City of Redondo Beach

ENERGY EFFICIENCY CLIMATE ACTION PLAN

DECEMBER 2015

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Prepared for:

SOUTH BAY CITIES COUNCIL OF GOVERNMENTS

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and

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Contents

APPENDICES

TABLES

FIGURES

Acronyms

AB	Assembly Bill
ADC	Alternative Daily Cover
BAU	Business-as-Usual
CAFE	Corporate Average Fuel Economy
CH_4	Methane
CAP	Climate Action Plan
CARB	California Air Resources Board
CEESP	California Long Term Energy Efficiency Strategic Plan
CIWMB	California Integrated Waste Management Board
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CPUC	California Public Utilities Commission
EECAP	Energy Efficiency Climate Action Plan
ELP	Energy Leadership Partnership
EO	Executive Order
GHG	Greenhouse Gas
GWP	Global Warming Potential
HERO	Home Energy Renovation Opportunity
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
PACE	Property Assessed Clean Energy
RPS	Renewable Portfolio Standard
RTP	Regional Transportation Plan
SB	Senate Bill
SBCCOG	South Bay Cities Council of Governments
SBESC	South Bay Environmental Services Center
SCAQMD	South Coast Air Quality Management District
SCAG	Southern California Association of Governments
SCE	Southern California Edison
SCG	Southern California Gas Company
SEEC	Statewide Energy Efficiency Collaborative
SCS	Sustainable Communities Strategy

Executive Summary

The City of Redondo Beach (City), in concert with the South Bay Cities Council of Governments (SBCCOG), is committed to providing a more livable, equitable, and economically vibrant community and sub-region through the implementation of energy efficiency measures and subsequent reduction of greenhouse gas (GHG) emissions. By using energy more efficiently, Redondo Beach will keep dollars in the local economy, create new green jobs, and improve the community's quality of life. The efforts toward increasing energy efficiency described in this report will be done in coordination with the City's other planning and land use decisions. Through this Energy Efficiency Climate Action Plan (EECAP), the City has established goals and policies that incorporate environmental responsibility into its daily management of its community and municipal operations.

Inventories

The first step in completing the EECAP was to update the City's community GHG emissions inventories. These inventories show us a snapshot of the emissions that the community itself puts into the atmosphere. The City had already completed community inventories for 2005 and 2007, and in 2014, the SBCCOG added inventories for 2010 and 2012. The year 2005 is the base year, which means that future emissions reductions will be measured against emissions that occurred in 2005.

The City's community GHG emissions increased less than 1% from 2005 to 2012, falling from 522,168 MT CO_2e in 2005 to 523,400 MT CO_2e in 2012. Figure 1 shows the change in emissions levels over time, as well as the amount that each sector (e.g. residential energy, on-road transportation) contributes to the overall GHG emissions.

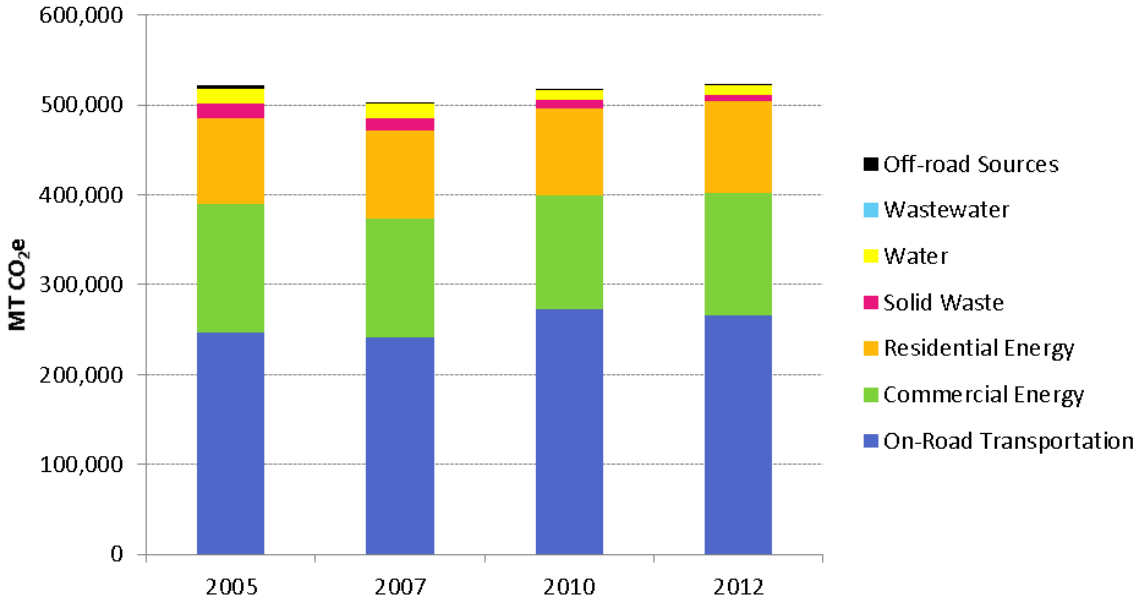

Figure 1 Community Emissions for 2005, 2007, 2010, and 2012

Table 1 Community GHG Emissions by Sector for 2005 and 2012

Sector	2005 (MT CO_2e)	2012 (MT CO_2e)	% Change 2005 to 2012
On-road Transportation	246,707	265,512	7.6%
Commercial Energy	142,679	137,031	-4.0%
Residential Energy	95,616	101,010	5.6%
Solid Waste	16,840	7,406	-56.0%
Water	15,576	10,332	-33.7%
Off-road Sources	4,492	1,906	-57.6%
Wastewater	258	203	-21.3%
Total	522,168	523,400	0.2%

Similarly, SBCCOG updated inventories for the City's municipal operations, which now include emissions snapshots for 2005, 2007, 2010, and 2012. Municipal emissions are a subset of community emissions and account for about 1% of community emissions. Even though the municipal emissions are a small portion of the overall community emissions, they represent tremendous opportunity for reductions because these are the emissions that the City has the most direct control over.

From 2005 to 2012, the City increased its municipal emissions by 12% from 7,191 MT CO_2e to 8,062 MT CO_2e. Figure 2 shows trends in municipal GHG emissions over time as well as sector-level details for the municipal inventories.

