City of Manhattan Beach

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

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Prepared for:

SOUTH BAY CITIES
COUNCIL OF GOVERNMENTS

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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
USLD	Ultra-low Sulfur Diesel

Key Findings

Community

- The City of Manhattan Beach decreased emissions 9% from 2005 to 2012, from 339,798 MT CO_2e to 310,065 MT CO_2e.
- On-road Transportation, Commercial Energy, Solid Waste, Water, Wastewater, and Off-Road Sources sector emissions decreased while the Residential Energy sector increased emissions from 2005 to 2012.
- Energy-related emissions account for 48% of total community emissions in 2012.
- Under the Adjusted Business-as-Usual (BAU) forecast, emissions will be 280,267 MT CO_2e in 2020 and 247,265 MT CO_2e in 2035. These emissions levels are 17.5% lower in 2020 than 2005 and 27% 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 73,968 MT CO_2e from the 2035 Adjusted BAU forecast. This is a 29.9% reduction from the 2035 Adjusted BAU emissions level and would achieve a 49% reduction from 2005 levels.

Municipal

- Municipal emissions have decreased 9% from 2005 to 2012, from 5,321 MT CO_2e to 4,854 MT CO_2e.
- Emissions in Fleet & Equipment, Employee Commute, and Solid Waste sectors decreased between 2005 and 2012, and the largest sector-level reductions were from Fleet & Equipment.
- Municipal emissions are a subset of community emissions and account for less than 2% of total community emissions.
- Under the 2020 Adjusted BAU forecast, emissions will be 4,710 MT CO_2e in 2020 and 2035. These emissions levels are 11% lower than 2005.
- The City will need to reduce emissions by 187 MT CO_2e from the 2020 Adjusted BAU emissions level to meet a 15% reduction target from 2005 levels. By 2035, the City will need to reduce emissions by 1,996 MT CO_2e from the 2035 Adjusted BAU emissions level to meet a 49% reduction target from 2005 levels.

Introduction

The Greenhouse Gas (GHG) Inventories, Long-Term Forecasts, and Target-Setting (IFT) Report contains the first steps toward the City of Manhattan 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 "Outdoor Lights."[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 lights) 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 Pacific Coast Highway 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.
- **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.

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

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 Lights** includes energy for streetlights on fixtures owned by SCE and outdoor lights.
  - **City-owned Outdoor Lights** includes energy for streetlights on fixtures owned by the City and traffic control signals.
  - **Water Delivery** includes energy for water, stormwater, and wastewater 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 Manhattan Beach reduced emissions 8.8% from 2005 to 2012, from 339,798 MT CO_2e to 310,065 MT CO_2e.**
- **On-road Transportation, Commercial Energy, Solid Waste, Water, Wastewater, and Off-road Sources sector emissions decreased while the Residential Energy sector emissions increased from 2005 to 2012.**

As shown in Figure 1 and Table 3, the Transportation sector was the largest contributor to emissions in both 2005 and 2012 (46%) by producing 154,556 MT CO_2e in 2005 and 141,488 MT CO_2e in 2012. This change represents an 8.5% decrease in emissions from 2005 to 2012. Commercial/Industrial Energy is the second-largest contributor to emissions, adding 24% in both 2005 and 2012. While the proportion of emissions did not change over time, the total emissions decreased by 7% from 2005 to 2012, from 81,623 MT CO_2e to 75,827 MT CO_2e. The proportion of emissions from the Residential Energy sector was 20% in 2005 and 23% in 2012, and total emissions increased by 6.7%, from 67,855 MT CO_2e in 2005 to 72,377 MT CO_2e in 2012. Water comprised 6% of the total (21,912 MT CO_2e) in 2005, but was reduced to 4% of the total (12,506 MT CO_2e) in 2012. Solid Waste, Wastewater, and Off-road Sources made up the remaining emissions in each year, which all declined from 2005 to 2012.

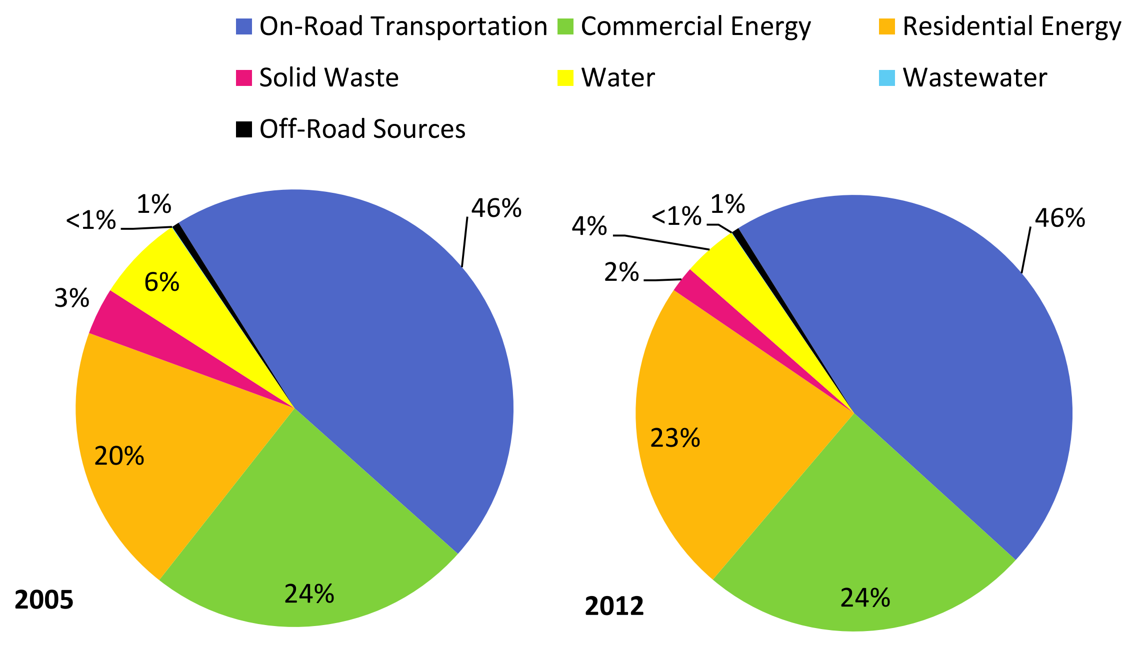


Figure 1. Community-Wide GHG Emissions by Sector for 2005 and 2012

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	154,556	141,488	-8.5%
Commercial Energy	81,623	75,827	-7.1%
Residential Energy	67,855	72,377	6.7%
Water	21,912	12,506	-42.9%
Solid Waste	11,830	5,979	-49.5%
Off-Road Sources	1,882	1,781	-5.3%
Wastewater	140	107	-23.6%
Total	339,798	310,065	-8.8%

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.

