emissions reduction strategy wedges will extend only to your selected carbon reduction goal date.

Carbon Reduction Strategies

The tool will guide you through four major categories of potential emissions reductions strategies (note each section is color coded to match the strategy wedges on the charts):

1. Building Efficiency
2. Renewable Energy
3. Transportation and Land Use
4. Purchase of Offsets

Each category contains one or more specific strategy that would result in emissions reductions. Work your way through each question and category, providing an input response in each green cell. If you would like to see and/or adjust any of the assumptions used in the tool's calculations, click the plus button next to the row to expand the view. Note that these assumptions are also provided at the end of this Guide for your reference.

Note that **terms and phrases identified in bold** in the tool questions and prompts are defined in the attached glossary. Sources for and information about the assumptions and suggested default values are provided in the appendix.

1. Building Efficiency

The questions in this section focus on opportunities associated with improving the efficiency of existing buildings, as well as enhancing efficiency of new construction to reduce greenhouse gas emissions generated from building energy use. Note that both series of questions focus on homes, as well as commercial and industrial buildings.

Note that the combination of standard energy renovations and deep energy renovations cannot sum to more than 100 percent to avoid double counting of opportunities.

2. Renewable Energy

The questions in this section focus on four different ways to incorporate renewable energy to reduce greenhouse gas emission from traditional energy sources. The renewable energy options include the following: rooftop solar, community solar, and utility-based renewables either through the establishment of a Community Choice Aggregation (CCA) agreement or purchase of electricity through a Green Rate program.

Note that the combination of utility based renewables (CCA or Green Rate) cannot sum to more than 100 percent to avoid double counting of opportunities.

3. Transportation and Land Use

The questions in this section emphasize reductions in greenhouse gas emissions through reductions in vehicle miles traveled (VMT), and increased prevalence of electric vehicles (EVs) in the consumer marketplace. The first question aligns with the Land Use and Transportation Scenarios under consideration for the General Plan update. Descriptions for each scenario are described below.

Scenario Name	Description
Scenario A: Comply with State Laws	This scenario proposes changes to the land use and transportation program to ensure that those components are in compliance with State Law and provide Hermosa Beach with a legally adequate General Plan framework. The estimated VMT reduction for this scenario is 2 percent.
Scenario B: Clarify and Align with Existing Uses & Zoning Code	This scenario would make minor clarifications and changes to the land use program and transportation network to clarify and align the General Plan land uses with the zoning code and existing uses. The estimated VMT reduction for this scenario is 4 percent.
Scenario C: Enhance Key Areas	This scenario would make minor adjustments to key activity nodes in the residential neighborhoods and propose moderate changes to land use designations and the transportation network in non-residential districts and corridors to achieve the intended vision and objectives articulated by many of the City's other plans such as the Downtown Core Revitalization Strategy and PCH/Aviation Corridor Streetscape Master Plan. The estimated VMT reduction for this scenario is 15 percent.
Scenario D: Transform Key Areas	This scenario would make minor adjustments to key activity nodes in the residential neighborhoods and propose more drastic changes to land use designations and the transportation network in non-residential districts and corridors to achieve the intended vision and objectives articulated by many of the City's other plans such as the Downtown Core Revitalization Strategy and PCH/Aviation Corridor Streetscape Master Plan. The estimated VMT reduction for this scenario is 25 percent.

The second question also aligns with the General Plan and focuses on policies and programs to support VMT reductions, rather than physical land use or transportation changes or projects. These types of policies and programs might include things like employee parking cash-out programs, workplace parking pricing changes, or commute trip reduction programs. It is estimated that the overall maximum total impact of these types of policies and programs is a 15 percent additional reduction in VMT, above what you select for preferred land use and transportation scenario.

VMT Policy Levels	Description
None	Assumes no additional reduction in VMT.
Low	Assumes an additional 5 percent reduction in VMT due to General Plan policies.
Medium	Assumes an additional 10 percent reduction in VMT due to General Plan policies.
High	Assumes an additional 15 percent reduction in VMT due to General Plan policies.

The third group of questions focus on the purchase of electric vehicles and their power sources.