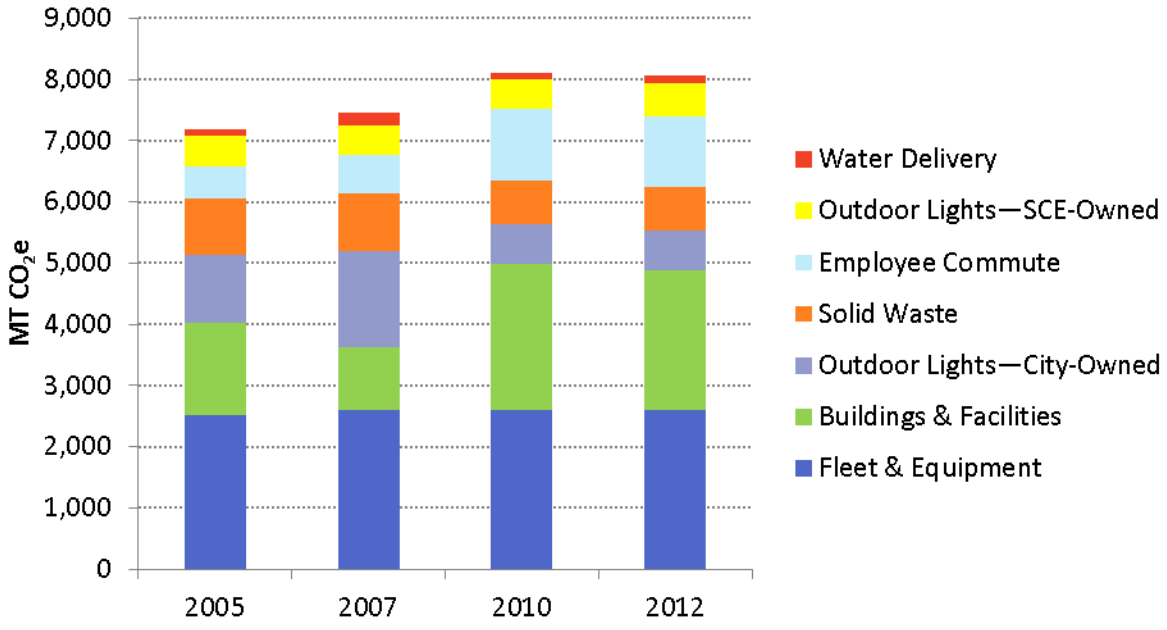

Figure 2 Municipal GHG Emissions by Sector for 2005, 2007, 2010, and 2012

Table 2 Municipal GHG Emissions by Sector for 2005 and 2012

Sector	2005 (MT CO_2e)	2012 (MT CO_2e)	% Change 2005 to 2012
Fleet & Equipment	2,515	2,591	3%
Buildings & Facilities	1,506	2,293	52%
Outdoor Lights—City-Owned	1,103	644	-42%
Solid Waste	934	719	-23%
Employee Commute	517	1,150	122%
Outdoor Lights—SCE-Owned	508	542	7%
Water Delivery	108	123	14%
Total	7,191	8,062	12.1%

Forecasts and Target Setting

The next step in the EECAP process was to estimate future emissions in the City and establish GHG reduction targets. Consistent with the State's adopted AB 32 GHG reduction target, the City is working to reduce emissions back to 1990 levels by the year 2020. This target was calculated as a 15 percent decrease from 2005 levels, as recommended in the AB 32 Scoping Plan. A longer-term goal was established for 2035. The goal for 2035 is to reduce emissions 49% below 2005 levels, which would put the City on a path toward the State's long-term goal to reduce emissions 80% below 1990 levels by 2050 (Table 3).

Table 3 Emissions Reduction Targets for Community and Municipal Operations

	Community	Municipal
2020 Target	15% below 2005 levels	
2020 Emissions Goal (MT CO_2e)	443,843	6,112
2035 Target	49% below 2005 levels	
2035 Emissions Goal (MT CO_2e)	266,306	3,667

The City's future emissions were estimated using demographic indicators such as population and job growth. Emissions for the City's municipal operations were estimated using the number of staff anticipated in future years. Growth indicators used are shown by sector in Table 4.

Future emissions estimates also included reductions that would happen with implementation of legislation adopted at the State level. That is, some level of emissions reduction is anticipated within the City as a result of policies implemented at the State level, including:

- Low Carbon Fuel Standard
- Assembly Bill (AB) 1493 and Advanced Clean Cars
- California Building Code Title 24
- Renewable Portfolio Standard
- Senate Bill X7-7

Table 4 Growth Factors Used for Forecasting 2012, 2020, and 2035 GHG Emissions

Sector	Demographic Indicator	2012	2020	2035
Transportation	Vehicle Miles Traveled	538,339,762	490,579,902	507,671,090
Solid Waste, Water, Wastewater, Off-road Sources	Service Population (Population + Jobs)	96,256	100,300	104,600
Commercial/ Industrial Energy	Jobs	67,007	69,700	73,000
NA[1]	Population	30,615	30,700	32,000
Residential Energy	Households	29,016	30,700	32,000
Municipal Jobs	Municipal Emissions[2]	715 FTE	715 FTE	715 FTE

[1] Not Applicable. Population data are shown for informational purposes but are not used for forecasting any sector.
[2] The number of jobs in the City is used as an indicator for all municipal operation emissions. As the City is not anticipating significant growth in municipal services, the number of jobs in 2020 and 2035 is assumed constant. 2012 data was not provided, therefore 2007 data was assumed
FTE: Full-time employees

The resulting projected emissions are considered an "adjusted" business-as-usual (Adjusted BAU) forecast. Historic emissions, Adjusted BAU forecast, and 2020 and 2035 targets are shown in Figure 3 for the community and Figure 4 for municipal operations. For both the community and municipal operations, the Adjusted BAU forecasts indicate the 2020 and 2035 emissions targets will not be met, and additional measures will be needed to meet these goals.