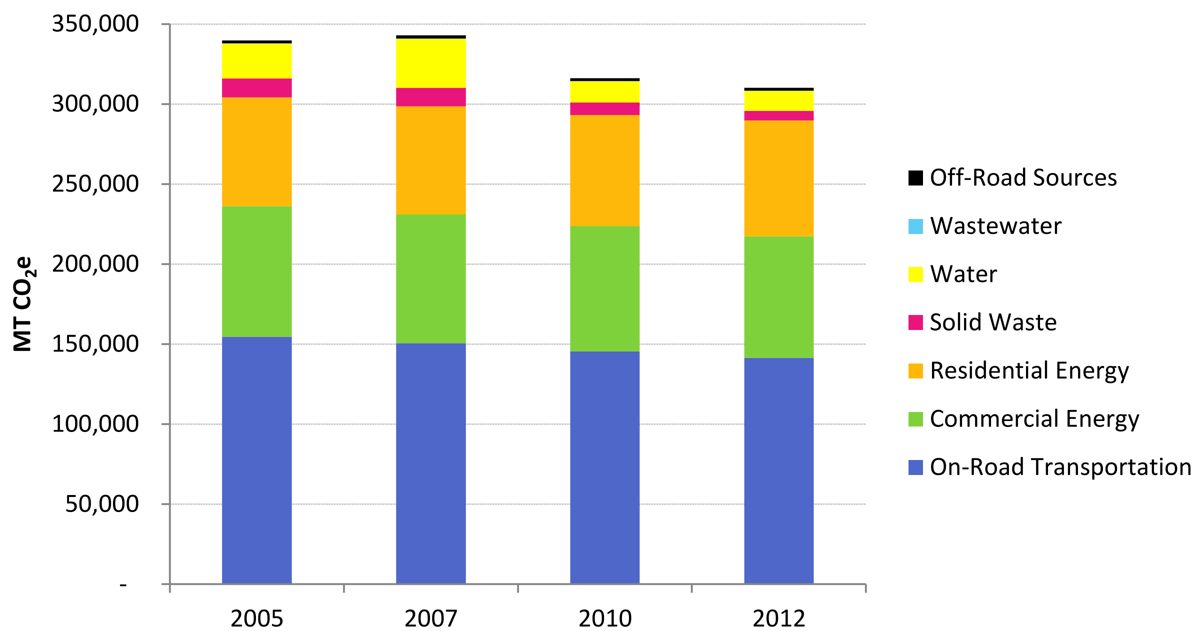


Figure 2. Community GHG Emissions for 2005, 2007, 2010, and 2012

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	154,556	45%	150,538	44%	145,373	46%	141,488	46%
Commercial/ Industrial Energy	81,623	24%	80,482	23%	78,321	25%	75,827	24%
Residential Energy	67,855	20%	67,412	20%	69,368	22%	72,377	23%
Water	21,912	6%	30,611	9%	13,327	4%	12,506	4%
Solid Waste	11,830	3%	11,682	3%	7,879	2%	5,979	2%
Off-Road Sources	1,882	1%	2,061	1%	1,820	1%	1,781	1%
Wastewater	140	<1%	107	<1%	107	<1%	107	<1%
Total	339,798		342,893		316,195		310,065	
% Change from 2005	--		0.9%		-6.9%		-8.8%	

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 Energy increased from 2005 to 2012, while Vehicle Miles Traveled, Commercial/Industrial Energy, Solid Waste, and decreased from 2005 to 2012, all of which mirror the emissions trends. 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 households between 2005 and 2012 mirrors the small increase in Residential Energy emissions and the decrease in Commercial Energy emissions from 2005 to 2012 mirrors the decrease in jobs during the same period.

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	295,559,253	290,605,266	287,939,838	286,874,776	-2.9%
Residential Energy					
Electricity (kWh)	98,244,689	102,974,828	102,830,336	103,874,968	5.7%
Natural Gas (therms)	7,147,953	7,103,109	7,478,906	7,364,309	3.0%
Commercial/Industrial Energy					
Electricity (kWh)	227,939,926	234,601,443	227,032,242	199,193,850	-12.6%
Natural Gas (therms)	2,327,389	2,435,647	2,439,055	2,280,694	-2.0%
Solid Waste					
Landfilled (tons)	47,106	46,827	31,939	23,966	-49.1%
ADC (tons) [1]	1,994	824	113	424	-78.7%
Water and Wastewater					
Water (MG)	4132	5954	3574	3366	-18.5%
Recycled Water (MG)	0.0	0.0	219.1	148.5	<1%
Wastewater (City portion of countywide residents)	0.36%	0.36%	0.36%	0.36%	-1.9%
Off-road Sources[2] (% of LA County emissions attributed to the City)					
Lawn & Garden (% Households)	0.46%	0.44%	0.43%	0.43%	-5.5%
Construction (% Building permits)	0.68%	0.72%	0.60%	0.57%	-15.5%
Industrial (% Manufacturing jobs)	0.22%	0.19%	0.19%	0.19%	-13.8%
Light Commercial (% Other jobs)	0.43%	0.37%	0.37%	0.37%	-14.3%
Recreation (Population weighted by income)	0.86%	0.85%	0.84%	0.81%	-6.5%
Agriculture (% Ag. Jobs)	0.00%	0.00%	0.00%	0.06%	<1%