4. Purchase of Offsets

The last category focuses on the optional purchase of carbon offsets to support additional emissions reductions to achieve your carbon reduction goal. Note that input value is the percentage of the remaining carbon emissions that you wish reduce through purchase of credits, after you have optimized all of the other strategies. The purchase of offsets is not required, but may be necessary to help the community achieve aggressive carbon reduction goals, at least in the near-term. The tool includes the purchase of offsets in the end year of your planning horizon. In order to maintain that level of carbon reductions beyond the planning horizon, offsets would need to be purchased each year thereafter.

The overall portion of your Caron Reduction Plan that comes from the purchase of offsets is reported on the Results page. While it is expected that most Carbon Reduction Plans will likely include some purchases of offsets, it is important to watch for the break-even point to ensure that the total cost effectiveness of your plan remains below the cost of offsets. Furthermore, the credibility of your Carbon Reduction Plan depends on having an appropriate level of carbon offsets--generally no more than half of your carbon reductions should come from offsets, but lesser values will likely add credibility and authenticity to your plan.

Results

After you've complete each question, review the summary of your plan's potential carbon emission reductions on the wedge diagram at the top of the page. To see more extensive analysis and summary results, including estimated costs and savings from the Plan, click the "See Complete Results" button at the top of the page.

The results table provides cumulative estimates of results by strategy, category, and as a whole. See the following sections for more detailed explanation of the different result values. Use the "Go To Inputs Dashboard" to go back to the inputs dashboard to test other options and refine your ideal carbon reduction plan.

Understanding Costs, Savings and Cost Effectiveness

It is important to note that the City of Hermosa Beach cannot invest in and achieve a low carbon future alone. Instead, the costs and associated savings from community carbon-reducing strategies would require involvement from the City organization, as well as the community's residents, businesses, and private investors. For this reason, the tool reports cumulative costs and cumulative cost savings – values that represent the total investment and savings estimates across the community, not one responsible party. As such, it is possible that those who bear the costs of implementing various strategies are not the same as those who will realize the savings benefits. For example, the community may use a variety of federal, state, and community funds to pay for a transportation infrastructure project to reduce vehicle miles traveled (e.g., enhance bicycling facilities), but the people who would most directly benefit from the savings associated with those reduced vehicle miles traveled would be those who use a bicycle instead of a vehicle for transportation.

Cost effectiveness is a value that indicates net cumulative costs (or savings) result in achieving a reduction of one MTCO2e over the life of the plan. Negative values indicate a net cumulative cost saving to the community, whereas larger, positive values indicate more costly strategies. For perspective, the cost of carbon offsets is modeled at $15 per MTCO2e, so values below this range represent strategies that are more cost competitive than buying offsets.

Understanding Indirect Savings

In addition to direct savings from reduced energy and fuel expenses, other benefits resulting from community carbon reduction strategies would likely include cost savings from reduced health care expenses and the creation of jobs based on the carbon reduction strategies selected.

Investments to reduce carbon emissions from the transportation sector are most likely to benefit the health of Hermosa Beach residents. In particular, reductions in overall vehicle miles traveled by Hermosa Beach motorists will likely mean shifts to other, more active modes of transportation, such as walking, bicycling, or even walking to a transit stop. Based on the vehicle miles traveled reduction values selected, the tool provides an estimated total health care costs savings each year.

The tool provides an estimated number of jobs created (in "job-years," or one full time equivalent position for one year) based on calculations that build on estimated investments into energy efficiency improvements and renewable energy installation within the City of Hermosa Beach. It does not include the potential jobs created from reductions in transportation or waste-related emissions because of the wide variations in potential strategies to achieve those necessary reductions.

These indirect savings are provided to expand the discussion about the potential upsides of carbon reduction strategies. One additional potential upside is the economic activity spurred by residents having more disposable income for local spending as a result of reduced utility bills. Calculating this 'multiplier effect' requires economic modeling outside the current scope of the tool, but is something to consider in interpreting the cost-benefits of carbon-reducing strategies.

Understanding the Community Perspective

For illustrative purposes, the cost and savings values are reported on a per-household basis. These values are calculated by simply dividing the total community costs and community savings by the number of households. This does not mean that all of these costs and savings are borne by households.

Sharing Your Plan

Use the tool as a way to inform and discuss carbon planning with your family, friends, and colleagues. Their ideas and experience may be useful in helping you refine your own ideal carbon reduction plan.