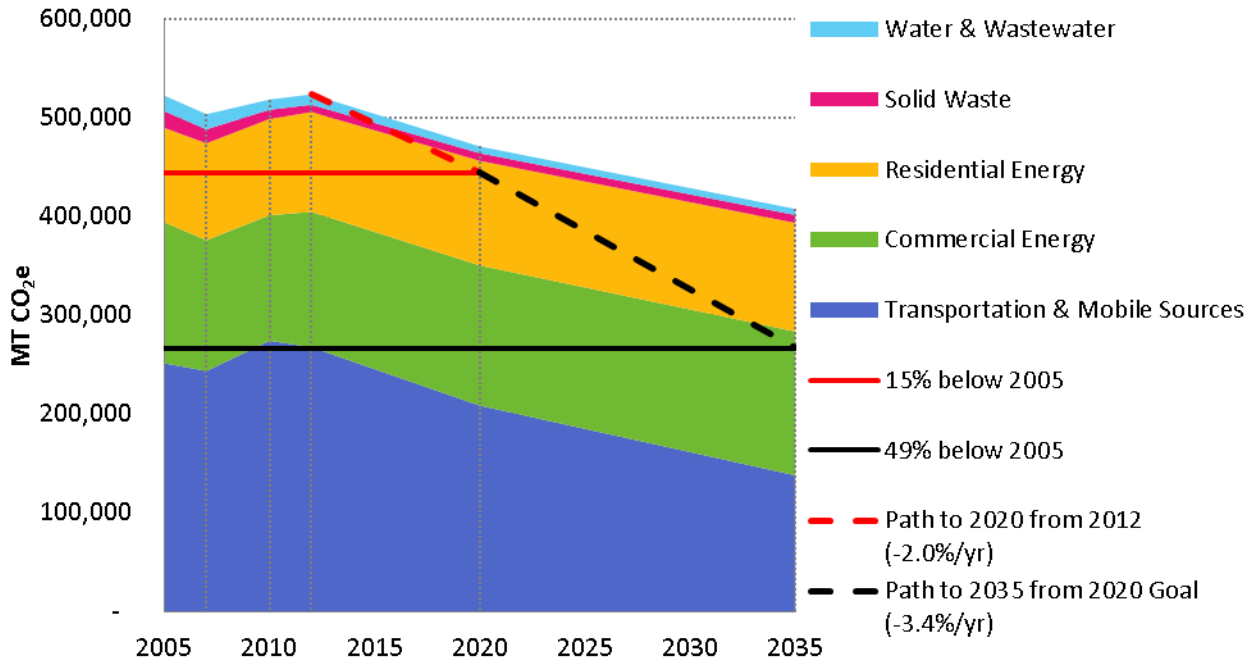

Figure 3 Community Emissions Inventories, Projections, and Targets

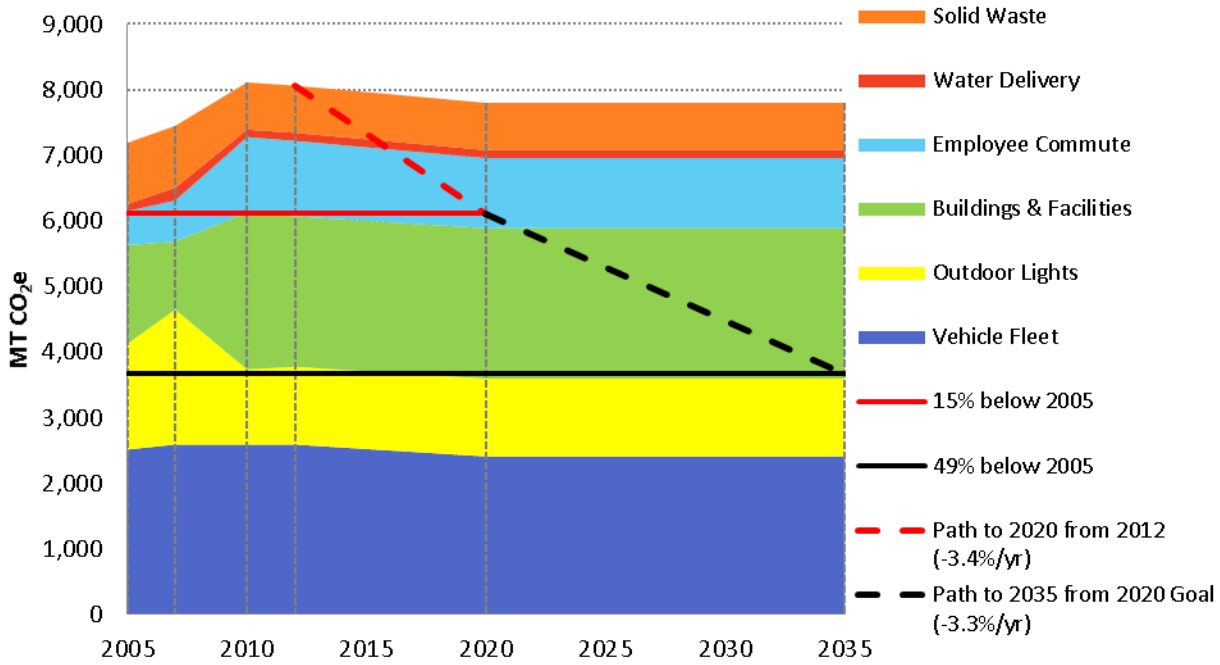

Figure 4 Municipal Emissions Inventories, Projections, and Targets

Energy Efficiency Measures

The City has already demonstrated its commitment to conserve energy and reduce emissions through a variety of programs and policies. Programs to reduce GHG emissions include implementing water efficient landscape ordinance and participation in multiple home financing programs that will allow home and business owners to obtain low-interest loans for implementing energy efficiency in their buildings. In order to reach the reduction target, the City will also consider implementing the additional local reduction measures described in this report. These measures encourage energy efficiency and water conservation. Table 5 and Table 6 summarize the measures that would be implemented to meet the community and municipal GHG reduction goals, respectively, for 2020 and 2035.

Table 5 Community GHG Reduction Strategies

Measure No.	Measures	Reductions (MT CO_2e) 2020	2035
Goal 1: Increase Energy Efficiency (EE) in Existing Residential Units			
Measure 1.1	EE Training and Education	Supporting Measure	
Measure 1.2	Increase Participation in Existing EE Programs	50	236
Measure 1.3	Establish, Promote, or Require Home Energy Evaluations	Supporting Measure	
Measure 1.4	Promote, Incentivize, or Require Residential Home Energy Renovations	8,862	42,096
Goal 2: Increase Energy Efficiency in New Residential Development			
Measure 2.1	Encourage or Require EE Standards Exceeding Title 24	Supporting Measure	
Goal 3: Increase Energy Efficiency in Existing Commercial Units			
Measure 3.1	EE Training and Education	Supporting Measure	
Measure 3.2	Increase Participation in Existing EE Programs	709	3,369
Measure 3.3	Promote or Require Non-Residential Energy Audits	1,250	5,936
Measure 3.4	Promote or Require Commercial Energy Retrofits	15,379	73,052
Goal 4: Increase Energy Efficiency in New Commercial Development			
Measure 4.1	Encourage or Require EE Standards Exceeding Title 24	Supporting Measure	
Goal 5: Increase Energy Efficiency through Water Efficiency (WE)			
Measure 5.1	Promote or Require WE through SBX7-7	715	3,396
Measure 5.2	Promote WE Standards Exceeding SB X7-7	3	14
Goal 6: Decrease Energy Demand through Reducing Urban Heat Island Effect			
Measure 6.1	Promote Tree Planting for Shading and EE	48	1,399
Total		27,263	129,499

Table 6 Municipal GHG Reduction Strategies

Measure No.	Measures	Reductions (MT CO_2e) 2020	2035
Goal 1: Participate in Education, Outreach, and Planning for Energy Efficiency			
Measure 1.1	Increase Energy Savings through the SCE Energy Leader Partnership	Supporting Measure	
Goal 2: Increase Energy Efficiency in Municipal Buildings			
Measure 2.1	Conduct Municipal Building Energy Audit	Supporting Measure	
Measure 2.2	Require Green Building Certification	Under Consideration	
Measure 2.3	Implement Water Leak Detection Program	Under Consideration	
Measure 2.4	Participate in Demand Response Programs	Supporting Measure	
Measure 2.5	Participate in Direct Install Program	71	224
Measure 2.6	Adopt a Procurement Policy for Energy Efficient Equipment	78	246
Measure 2.7	Install Cool Roofs	Under Consideration	
Measure 2.8	Increase Recycled Water Use	Under Consideration	
Measure 2.9	Retrofit HVAC Equipment	Under Consideration	
Measure 2.10	Track Additional Energy Savings	22	68
Measure 2.11	Utilize an Energy Management System	Supporting Measure	
Goal 3: Increase the Energy Efficiency in City Infrastructure			
Measure 3.1	Retrofit Traffic Signals and Outdoor Lighting	415	1,305
Measure 3.2	Upgrade or Incorporate Water-Conserving Landscape	Under Consideration	
Measure 3.3	Plant Trees for Shade and Carbon Sequestration	Under Consideration	
Goal 4: Reduce Energy Consumption in the Long Term			
Measure 4.1	Develop an Energy Reinvestment Fund	Supporting Measure	
Total		587	1,844

Implementation

To reduce GHG emissions and meet the City's GHG reduction goals, the City must work to fully implement the EECAP. The following section identifies a process for implementation and monitoring for the strategies described. The six step process is summarized in Figure 5.