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
Population	35,667	35,051	35,168	35,239	-1.2%
Households	14,523	14,249	14,038	14,028	-3.4%
Jobs	18,392	15,745	14,419	14,800	-19.5%
Service Population (Population + Jobs)	54,059	50,796	49,587	50,039	-7.4%

Source: SCAG

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 44% of the total community emissions in 2005 and 48% in 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	227,939,926	69,247	199,193,850	63,699	-12.6%	-8.0%
Natural Gas	2,327,389	12,376	2,280,694	12,128	-2.0%	-2.0%
Residential						
Electricity	98,244,689	29,846	103,874,968	33,217	5.7%	11.3%
Natural Gas	7,147,953	38,009	7,364,309	39,160	3.0%	3.0%
Total (MT CO_2e)		149,478		148,204		-0.9%

Commercial electricity use decreased 12.6% between 2005 and 2012; however, emissions decreased by only 8%. Residential electricity use increased by about 5.7% but emissions increased by more than 11%. The difference between the change in activity data and emissions data is 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 Manhattan Beach, Commercial/Industrial natural gas consumption (therms) decreased by 2% from 2005 to 2012; therefore the emissions also declined 2%. Residential natural gas therms used and GHG emissions increased nearly 3% 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.

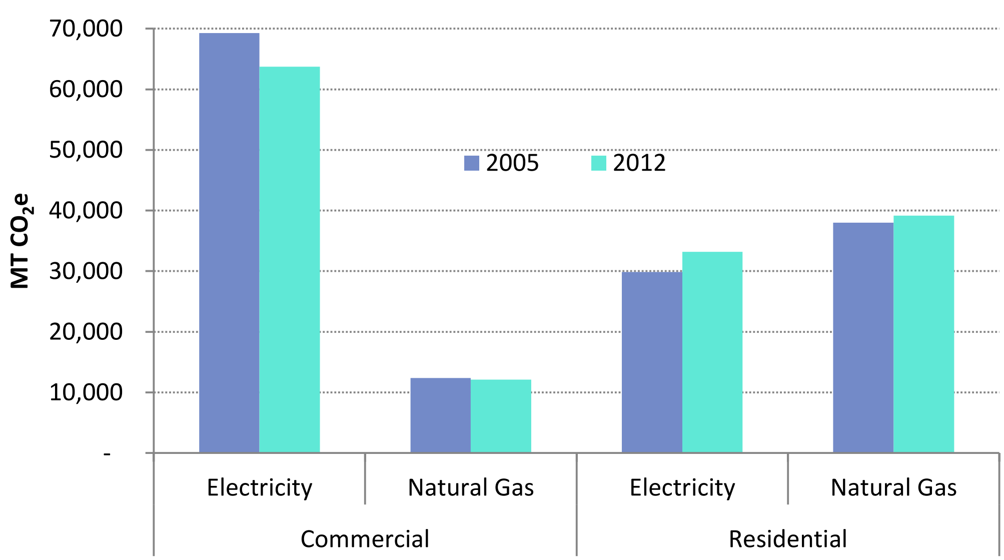


Figure 3. GHG Emissions for Community Electricity and Natural Gas, by Sector

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 9% from 2005 to 2012, from 5,321 MT CO_2e to 4,854 MT CO_2e.**
- **The City reduced emissions in the Fleet & Equipment, Employee Commute, and Solid Waste sectors. The greatest reductions were achieved in the Fleet & Equipment sector (886 MT CO_2e reductions).**
- **Emissions from municipal operations accounted for less than 2% of community emissions in 2012.**

The City's Fleet & Equipment is the sector with the largest percentage of emissions in 2005 (48%) and 2012 (34%), although emissions from this sector decreased 35% over the period, form 2,543 to 1,657 MT CO_2e (Figure 4). The second largest-emitting sector for 2005 was Employee Commute, which dropped by 50% by 2012 (from 757 MT CO_2e to 382 MT CO_2e), making it the fourth largest-emitting sector in 2012. Emissions from the Solid Waste sector also decreased over the period. Buildings & Facilities increased emissions 83% between 2005 and 2012 (from 804 MT CO_2e to 1,471 MT CO_2e). One key contributor to the large increase in emissions of the Buildings & Facilities is the opening of the Fire Department 1 in 2006. Emissions from the Water Delivery, SCE-owned Outdoor Lights and City-owned Outdoor Lights sectors also increased from 2005 to 2012 and are detailed in Table 8. Some City-owned outdoor lighting accounts have been re-categorized to SCE-owned outdoor lighting from 2005 to 2012 for improved accuracy of categorization. This change may partially contribute to the increase in SCE-owned outdoor lighting emissions.