Once you have refined your inputs to achieve your ideal carbon reduction plan, please take a few minutes to document and share your analysis inputs and experiences with the General Plan update team by sending your completed copy of the tool with your contact information and any comments to generalplan@hermosabch.org.

Glossary of Terms

Adjusted Business as Usual Forecast: A modeling scenario that assumes a continuation of existing practices adjusted for the effects of existing legislation that mandates future reductions in emissions.

Benefit: The positive effects of an action; these can be measured in terms of financial benefits in dollars or through other types of benefits such as health benefits, social benefits, or environmental benefits.

Beyond Code Construction: Standards for construction voluntarily adopted by a jurisdiction that exceed the requirements of current building codes.

Business as Usual Forecast: A modeling scenario that assumes a continuation of existing practices.

Carbon Reduction: Limiting the emissions of carbon pollution to decrease the total amount of carbon released into the atmosphere.

Community Choice Aggregation (CCA, Utility Based Renewables): state policy that enables local governments to aggregate electricity demand within their jurisdictions in order to purchase renewables while maintaining the existing electricity provider for transmission and distribution services.

Community Solar Photovoltaic (Solar Garden): A solar electric energy ownership model whereby a single large installation is built and ownership shares are sold to community members which can then (typically) be applied as a cost reduction of their utility bill.

Cost: The amount spent to achieve or obtain something, typically measured in dollars.

Cost Effectiveness: The degree to which a cost returns positive benefits; the more cost effective a measure is, the more results (benefits) are created per dollar spent. This value is calculated as total costs minus total cost savings, divided by the total carbon reduction. Negative values indicate a net cumulative cost saving to the community for each MTCO2e reduced, whereas larger, positive values indicate more costly strategies.

Cost Savings: Financial benefits in dollars that would otherwise be spent.

Deep Energy Renovation: Altering an existing building or buildings with a focus on not only short-term payback measures but measures that may require more investment and have payback periods that can be substantially longer in order to effect levels of energy reductions that are "deeper" and enable them to use very limited amounts of energy to operate.

Electric Vehicles (EVs): Vehicles that do not have combustion engines and are designed to be powered entirely by charging batteries with electricity.

Green Rate: An elective rate choice from select California electric utilities that allows customers to purchase 100% renewable power.

Greenhouse Gas (GHG) Emissions: Emissions produced primarily by burning fossil fuels that increase global warming activity; while several gases are known to have this effect they are typically expressed in terms of equivalent units to carbon dioxide, or CO2e.

Offsets: A financial vehicle that allows the buyer to claim credit for reducing greenhouse gas emissions, typically by funding carbon reduction measures such as wind turbine construction or rainforest reforestation.

Rooftop Solar Photovoltaic: A model of solar electric energy capture that relies on solar photovoltaic panels being installed directly on properly oriented rooftops.

Standard Energy Renovation: Altering and existing building or buildings with a focus on short term payback energy measures such as increasing insulation, air sealing, and replacing inefficient equipment.

Vehicle Miles Traveled (VMT): The standard measure used to calculate transportation impacts; measures the amount of miles a vehicle travels to get from an origin to a destination (e.g. home to work).