Figure 5 Process of Implementing the EECAP

Upon successful implementation of this EECAP, the City and its partner agencies will demonstrate the potential economic, social, and environmental benefits of increasing energy efficiency and leading on environmental stewardship within the community.


REDONDO BEACH
THE PIER

Chapter 1
Introduction

The EECAP is the City's plan to become more energy efficient. The City recognizes that energy efficiency is necessary and can be achieved cost-effectively. The EECAP is built upon efforts at the Federal, State, regional, and local levels along with the other cities in the South Bay Sub-Region. Through this effort, the City has developed and will implement energy efficiency and greenhouse gas reduction efforts that preserve the City's character while fostering a more sustainable future.

Purpose and Need for the Energy Efficiency Climate Action Plan

Jurisdictions in California are increasingly facing the need to address climate change and energy efficiency due to increasing energy rates, changing weather and climate conditions, and state mandates. Many communities have taken local control of the issue by developing plans or strategies that will increase energy efficiency and lower GHG emissions in a manner that is most feasible in their community. An Energy Efficiency Climate Action Plan (EECAP) is one such effort. An EECAP evaluates the energy and other resource consumption in a jurisdiction and identifies strategies that will increase the jurisdiction's energy efficiency and lower GHG emissions over time. Development and adoption of this EECAP allows the City of Redondo Beach (City) to:

- Understand its municipal and community energy use and GHG emissions now and in the future;
- Identify strategies at the local level that will result in long-term energy efficiency;
- Develop a plan to implement strategies; and
- Monitor and report progress toward energy-efficiency goals.

Further, this EECAP serves as a foundation for developing a comprehensive Climate Action Plan (CAP), which would expand the strategies for reducing GHG emissions to all sectors of the City's economy, including transportation and solid waste.

The EECAP provides the framework to implement and monitor energy efficiency strategies in the City that are feasible, cost-effective, and improve the quality of life for its citizens.

Alignment with California's Long Term Energy Efficiency Strategic Plan

In September of 2008, the California Public Utilities Commission (CPUC) adopted California's Long-Term Energy Efficiency Strategic Plan (CEESP). The purpose of the plan is to provide a single roadmap for maximum energy savings across major groups and sectors in California. The Strategic Plan presents an integrated framework of goals and strategies for energy efficiency, and affirms the role of energy efficiency as the highest-priority in meeting California's energy needs.

In January of 2011, the CPUC updated the CEESP, which set the following goals for local governments:

1. Local governments lead adoption and implementation of "reach" codes stronger than Title 24 on both a mandatory basis and a voluntary basis.
2. Strong support from local governments for energy code compliance enforcement.
3. Local governments lead by example with their own facilities and energy usage practices.
4. Local governments lead their communities with innovative programs for energy efficiency, sustainability, and climate change.
5. Local government energy efficiency expertise becomes widespread and typical.

Based on the energy efficiency strategies selected by the City, the EECAP advances these goals. Upon successful implementation of the EECAP, the City can keep dollars in its local economy, create new green jobs, and improve quality of life within its community. The efforts toward energy efficiency improvements and GHG emission reductions are consistent with the goals and policies found in the City's General Plan.

Regulatory Setting

Federal and State

In addition to the CEESP, the State and Federal governments promote energy efficiency and GHG emissions reductions through legislation, regulations, planning, policy-making, education, and a variety of programs. The programs most relevant to the EECAP are summarized in Table 7.

2005

Executive Order S-3-05: Reduce emissions to
- 2000 levels by 2010
- 1990 levels by 2020
- 80% below 1990 levels by 2050

2006

Assembly Bill 32: Reduce emissions to 1990 levels by 2020

2009

Senate Bill X7-X: Reduce per-capita water use 20% by 2020

2013

Title 24 Building Efficiency Standards: Increase energy efficiency standards for new building construction.

Table 7 Climate Change Legislation and Policy

Bill & Date of Issuance	Title	Description	Implementing Agency
Public Law (PL) 88-206	Clean Air Act	Federal policy to address global climate change through monitoring, reporting, and regulation of GHG emissions.	USEPA
Executive Order S-3-05 (2005)	Greenhouse Gas Initiative	Set statewide GHG emissions targets to 2000 levels by 2010; 1990 levels by 2020; and 80% below 1990 levels by 2050.	California Air Resources Board (CARB)
Assembly Bill (AB) 32 (2006)	Global Warming Solutions Act	State must reduce GHG emissions to 1990 levels by 2020.	CARB
Senate Bill (SB) 1078, 107, and X1-2, and Executive Order S-14-08 and S-21-09	Renewable Portfolio Standard	California investor-owned utilities must provide at least 33% of their electricity from renewable resources by 2020.	California Public Utilities Commission
SB 1368 (2006)	Emission Performance Standards	Requires the California Public Utilities Commission (CPUC) to establish a performance standard for base-load generation of GHG emissions by investor owned utilities.	California Energy Commission (CEC)
Executive Order S-20-04 (2004)	California Green Building Initiative	Reduce energy use in state-owned buildings 20% from a 2003 baseline by 2015.	CEC
California Code of Regulations (CCR) Title 24	2013 Building Efficiency Standards	Statewide green building code that raises the minimum environmental standards for construction of new buildings in California.	CEC
AB 811 (2008)	Contractual Assessments: Energy Efficiency Improvements	Provides financing to allow property owners to finance renewable energy generation and energy efficiency improvements.	California cities and counties
AB 474 (2009)	Contractual Assessments: Water Efficiency Improvements	Designed to facilitate the installation of permanent water conservation and efficiency improvements on private property through a voluntary financing program between public entities and property owners.	California cities and counties
AB 1493 (2002)	Pavley I and II	GHG emissions must be reduced from passenger vehicles, light-duty trucks, and other non-commercial vehicles for personal transportation.	CARB
Executive Order S-1-07 (2007)	Low Carbon Fuel Standard	The carbon intensity of transportation fuels in California must be lowered 10% by 2020.	CARB
SB X7-7	Statewide Water Conservation	Water suppliers must reduce urban per capita water consumption 20% from a baseline level by 2020.	Department of Water Resources

Regional

Regional agencies have a role in identifying more localized plans and priorities than the State and Federal governments. Two agencies in particular, the Southern California Association of Governments (SCAG) and the South Coast Air Quality Management District (SCAQMD), provide regional planning and air quality standards that affect the City and can provide funding sources for implementing the EECAP.

Southern California Association of Governments

SCAG undertakes regional planning for the six-county region of Los Angeles, Orange, Riverside, San Bernardino, Imperial, and Ventura counties. SCAG's efforts focus on developing regional strategies to minimize traffic congestion, promote environmental quality, and provide adequate housing. The Regional Comprehensive Plan and Guide sets forth broad goals intended to be implemented by participating local and regional jurisdictions and SCAQMD. SCAG has adopted companion documents to the Regional Comprehensive Plan and Guide, most notably the Regional Transportation Plan.

SCAG worked with the Los Angeles County Metropolitan Transportation Authority, elected officials, and local jurisdictions in Los Angeles County to develop the 2012–2035 Regional Transportation Plan and Sustainable Communities Strategy (RTP/SCS). The long-range plan improves overall mobility, reduces GHG emissions and enhances the quality of life for the region's residents. Approved by state and federal agencies in June 2012, the plan includes $180 billion in transportation projects for Los Angeles County. The RTP/SCS will be updated every four years and some of the projects will result in benefits to the City and sub-region.