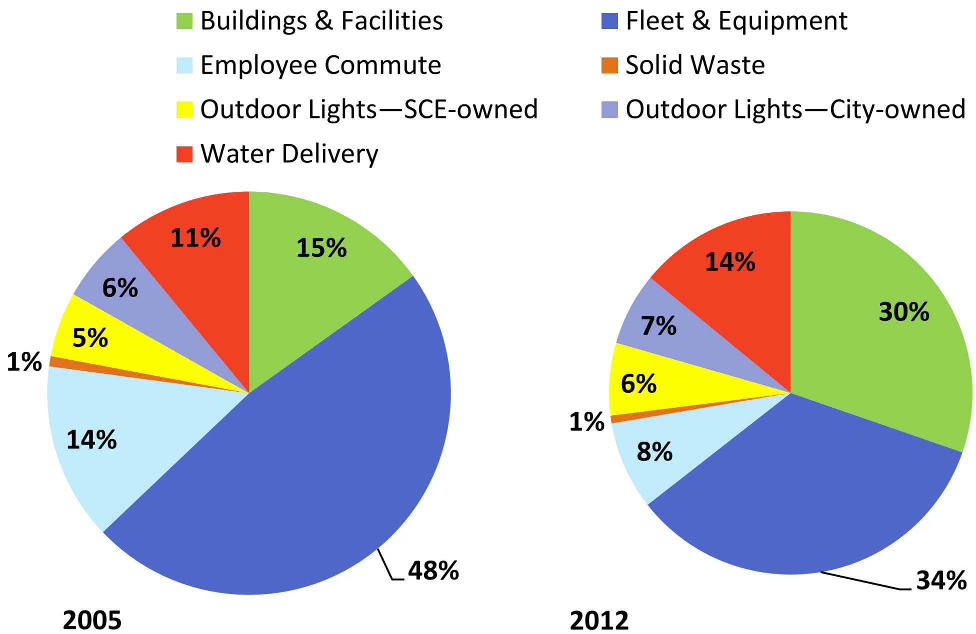


Figure 4. Municipal GHG Emissions by Sector for 2005 and 2012

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

Sector	2005 (MT CO_2e)	2012 (MT CO_2e)	% Change 2005 to 2012
Fleet & Equipment	2,543	1,657	-35%
Employee Commute	757	382	-50%
Water Delivery	583	682	17%
Buildings & Facilities	804	1,471	83%
Outdoor Lights—City-owned	312	315	1%
Outdoor Lights—SCE-owned	278	313	13%
Solid Waste	44	34	-23%
Total	5,321	4,854	-9%

Note: City-Owned Outdoor Lights includes streetlights and traffic signals. SCE-Owned Outdoor Lights includes streetlights and outdoor lighting. Water Delivery includes water, stormwater, and wastewater pumping and irrigation.

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 2005 (5,321 MT CO_2e) and were the lowest in 2010 (4,854 MT CO_2e).

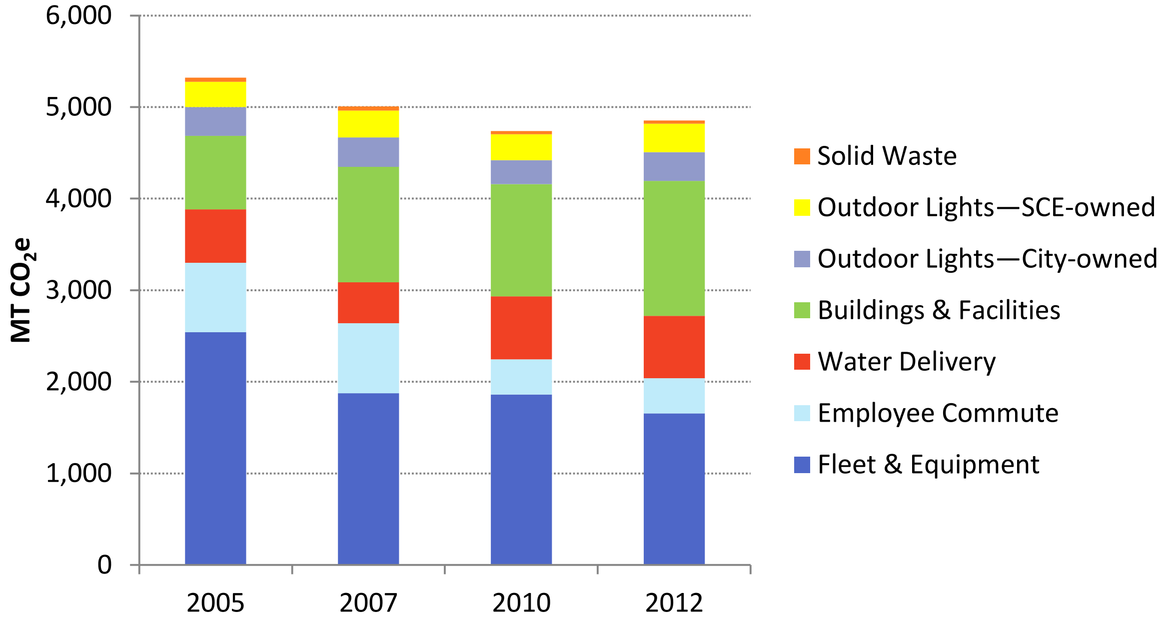


Figure 5. Municipal GHG Emissions for 2005, 2007, 2010, and 2012

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
Fleet & Equipment	2,543	48%	1,874	37%	1,861	39%	1,657	34%
Buildings & Facilities	804	15%	1,262	25%	1,226	26%	1,471	30%
Employee Commute	757	14%	767	15%	383	8%	382	8%
Water Delivery	583	11%	446	9%	688	15%	682	14%
Outdoor Lights—City-owned	312	6%	321	6%	261	6%	315	7%
Outdoor Lights—SCE-owned	278	5%	293	6%	284	6%	313	6%
Solid Waste	44	1%	45	1%	34	1%	34	1%
Total	5,321		5,008		4,737		4,854	

Table 10 summarizes activity data for each sector and subsector.

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

Sector	2005	2007	2010	2012	% Change 2005 to 2012
Buildings & Facilities—Other					
Electricity (kWh)	2,250,269	3,567,925	2,949,015	3,465,274	54%
Natural Gas (therms)[1]	22,767	44,231	70,811	68,113	199%
Outdoor Lights					
City-owned (kWh)	1,028,193	1,115,187	907,498	984,535	-4%
SCE-owned (kWh)	914,005	1,016,465	985,425	979,147	7%
Fleet & Equipment					
City-owned Fleet					
Gasoline (gallons)	88,778	81,971	80,422	80,973	-9%
Diesel (gallons)[2]	19,331	14,421	12,776	13,660	-29%
CNG (standard cubic feet)	422,715	442,112	301,440	301,440	-29%
Contracted[3]					
Gasoline (gallons)[4]	9,000	9,000	9,000	0	-100%
Diesel (gallons)[4,5]	33,194	11,152	11,152	3,125	-91%
LPG (gallons)	1,330	19,753	23,759	5,590	320%
CNG (standard cubic feet)	0	0	0	885,280	--
LNG (gallons)[4]	198,528	116,577	116,577	116,577	-41%
Employee Commute[6]					
Gasoline (vehicle miles traveled)	1,736,058	1,778,461	887,427	887,427	-49%
Diesel (vehicle miles traveled)	-	-	7,345	7,345	--
# Full-time equivalent employees	419	423	320	316	-24%
Solid Waste[7]					
Generated Waste (tons)	138	139	139	139	1%
Water Delivery					
Electricity (kWh)	1,917,800	1,550,882	2,388,490	2,133,921	11%

Notes: Data for 2005 and 2007 were taken from the Manhattan Beach Municipal Greenhouse Gas Emissions Inventory Report (2009).