Sources and Assumptions

	Default Value	*Sources or Justification*
Planning Horizon		
What year would you like to begin the carbon planning analysis?	*2015*	Assuming implementation begins as early as this year.
When would you like to reach your carbon reduction goal?	*25 years – 2040*	Assuming implementation will occur generally on the same timeline as the General Plan.
Building Efficiency		
Existing Homes		
What percent could undergo a *deep energy renovation*?	*20%*	Per the US Census American Community Survey data, approximately 20% of the City's housing stock was built before 1950 (before modern building and energy codes) and would therefore be likely candidates for deep energy renovations. Based on a 25 year horizon and 10,600 total housing units, this would equate to approximately 85 houses per year.
What percent of homes' annual energy use would be reduced?	*43%*	A study by the Berkeley Lab was used to validate the assumed energy reduction of deep-energy retrofits.
What is the cost (per square foot) of deep energy renovations?	*$14.00/sq.ft.*	We assume a $30,000 implementation cost, based on a Berkeley Lab study, focused on retrofits to a median sized single family home.
What percent could undergo a *standard energy renovation*?	*30%*	Per the US Census American Community Survey data, approximately 30% of the City's housing stock was built between 1950 and 1970 and would therefore be likely candidates for standard energy renovations. Based on a 25 year horizon and 10,600 total housing units, this would equate to approximately 130 houses per year.
What percent of the homes' annual energy use would be reduced?	*15%*	A study by the Berkeley Lab was used for this assumption based on savings from weatherization and utility sponsored utility programs.
What is the cost (per square foot) of standard energy renovations for homes?	*$0.60/sq.ft.*	This cost assumes that residents would invest in energy renovations with a simple payback of 5-10 yrs.
New Homes		
What percent could be constructed ***beyond existing code***?	*50%*	This assumes that half of all new residential construction would be built to standards above the current building code requirements.
What percent of the homes' annual energy use would be reduced?	*50%*	LEED Platinum certified homes can see a potential energy reduction of 50-60% over a typical home's energy use based on USGBC.
What is the incremental cost (per square foot) of green building for residential new construction?	*$3.60/sq.ft.*	Based on the same article from the USGBC it is expected that green building practices will increase the upfront construction costs ($150/sq.ft.) by 2.4%.

Existing Commercial and Industrial Buildings		
What percent of buildings could undergo a **deep energy renovation?**	*20%*	This assumption is up to the discretion of the user. The 2012 American Community Survey estimates 264 business establishments in the city. Based on a 25 year horizon, this would equate to approximately 2 business establishments per year.
What percent of the buildings' annual energy use would be reduced?	*50%*	The source below gives examples of commercial buildings which were able to reduce energy use by 46-80% through deep energy retrofits. *A Handbook on Low-Energy Buildings and District-Energy Systems,* Harvey, L.D. Danny
What is the cost (per square foot) of deep energy renovations for commercial and industrial buildings?	*$17.00/sq.ft.*	The examples above yielded estimated simple payback of 10 – 15 years. This was used to inform the estimated cost per square foot on deep energy reductions. *A Handbook on Low-Energy Buildings and District-Energy Systems,* Harvey, L.D. Danny
What percent of buildings could undergo a ***standard energy renovation***?	*30%*	This assumption is up to the discretion of the user. The 2012 American Community Survey estimates 264 business establishments in the city. Based on a 25 year horizon, this would equate to approximately 3 business establishments per year.
What percent of the buildings' annual energy use would be reduced?	*16%*	The commercial and industrial building projects from the Berkeley Lab study revealed over 10,000 energy-related problems, resulting in 16% median whole-building energy savings.
What is the cost (per square foot) of standard energy renovations for commercial and industrial buildings?	*$3.50/sq.ft.*	This cost assumes that commercial owners or tenants would invest in energy retrofits with a payback of 5-10 years.
New Commercial and Industrial Buildings		
What percent of buildings could be constructed ***beyond existing code***?	*50%*	This assumes that half of all new commercial and industrial construction would be built to standards above the current building code requirements.
What percent of the buildings' annual energy use would be reduced?	*50%*	Based on an article from the USGBC LEED Platinum certified buildings' energy use intensity (EUI) is on average 50% below the average office building.
What is the incremental cost (per square foot) of green building for commercial and industrial new construction?	*$6.00/sq.ft.*	Based on the information from the source below it is expected that green building practices will increase the upfront construction costs of commercial building ($200/sq.ft.) by 3.0%. *RSMeans Green Building Cost Data*, 3rd Annual Edition