South Coast Air Quality Management District

The South Coast Air Quality Management Plan (AQMP) is a comprehensive program designed to bring the South Coast Air Basin into compliance with all federal and State air quality standards. The AQMP was prepared and adopted by SCAG and the SCAQMD. Because of the importance of motor vehicles as a pollution source, the AQMP places substantial emphasis on reducing motor vehicle miles traveled. Cities can facilitate this by taking an active role in solving air pollution problems through adoption of trip reduction ordinances at the local level, the adoption of Air Quality Elements of City general plans, and the implementation of land use policies that mitigate the negative traffic impacts of land development. A major strategy for the SBCCOG and the South Bay cities to improve air quality standards and reduce vehicle emissions has been, and will continue to be, to promote alternative fueled vehicles both in municipal fleets and through building the supporting infrastructure in the South Bay sub-region.

The Role of the South Bay Cities Council of Governments

This EECAP is developed through the South Bay Cities Council of Governments (SBCCOG), which received funding from SCE's 2013-2014 Local Government Partnership Strategic Plan Pilots program. SBCCOG is a joint powers authority of 16 cities and contiguous unincorporated areas of the County of Los Angeles. SBCCOG member cities include Carson, El Segundo, Gardena, Hawthorne, Hermosa Beach, Inglewood, Lawndale, Lomita, Manhattan Beach, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, Torrance, and the Harbor City/San Pedro communities of the City of Los Angeles, along with the County of Los Angeles District 2 and 4 unincorporated areas (Figure 6). The 15 communities served by Southern California Edison (SCE) are participating in this effort. This excludes the City of Los Angeles, which obtains its electricity through the Los Angeles Department of Water and Power.

Source: http://www.southbaycities.org/

Figure 6 South Bay Member Cities

The SBCCOG has demonstrated its commitment to increasing environmental quality and awareness among its residents, local businesses, and jurisdictions while maintaining economic prosperity through effective sub-regional coordination. The effort also helps the SBCCOG meet the first goal (Goal A) of its Strategic Plan for Environment, Transportation and Economic Development: to facilitate, implement and/or educate members and others about environmental, transportation and economic development programs that benefit the South Bay.

SBCCOG has assisted the South Bay sub-region in related programs and policies, including many of the resources identified later in this EECAP. SBCCOG assisted the 15 participating cities to develop individual EECAPs, such as this report, resulting in cost-effectiveness and sub-regional coordination. SBCCOG also developed a sub-regional EECAP that identifies the cumulative efforts for the South Bay and identifies synergies that may compound the success of each city's EECAP by coordinating implementation of shared strategies and positioning the sub-region for unique funding opportunities.

City Profile

Setting

The City of Redondo Beach is a community of approximately 67,000 residents and 29,000 households. The City's population is about 64 percent White, 15 percent Hispanic, 12 percent Asian, 3 percent African American, and 5 percent other races/ethnicities.

Table 8 Demographic Data for 2005, 2007, 2010, and 2012

	2005	2007	2010	2012	% Change 2005-2012
Population	65,931	65,738	66,716	67,007	1.6%
Households	28,740	28,784	29,011	29,016	1.0%
Jobs	30,079	31,294	28,666	29,249	-2.8%
Service Population (Population + Jobs)	96,010	97,032	95,382	96,256	0.3%

The median age of residents is 40 and the median household income is around $87,000 (Figure 7).

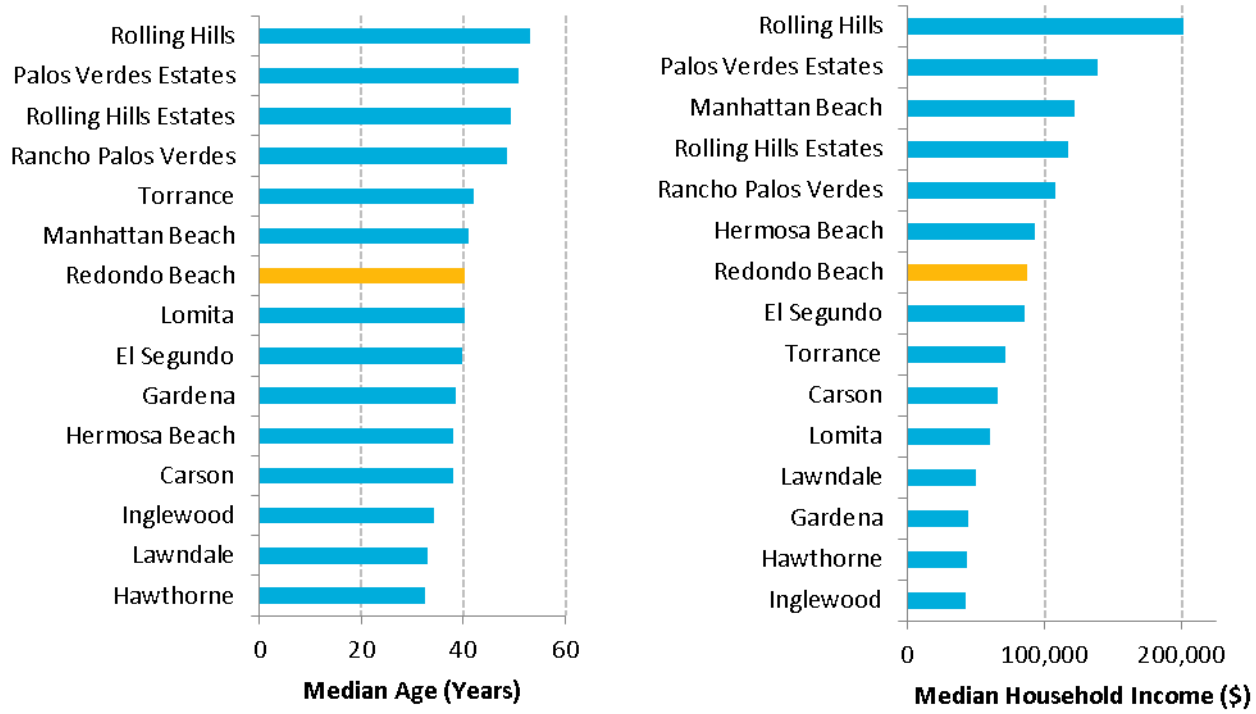

Figure 7 2012 Median Age and Household Income for Cities within the South Bay Sub-region

Existing Sustainability Efforts

The City has a number of policies, plans, and programs that demonstrate its ongoing commitment to sustainability, energy efficiency, and GHG emissions reductions. These are highlighted below.

General Plan Policies

The Redondo Beach General Plan serves as the City's guide for long range planning of physical development within the community. The General Plan's Circulation Element (updated in 2009) and the Housing Element (updated in 2012) contain a number of policies that reduce energy and GHG emissions. Table 9 summarizes these relevant policies.