1 Natural Gas from City Fleet was subtracted from provided Natural Gas data.

2 Ultra-low Sulfur Diesel (ULSD) data were included in Diesel fuel.

3 The City contracted services to Tru Green until its contract was discontinued in 2011. The City then switched to Athens, which used diesel and CNG fuel for its vehicles.

4 Data for 2010 was not available. 2007 data was assumed for 2010.

5 Diesel fuel is a combination ULSD gallons and Diesel gallons.

6 Employee Commute survey conducted in 2014 and adjusted based on the number of employees in 2010 and 2012.

7 Data for 2010 and 2012 were not available. 2007 data was assumed for 2010 and 2012.

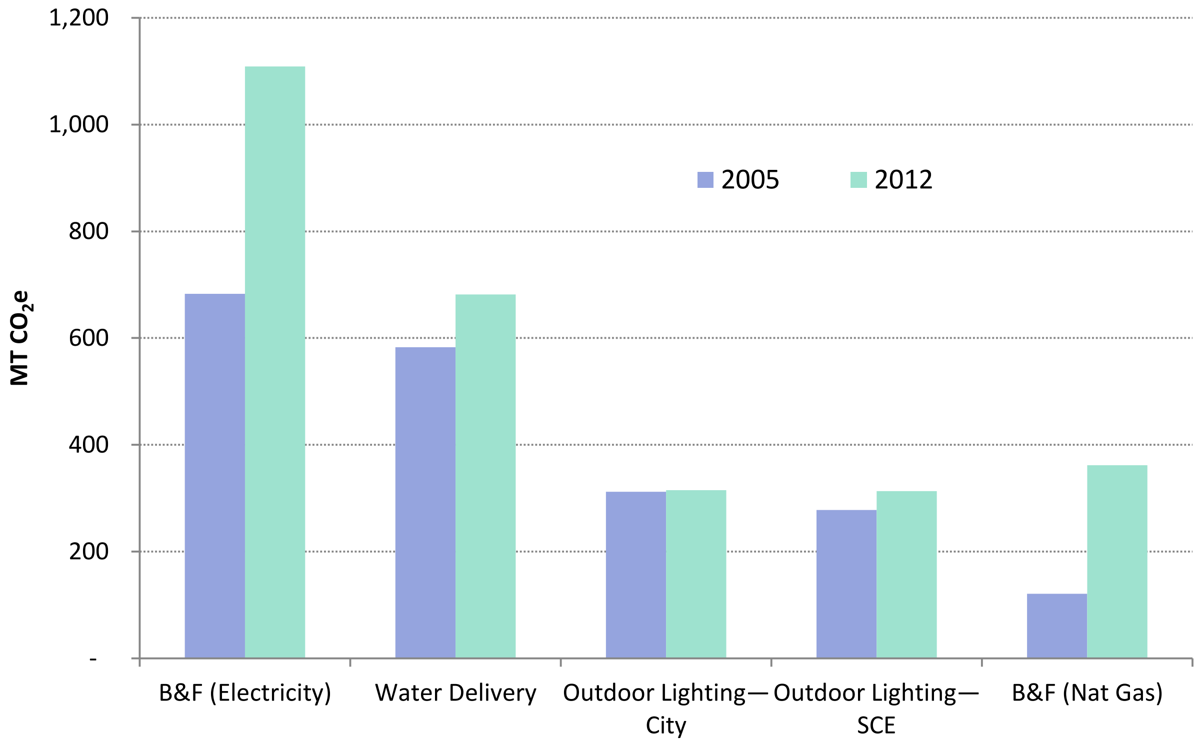
Energy

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 Lights, City-owned Outdoor Lights, and Water Delivery. Energy accounted for 37% of total emissions in 2005 and 57% in 2012. While both electricity and natural gas are used for Building & Facilities, Outdoor Lights and Water Delivery only use electricity. Emissions from energy increased 41% from 2005 to 2012; electricity-based emissions increased 30% and natural gas related emissions increased 199% (Table 11). Electricity emissions increased for each sector. 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 Municipal 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)		
Buildings & Facilities						
Electricity	2,250,269	683	3,465,274	1,109	54%	62%
Natural Gas	22,767	121	68,113	362	199%	199%
Outdoor Lights—SCE-owned						
Electricity	914,005	278	979,147	313	7%	13%
Streetlights & Traffic Signals—City-owned						
Electricity	1,028,193	312	984,535	315	-4%	1%
Water Delivery						
Electricity	138	583	139	682.00	1%	17%
Total (MT CO_2e)		1,977		2,781		41%

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.

Community Business-as-Usual Forecast

- **BAU community emissions are expected to decrease nearly 8% from baseline levels by 2020 and 4% by 2035.**

The City's BAU emissions in 2020 are estimated to be 313,714 MT CO_2e, or a nearly 8% decrease from baseline (2005) emissions. By 2035, emissions are estimated to decrease 4% from the baseline level to 327,070 MT CO_2e (Table 13).

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	286,874,776	263,000,432	275,739,334	-1.08%	0.32%
Solid Waste, Water, Wastewater, Off-road Sources	Service Population (Population + Jobs)	50,039	51,600	53,200	0.38%	0.20%
NA[2]	Population	35,239	35,500	36,000	0.09%	0.09%
Residential Energy	Households	14,028	14,100	14,100	0.06%	0.00%
Commercial/ Industrial Energy	Jobs	14,800	16,100	17,200	1.06%	0.44%
Municipal Jobs	Municipal Emissions[3]	251 F/T 130 P/T	251F/T 130 P/T	251 F/T 130 P/T	0%	0%

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.