Renewable Energy		
Rooftop Solar		
What percent of homes could install rooftop solar (by 2040)?	50%	This assumes that half of all homes would have the proper orientation and space for rooftop solar.
What is the average size of a solar array (in kilowatts, kW)?	5 kW	The average size based of residential rooftop solar installations is provided in this presentation by SEIA.
What percent of businesses could install rooftop solar (by 2040)?	50%	This assumes that half of all businesses would have the proper orientation and space for rooftop solar.
What is the average size of a commercial solar array (in W/ft2)?	6.6 W/ft2	The average size of commercial rooftop solar is estimated by the California Energy Commission, assuming that 150 square feet of roof space is necessary for each kilowatt of PV capacity.
What is the current cost (per kilowatt) of rooftop solar?	$3.69/W	The estimated cost for rooftop solar installations was retrieved from the following NREL presentation.
Community Solar		
How large of a solar garden could the community support (in acres)?	2 acres	This assumption will depend on the user's preference of location. In total, City facilities currently cover approximately 20 acres within the community and educational uses encompass approximately 17 acres. It is most likely that community solar facilities would be constructed on top of institutional facilities or their parking areas.
How much would a solar garden cost (in dollars per kilowatt)?	$2,610/kW	The estimated cost for community solar installations was retrieved from the following NREL presentation.
Utility Based Renewables: CCA		
What year should the CCA begin?	2018	This assumption is based on a 3-year time horizon to get the CCA in place, assuming a planning horizon beginning year of 2015.
What percent of customers will voluntarily opt to pay a rate premium to ensure 33% of their electric supply mix is comprised of renewable energy (beginning in 2018)?	75%	This assumption, specific to Hermosa Beach, is based on guidance provided by Kaizenergy. This assumes a $0.20 per kWh cost compared to $0.16 per kWh. Costs were estimated based on the CleanStart Rate Schedule provided by from Sonoma CleanPower.
What percent of customers will opt to pay for a rate with 100% renewable energy from a CCA (beginning in 2018)?	10%	This assumption, specific to Hermosa Beach, is based on guidance provided by Kaizenergy. This assumes a $0.24 per kWh cost compared to $0.16 per kWh. Costs were estimated based on the CleanStart Rate Schedule provided by from Sonoma CleanPower.
Utility Based Renewables: Green Rate		
Should electricity be purchased from the electric utility (Southern California Edison, or SCE) at a green rate instead? If so what percentage of electricity should be purchased at this higher rate?	0-75%	This assumption is up to the discretion of the user. The default value varies, depending on the level of CCA participation selected above.
What will be the premium for a SCE Green Rate?	34%	Estimated Green Rate Charge to be a 34% premium over base generating charge; inferred from the Hermosa Beach Municipal Carbon Neutral Plan calculations.

Transportation and Land Use		
Vehicle Miles Traveled (VMT) Reduction Strategies		
Please select your preferred Land Use and Transportation Scenario (from the General Plan update process) from the drop box on the right.	None	Please reference the General Plan documents for more detailed information on VMT reduction strategies.
What level of policies and programs should be added to the general plan to further reduce VMT?	None	Please reference the General Plan documents for more detailed information on additional programs that could be included to further reduce VMT.
What will be the implementation cost (in dollars per vehicle mile traveled) of this strategy?	$0.75/VMT	Transportation costs are based on analysis by Rocky Mountain Institute during their study: Stepping Up: Benefits and Cost of accelerating Fort Collins' Energy and Climate Goals.
Electric Vehicles		
What percentage of new car purchases in 2040 will be EVs?	50%	A recent article in Sustainability indicates that as many as 69% of survey respondents would purchase an EV if sufficient charging station infrastructure existed. This assumption is scaled down to reflect potentially lower adoption rates. The calculations assume that 50 percent of the electric power for the charging stations will come from renewable sources.
What will be the incremental cost of EVs be in 2015?	$10,000	The incremental cost of Electric vehicles is documented in this paper from EPRI.
What will be the incremental cost of EVs be in 2020?	$0	It is assumed that electric vehicles will reach cost parity in 2020 based on the following paper by IEA.
What will be the cost of residential charging stations?	$1,000	Costs for a Level 2 Home charging station are estimated to be between $650 and $1,800 depending on materials, labor, and permitting; based on a study from Rocky Mountain Institute.
What will be the cost of community charging stations?	$10,000	Costs for a Level 2 Curb-side charging station are estimated to be between $5,300 and $13,150 depending on materials, labor, and permitting; based on a study from Rocky Mountain Institute.
Purchase of Offsets		
What percentage of remaining emissions should be reduced through the purchase of carbon offsets?	20%	This assumption is up to the discretion of the user.
What will be the cost of purchasing carbon offsets?	$15.00/MTCO2e	Rounded average of the low, middle, and high projected California Air Resources Board Allowance prices for 2014-2020; from the Hermosa Beach Municipal Carbon Neutral Plan.