Table 9 Redondo Beach General Plan Policies Related to Energy, Water, and GHG Reductions

Source	Element	Objective	Policy
Energy	Circulation Element	Reducing Transportation Emissions	1, 2, 4, 17, 19, 20, 21
	Circulation Element	Alternative Transportation	22, 23, 24, 25, 26, 27, 28, 29, 30
	Housing Element	Green Building Methods	2.5

Source: City of Redondo Beach General Plan (2009 and 2012)

Energy Leadership Partnership

Redondo Beach is a Silver member of the SCE's Energy Leader Partnership (ELP) program based on their energy efficiency accomplishments to date. The ELP program is a framework that offers enhanced rebates and incentives to cities that achieve measurable energy savings, reduce peak-time electricity demand and plan for energy efficiency. The program has a tiered incentive structure with threshold criteria required to trigger advancement to the next level of participation.

Property Assessed Clean Energy Financing

Property Assessed Clean Energy (PACE) is a mechanism to finance energy efficiency, renewable energy, and water conservation upgrades to residential and commercial facilities. Financing is repaid as a special assessment on their property tax, allowing the home or business owner to finance improvement projects that will result in GHG reductions without needing up-front capital.

The City of has adopted a resolution to participate in Los Angeles PACE. This financing option is available to Los Angeles County commercial, industrial and multi-family property owners to fund on-site energy efficiency, renewable energy and water-saving improvements. Under the program, the County issues a bond to a lender, which secures funding for the construction of the energy upgrade. Property owners then repay financing twice a year through an assessment on their property tax bill.

South Bay Bicycle Master Plan

The South Bay Bicycle Master Plan is intended to guide the development and maintenance of a comprehensive bicycle network and develop a set of programs and policies throughout the South Bay Region. The participating cities include El Segundo, Gardena, Hermosa Beach, Lawndale, Manhattan Beach, Redondo Beach, and Torrance. The multi-city bicycle master plan encourages the replacement of

vehicular trips with bicycle trips, which has a measurable impact on reduced fuel consumption and subsequently fewer mobile source pollutants.

car2go Program

car2go launched in six South Bay cities, including Redondo Beach, in spring 2014 and provides a car sharing service that can reduce the need for second or third vehicles per household. The program will advance the City's sustainability objectives, facilitate efficient use of resources, and reduce traffic congestion and individual vehicle use.

Beach Cities Livability Plan

In 2011, Hermosa Beach, Redondo Beach and Manhattan Beach City Councils adopted the Beach Cities Livability Plan. The plan analyzes the built environment and provides a framework to improve livability and well-being through land use and transportation systems. The plan consists of goals and recommendations for safe walking and biking conditions and sustainable transportation choices. Implementation of this plan not only improves support for walking and biking, but also reduces congestion and improves air quality.

Other

Sustainable Development Plan. In 2004, the City created a Strategic Plan to encourage and promote sustainable development through policies, strategies, and programs. The plan's goals include increasing community awareness of sustainable development, revising codes to promote sustainable urban design, sustainable building practices in City projects, increasing water and energy resource conservation, and increasing sustainable transportation practices.

Sustainable City Plan. The City's Green Task Force created the Sustainable City Plan, presented to City Council in 2008. The plan is a compilation of sustainable recommendations addressing five issue areas, including Economic Vitality and Regional Issues; Housing and Building; Open Space, Land Use and Trees; Resource Conservation; and Transportation. The plan consists of benefits, funding, and goals of recommended environmental programs.

The City of Redondo Beach's website includes a number of suggested energy conservation steps for residents and businesses. In addition, it offers a list of recommended trees and water conserving plants for water efficient landscaping.

Finally, SBCCOG recognizes the City's existing and ongoing efforts in reducing GHG emissions and gaining energy efficiency. As identified by the City, the following additional strategies are currently being implemented:

- Single-family curbside compost collection program
- Carpooling among City employees
- Shuttle services to activity areas


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Chapter 2
GHG Emissions, Forecasts, and Reduction Targets

Key Findings

Community

- The City of Redondo Beach increased emissions less than 1% from 2005 to 2012, from 522,168 MT CO_2e to 523,400 MT CO_2e.
- Commercial Energy, Solid Waste, Water, Wastewater, and Off-road Sources sector emissions decreased while On-road Transportation and Residential Energy sectors increased emissions from 2005 to 2012.
- Energy-related emissions account for nearly 46% of the total community emissions in 2005 and 45% of total emissions in 2012.
- Under the Adjusted Business-as-Usual (BAU) forecast, emissions will be 470,593 MT CO_2e in 2020 and 407,422 MT CO_2e in 2035. These emissions levels are nearly 10% lower in 2020 than 2005 and nearly 22% lower in 2035 than 2005.

Municipal

- Municipal emissions have increased 12% from 2005 to 2012, from 7,191 MT CO_2e to 8,062 MT CO_2e.
- Emissions in Solid Waste and City-Owned Outdoor Lights decreased, while emissions from Buildings & Facilities, Vehicle Fleet & Equipment, Employee Commute, Water Delivery, and SCE-Owned Outdoor Lights increased.
- Municipal emissions are a subset of community emissions and account for about 1% of total community emissions.
- Under the Adjusted BAU forecast, emissions will be 7,799 MT CO_2e in 2020 and 2035. These emissions levels are 8% higher than 2005 emission levels.

This chapter describes the City's community and municipal historic energy use and GHG emissions inventories, and projects future usage and emissions for the years 2020 and 2035. The target-setting section describes GHG reduction levels that the City has chosen for 2020 and 2035.

Specifically, this chapter includes (words and phrases in bold are described in Table 10:

- 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
- **Reduction targets** for 2020 and 2035.

Table 10 Key Terms in this Chapter

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.

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. The City has four years of historic inventories, which show the major sources of emissions and how those sources vary over time. 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

There are several types of GHGs and each GHG has a different capacity to trap heat. To report GHG emissions as a single number, emissions are reported in carbon dioxide equivalents, or CO_2e, with each

GHG normalized and calculated relative to CO_2 using its GWP. Table 11 describes the GHGs analyzed in this chapter, their symbol, GWP, and primary community sources of emissions. More detail regarding the GHGs can be found in the Inventories, Forecasts, and Target-Setting Report, Appendix A.

Table 11 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). The sectors evaluated for the inventories are summarized in Figure 8. More detail can be found in Appendix A.

Community 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 vehicles traveling (wholly or partially) within the City.

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.

Municipal Sectors

Buildings and Facilities includes energy use by the government, including electricity and natural gas.

SCE-owned Streetlights includes energy for streetlights on fixtures owned by SCE.

City-owned Outdoor Lights includes energy for streetlights and traffic signals on fixtures owned by the City.

Water Delivery 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.

Figure 8 Community and Municipal GHG Emission Sectors

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 A.

Community Emissions

The City of Redondo Beach increased emissions less than 1% from 2005 to 2012, from 522,168 MT CO_2e to 523,400 MT CO_2e. Commercial Energy, Solid Waste, Water, Wastewater, and Off-road Sources sector emissions decreased while On-road Transportation and Residential Energy sectors increased emissions from 2005 to 2012.