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	154,556	141,488	137,916	-3%	144,597	2%
Commercial Energy	81,623	75,827	81,985	8%	87,586	16%
Residential Energy	67,855	72,377	72,702	0%	72,702	0%
Solid Waste	11,830	5,979	6,154	3%	6,345	6%
Water	21,912	12,506	12,873	3%	13,272	6%
Wastewater	140	107	110	3%	114	7%
Off-road Sources	1,882	1,781	2,001	12%	2,454	38%
Total	339,798	310,065	313,741	1%	327,070	5%
% Change from 2005		-8.8%	-7.7%		-3.7%	

Municipal Business-as-Usual Forecast

- **BAU municipal emissions are expected to be 9% below baseline levels in 2020 and 2035.**

The City is not anticipating growth in city services by 2020 or 2035 from current (2012) levels; therefore, the activity data for all sectors are assumed to remain constant from 2012. Therefore, the emissions in 2020 and 2035 will be equal to those in 2012 under a BAU scenario (Table 14). However, since 2012 emissions were lower than the baseline, future municipal emissions are also projected to be significantly lower than in 2005. In 2020 and 2035, municipal emissions are estimated to be 9% below baseline emissions in the BAU Forecast.

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
Vehicle Fleet	2,543	1,657	1,657	0%	1,657	0%
Buildings & Facilities	804	1,471	1,471	0%	1,471	0%
Employee Commute	757	382	382	0%	382	0%
Outdoor Lights	590	628	628	0%	628	0%
Water Delivery	583	682	682	0%	682	0%
Solid Waste	44	34	34	0%	34	0%
Total	5,321	4,854	4,854	0%	4,854	0%
% Change from 2005		-9%	-9%		-9%	

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 supplies water to its community through its municipal water service and the reductions in GHG emissions from SB X7-7 were calculated by applying the reduction goals established by the City to its population in 2020 and 2035.

Community Adjusted Business-as-Usual Forecast

- **Emissions are expected to decrease under the Adjusted BAU forecast and will be 17.5% lower in 2020 than 2005 and 27% lower than 2005 levels by 2035.**

The City's Adjusted BAU emissions in 2020 are estimated to be 280,267 MT CO_2e in 2020 and 247,265 MT CO_2e in 2035 (Table 15). This change represents a 17.5% reduction from 2005 by 2020 and 27% 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 over time but 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	156,438	143,269	112,545	41%	75,846	31%
Non-Residential Energy	81,623	75,827	80,882	29%	85,243	35%
Residential Energy	67,855	72,377	72,673	26%	72,673	29%
Water & Wastewater	22,052	12,613	8,013	3%	7,158	3%
Solid Waste	11,830	5,979	6,154	2%	6,345	3%
Total	339,798	310,065	280,267	100%	247,265	100%
% Change from 2005		-9%	-17.5%		-27.2%	

Municipal Adjusted Business-as-Usual Forecast

- **Under an Adjusted BAU forecast, the City's emissions will be 11% below 2005 levels in 2020 and 2035.**

The City's Municipal Adjusted BAU emissions in 2020 and 2035 are estimated to be 4,710 MT CO_2e, which is 11% below the 2005 baseline level (Table 16). 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
Vehicle Fleet	2,543	1,657	1,540	33%	1,540	33%
Buildings & Facilities	804	1,471	1,471	31%	1,471	31%
Employee Commute	757	382	355	8%	355	8%
Outdoor Lights	590	628	628	13%	628	13%
Water Delivery	583	682	682	14%	682	14%
Solid Waste	44	34	34	1%	34	1%
Total	5,321	4,854	4,710	100%	4,710	100%
% Change from 2005		-9%	-11%		-11%	

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]. In 2012, City staff recommended a GHG reduction target consistent with this approach for both the community and municipal operations. 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.

Ultimately, the City will determine the level of reductions that it can and should achieve. The City has not made a recommendation for reduction goals past 2020 and the long-term 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 73,968 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)	339,798	310,065	313,741	327,070
Adjusted BAU Emissions (MT CO_2e)	339,798	310,065	280,267	247,265
State-Aligned Target (% change from 2005)			-15%	-49%
State-Aligned Target (% change from 2012)			-7%	-44%
State-Aligned Emissions Goal (MT CO_2e)			288,828	173,297
Reductions from Adjusted BAU needed to meet the Target (MT CO_2e)			Target Met	73,968

[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.