As shown in Table 12 and Figure 9, the Transportation sector was the largest contributor to emissions in both 2005 (49%) and 2012 (51%) by producing 246,707 MT CO_2e in 2005 and 265,512 MT CO_2e in 2012. This change represents a nearly 8% increase in emissions from 2005 to 2012. Commercial/Industrial energy is the second-largest contributor to emissions, adding 28% in 2005 and 26% in 2012. While the proportion of emissions did not change significantly over time, the total emissions decreased by 4% from 2005 to 2012, from 142,679 MT CO_2e to 137,031 MT CO_2e. The proportion of emissions from the Residential sector was also steady, at 18% in 2005 and 19% in 2012, although total emissions increased by less than 6%, from 95,616 MT CO_2e in 2005 to 101,010 MT CO_2e in 2012. Solid Waste comprised 3% of the total (16,840 MT CO_2e) in 2005, and was reduced to 1% of the total (7,406 MT CO_2e) in 2012. Water emissions also comprised of 3% of the total (15,576 MT CO_2e) in 2005 and reduced to 2% (10,332 MT CO_2e) in 2012. Wastewater and Off-road Sources made up the remaining emissions in each year. Wastewater and Off-road Sources emissions declined from 2005 to 2012. Off-road Sources comprise a very small percentage of overall emissions, but are variable primarily due to construction-related emissions, which are based on the level of development estimated in the City each year.

Table 12 Community GHG Emissions by Sector for 2005 and 2012

Sector	2005 (MT CO_2e)	2012 (MT CO_2e)	% Change 2005 to 2012
On-road Transportation	246,707	265,512	7.6%
Commercial Energy	142,679	137,031	-4.0%
Residential Energy	95,616	101,010	5.6%
Solid Waste	16,840	7,406	-56.0%
Water	15,576	10,332	-33.7%
Off-road Sources	4,492	1,906	-57.6%
Wastewater	258	203	-21.3%
Total	522,168	523,400	0.2%

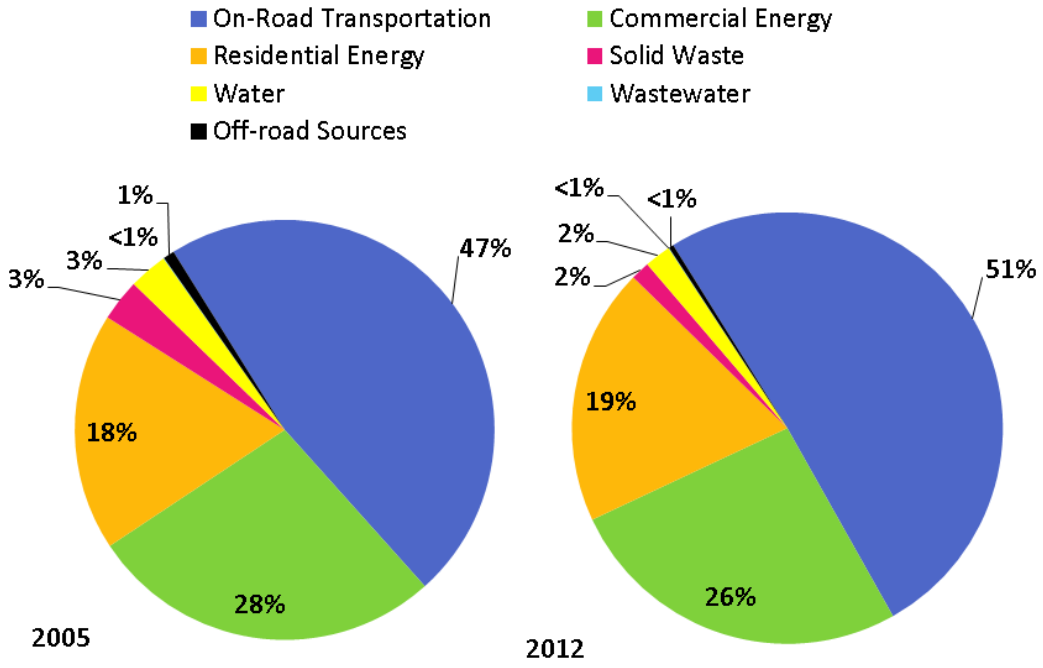


Figure 9 Community GHG Emissions by Sector for 2005 and 2012

Figure 10 shows 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.

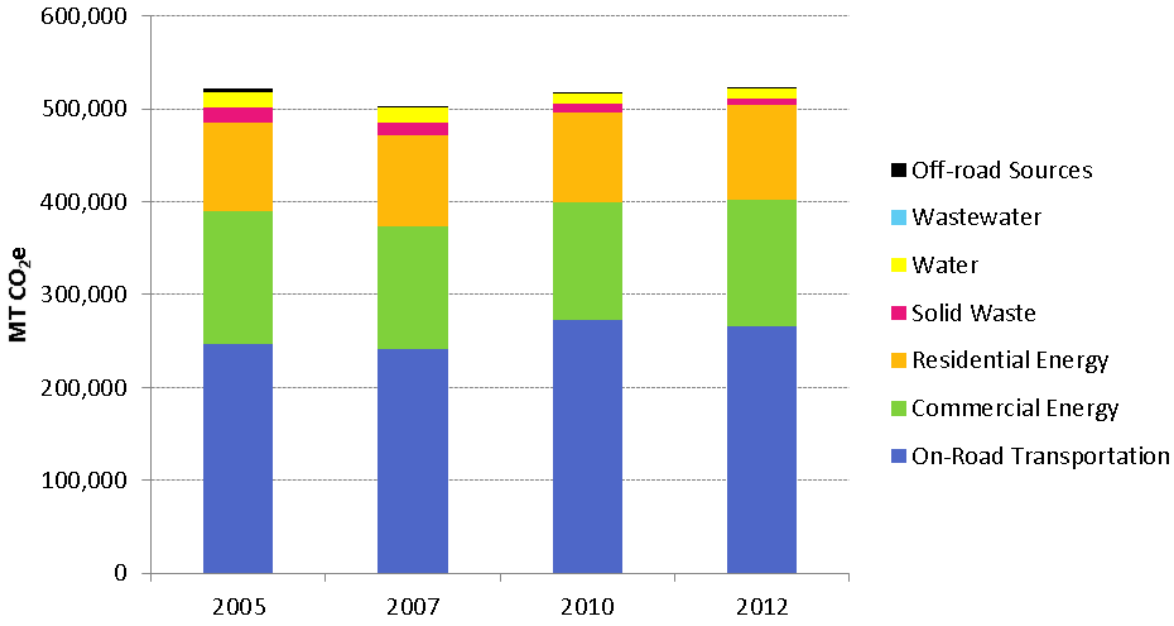


Figure 10 Community GHG Emissions for 2005, 2007, 2010, and 2012

Table 13 summarizes activity data for each sector and subsector. Residential electricity, Residential natural gas, recycled water, wastewater, and some Off-road Sources (industrial, light commercial, recreation, and agriculture) increased from 2005 to 2012, while Commercial electricity, Commercial natural gas, Solid Waste, Water, and some Off-road Sources (Lawn and Garden, and Construction) decreased from 2005 to 2012. Wastewater and Off-road Source emissions use indicator data to attribute county-level emissions to the City and the indicator data are also shown in Table 13. Notably, while On-road Transportation emissions increased nearly 8% between 2005 and 2012, vehicle miles traveled increased by 14%. The difference reflects that for each vehicle mile traveled, fewer emissions are generated due to improvements in the fuel efficiency of vehicles.