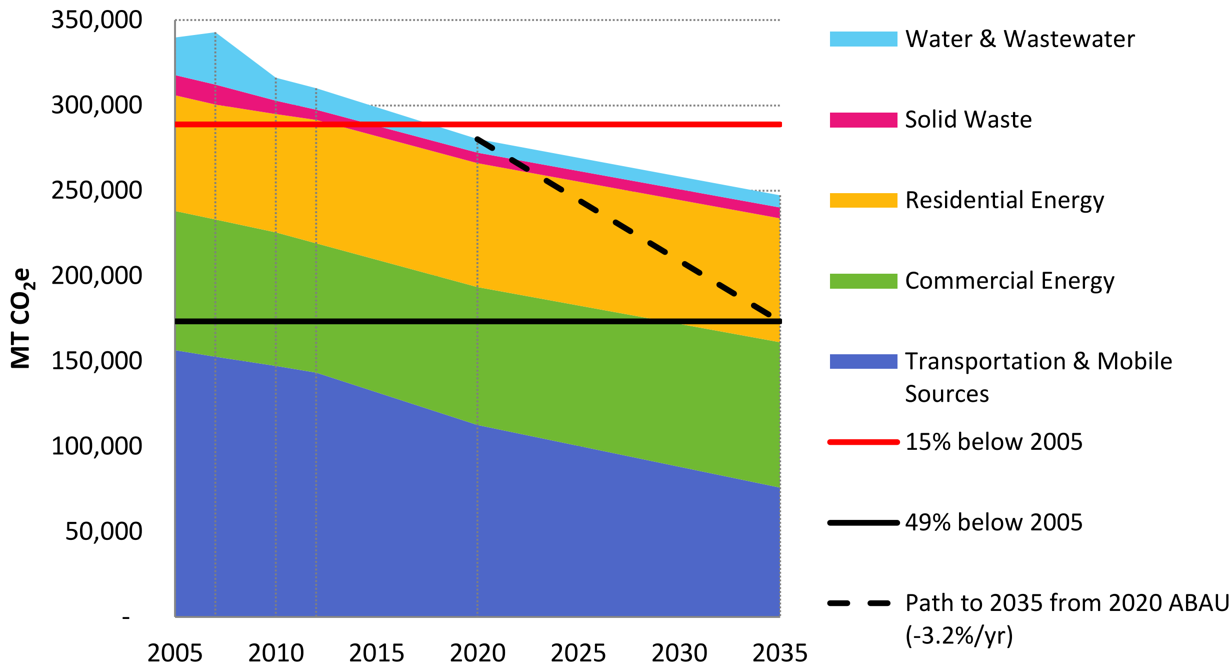


Figure 7. Community Emissions Inventories, Projections, and Targets

Recommended Municipal Targets

In 2020, the City will need to reduce its emissions by 187 MT CO_2e from the 2020 Adjusted BAU forecast to achieve a reduction goal consistent with the State (Table 18 and Figure 8). The City will also need to implement measures to achieve even greater GHG reductions beyond 2020. Early implementation of measures demonstrates the City's commitment to the EECAP, leadership in the community, and allows the City to phase implementation of new strategies so that ongoing reductions may be achieved. By 2035, the City will need to reduce municipal operation emissions by 1,996 MT CO_2e from a 2035 Adjusted BAU forecast to meet a 49% reduction goal (below 2005 levels).

Table 18. State-Aligned Municipal GHG Reduction Targets

	2005	2012	2020	2035
BAU Emissions (MT CO_2e)	5,321	4,854	4,854	4,854
Adjusted BAU Emissions (MT CO_2e)	5,321	4,854	4,710	4,710
State-Aligned Target (% change from 2005)			-15%	-49%
State-Aligned Target (% change from 2012)			-7%	-44%
State-Aligned Emissions Goal (MT CO_2e)			4,523	2,714
Reductions from Adjusted BAU needed to meet the Target (MT CO_2e)			187	1,996

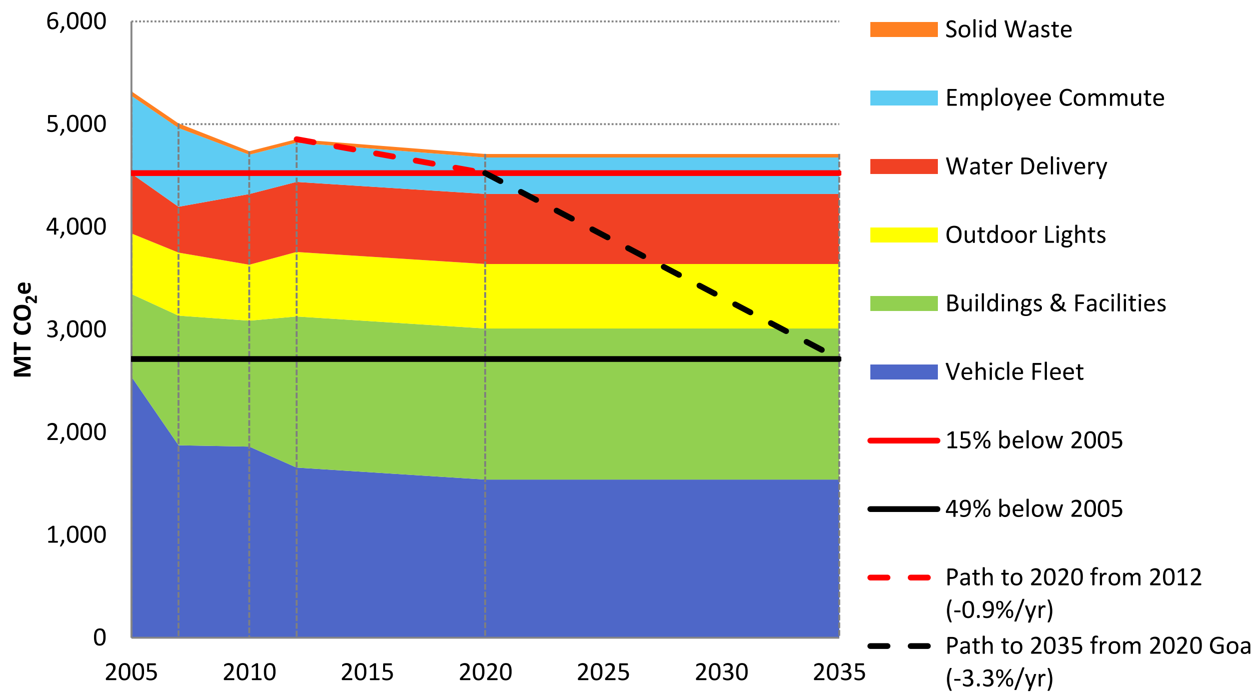


Figure 8. Municipal Emissions Inventories, Projections, and Targets

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 Commercial 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.

References

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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-2.

TableB-2. 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	City	
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-3, except for off-road emissions, which are shown in Table B-4 for Los Angeles County.

Table B-3. 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	295,559,253	290,605,266	287,939,838	286,874,776	-2.9%
Residential Energy					
Electricity (kWh)	98,244,689	102,974,828	102,830,336	103,874,968	5.7%
Natural Gas (therms)	7,147,953	7,103,109	7,478,906	7,364,309	3.0%
Commercial/Industrial Energy					
Electricity (kWh)	227,939,926	234,601,443	227,032,242	199,193,850	-12.6%
Natural Gas (therms)	2,327,389	2,435,647	2,439,055	2,280,694	-2.0%
Solid Waste					
Landfilled (tons)	47,106	46,827	31,939	23,966	-49.1%
ADC (tons) [1]	1,994	824	113	424	-78.7%
Water and Wastewater					
Water (MG)	4132	5954	3574	3366	-18.5%
Recycled Water (MG)	0.0	0.0	219.1	148.5	<1%
Wastewater (City portion of countywide residents)	0.36%	0.36%	0.36%	0.36%	-1.9%
Off-road sources[3] (% of LA County emissions attributed to the City)					
Lawn & Garden (% Households)	0.46%	0.44%	0.43%	0.43%	-5.5%
Construction (% Building permits)	0.68%	0.72%	0.60%	0.57%	-15.5%
Industrial (% Manufacturing jobs)	0.22%	0.19%	0.19%	0.19%	-13.8%
Light Commercial (% Other jobs)	0.43%	0.37%	0.37%	0.37%	-14.3%
Recreation (Population weighted by income)	0.86%	0.85%	0.84%	0.81%	-6.5%
Agriculture (% Ag. Jobs)	0.00%	0.00%	0.00%	0.06%	<1%

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 B-4. 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-5.

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. City staff completed ridership surveys in 2014 through SurveyMonkey.com. The City had 117 responses to the survey, representing over 30% of employees. The results were used with the total number of City employees in 2010 and 2012 to estimate employee commutes 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.

Table B-5. Activity Data used in 2005, 2007, 2010, and 2012 Municipal Inventories

Sector	2005	2007	2010	2012	% Change 2005 to 2012
Buildings & Facilities					
Electricity (kWh)	2,250,269	3,567,925	2,949,015	3,465,274	54%
Natural Gas (therms)	22,767	44,231	73,826	71,128	212%
Outdoor Lights					
City-Owned (kWh)	1,028,193	1,115,187	907,498	984,535	-4%
SCE-Owned (kWh)	914,005	1,016,465	985,425	979,147	7%
Fleet & Equipment					
City-Owned Fleet					
Gasoline (gallons)	88,778	81,971	80,422	80,973	-9%
Diesel (gallons)[1]	19,331	14,421	12,776	13,660	-29%
CNG (standard cubic feet)	422,715	442,112	0	0	-100%
Contracted [2]					
Gasoline (gallons)	9,000	9,000	9,000	9,000	0%
Diesel (gallons)[3]	33,194	11,152	11,152	11,152	-66%
LPG (gallons)	1,330	19,753	19,753	19,753	1385%
LNG (gallons)	198,528	116,577	116,577	116,577	-41%
Employee Commute[4]					
Gasoline (vehicle miles traveled)	1,736,058	1,778,461	887,427	887,427	-49%
Diesel (vehicle miles traveled)	-	-	7,345	7,345	--
# Full-time equivalent employees	419	423	320	316	-24%
Solid Waste[5]					
Generated Waste (tons)	138	139	139	139	1%
Water Delivery					
Electricity (kWh)	1,917,800	1,550,882	2,388,490	2,133,921	11%

Notes: Data for 2005 and 2007 were taken from the Manhattan Beach Municipal Greenhouse Gas Emissions Inventory Report (2009).

1: Ultra-low Sulfur Diesel (ULSD) data were included in Diesel fuel.

2: Data for 2010 and 2012 were not available. 2007 data were assumed for 2010 and 2012.

3. Diesel fuel is a combination ULSD gallons and Diesel gallons.

4: Employee Commute survey conducted in 2014 and adjusted based on the number of employees in 2010 and 2012.

5: Data for 2010 and 2012 were not available. 2007 data was assumed for 2010 and 2012.

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-6).

Table B-6. 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 CO2e; therefore, there are no CH4 and N2O 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 (Table B-7).

Table B-7. 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-8).

Table B-8. 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

[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.

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 and N_2O emissions using emission factors from the Community Protocol. Table B-9 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-9.

Table B-9. 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.

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

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-10 lists the indicator used to estimate the City's portion of emissions for each category and Table B-11 shows City-specific data. City- and county-level indicator data were obtained from SCAG.

Table B-10. 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-11. Off-road Emissions Indicator Data

		Ag. Jobs	Building Permits	Mfg. Jobs	Households	Other Jobs[1]	Population	Income ($)
2005	City	0	173	1,012	14,523	17,380	35,667	115,289
	County	13,562	25,623	461,099	3,178,736	4,045,922	9,816,200	48,606
	%	0.00%	0.68%	0.22%	0.46%	0.43%		0.86%
2007	City	0	146	866	14,249	14,879	35,051	121,628
	County	13,562	20,303	461,099	3,224,053	4,045,922	9,780,800	51,439
	%	0.00%	0.72%	0.19%	0.44%	0.37%		0.85%
2010	City	0	45	678	14,929	13,741	35,168	131,795
	County	10,598	7,466	362,157	3,454,093	3,758,244	9,818,605	56,000
	%	0.00%	0.60%	0.19%	0.43%	0.37%		0.84%
2012	City	6	108	698	14,918	14,096	35,239	121,796
	County	10,798	18,926	369,005	3,454,093	3,829,313	9,889,632	53,880
	%	0.06%	0.57%	0.19%	0.43%	0.37%		0.81%

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-12 using the CEC report and estimated indoor vs. outdoor water usage in the region.

Table B-12. 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-13). 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-13. 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-14). 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-14 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-14. 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-15). For the municipal inventory, the characterization for public administration was used (Table B-15). 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-15. The "Category in in the 2004 and 2008 Studies" detail which Study categories make up the ClearPath Category.

Table B-15. 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%	2.6%	3.3%	0.1%	0.062
Branches	Lumber	30%	9.6%	14.5%	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.

TableB-16. Emissions Sectors and Demographic Growth Indicators

Sector	Demographic Indicator
Residential Energy	Households
Commercial/ Industrial Energy	Jobs
Solid Waste, Water, Wastewater, 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.

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.

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. The City has its own water services, and the level of implementation was estimated using an annualized reduction rate from the City's baseline water consumption rate (179.1 gallons per capita per day, GPCD) to the target water consumption rate (143.3 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 both municipal operations and communitywide emissions reductions efforts.

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%