Table 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	471,782,607	465,368,722	538,938,917	538,339,762	14.1%
Residential Energy[1]					
Electricity (kWh)	146,624,086	154,752,638	153,965,618	153,829,706	4.9%
Natural Gas (therms)	9,604,693	10,070,195	10,000,521	9,744,860	1.5%
Commercial/Industrial Energy[1]					
Electricity (kWh)	342,048,319	347,205,566	335,044,830	334,749,071	-2.1%
Natural Gas (therms)	7,290,573	6,099,800	5,748,231	5,638,732	-22.7%
Solid Waste					
Landfilled (tons)	65,115	52,029	37,585	29,881	-54.1%
ADC (tons) [2]	5,215	6,696	123	278	-94.7%
Water and Wastewater					
Water (MG)[3]	2,933	2,935	2,745	2,802	-4.5%
Recycled Water (MG)[3]	20	20	17	20	1.1%
Wastewater (City portion of countywide residents)	0.67%	0.67%	0.68%	0.68%	0.9%
Off-road sources[4] (% of LA County emissions attributed to the City)					
Lawn & Garden (% Households)	0.90%	0.89%	0.89%	0.89%	-2.0%
Construction (% Building permits)	1.62%	0.77%	0.60%	0.59%	-63.9%
Industrial (% Manufacturing jobs)	0.47%	0.49%	0.49%	0.49%	4.1%
Light Commercial (% Other jobs)	0.69%	0.72%	0.71%	0.72%	3.9%
Recreation (Population weighted by income)	1.10%	1.10%	1.12%	1.10%	0.1%
Agriculture (% Ag. Jobs)	0.22%	0.23%	0.27%	0.34%	54.5%

1 2010 Electricity data provided as a single number by SCE. Data were apportioned using Residential/Non-residential proportion in 2012.

2 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.

3 Includes Golden State Water, Cal Water, and Municipal water. 2005 and 2007 Cal Water data was unknown; therefore 2009 data was used as proxy.

4 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.

Municipal Emissions

Emissions from the City's municipal operations account for about 1% of community emissions and have increased 12% from 2005 to 2012, from 7,191 MT CO_2e to 8,062 MT CO_2e. The City's Vehicle Fleet & Equipment sector had the largest percentage of emissions in 2005 (35%) and 2012 (32%). Although its percentage of the total emissions decreased, the sector's emissions increased 3% over the period, from 2,515 MT CO_2e to 2,591 MT CO_2e. Buildings & Facilities was the sector with the second largest percentage of emissions in 2005 (21%) and 2012 (28%) and emissions increased 52% over the period, from 1,506 to 2,293 MT CO_2e (Figure 11). A few projects that took place between 2005 and 2012 are the main contributors to the large increase in emissions for the Buildings & Facilities sector. The Community Service Department was relocated to a new office in 2011. Also, the first half of the "Reinventing the Pier" project was completed in 2012, which created about 30 new accounts that used energy. City-Owned Outdoor Lights accounted for 15% of emissions in 2005 (1,103 MT CO_2e) and its emissions decreased 42% by 2012, accounting for 8% of the total emissions (644 MT CO_2e). Solid Waste emissions also decreased over the period, from 934 MT CO_2e in 2005 (13%) to 719 MT CO_2e in 2012 (9%). Employee Commute increased emissions 122% over the same period (from 517 MT CO_2e to 1,150 MT CO_2e), and became the third highest-emitting sector for 2012. SCE-Owned Outdoor Lights accounted for 7% of emissions in 2005 and 2012, and emission increased from 508 to 542 MT CO_2e in that period. Some City-Owned Outdoor Lights accounts have been re-categorized to SCE-Owned Outdoor Lights from 2005 to 2012 for improved accuracy of categorization. This change may partially contribute to the increase in SCE-Owned Outdoor Lights emissions as well as the decrease in City-Owned Outdoor Lights. Emissions from the Water Delivery sector accounts for the remaining emissions, accounting for 2% of total emissions. Emissions from this sector increased slightly from 2005 to 2012. The 2005 and 2012 emissions and changes are detailed in Table 14.

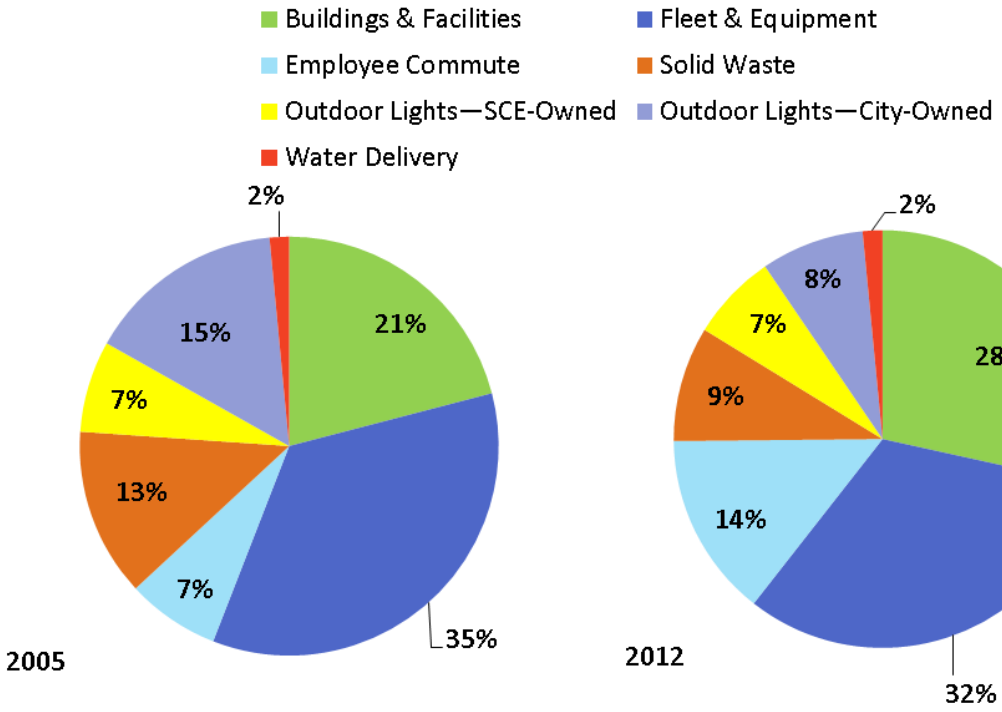


Figure 11 Municipal GHG Emissions by Sector for 2005 and 2012

Table 14 Municipal GHG Emissions by Sector for 2005 and 2012

Sector	2005 (MT CO_2e)	2012 (MT CO_2e)	% Change 2005 to 2012
Fleet & Equipment	2,515	2,591	3%
Buildings & Facilities	1,506	2,293	52%
Outdoor Lights—City-Owned	1,103	644	-42%
Solid Waste	934	719	-23%
Employee Commute	517	1,150	122%
Outdoor Lights—SCE-Owned	508	542	7%
Water Delivery	108	123	14%
Total	7,191	8,062	12.1%

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

Figure 12 shows the municipal GHG emissions by sector for all inventory years and activity data are shown in Table 15. Emissions were highest in 2010 (8,112 MT CO_2e) and were the lowest in 2005 (7,191 MT CO_2e), although the proportion of emissions from each sector has remained relatively constant over the four years.

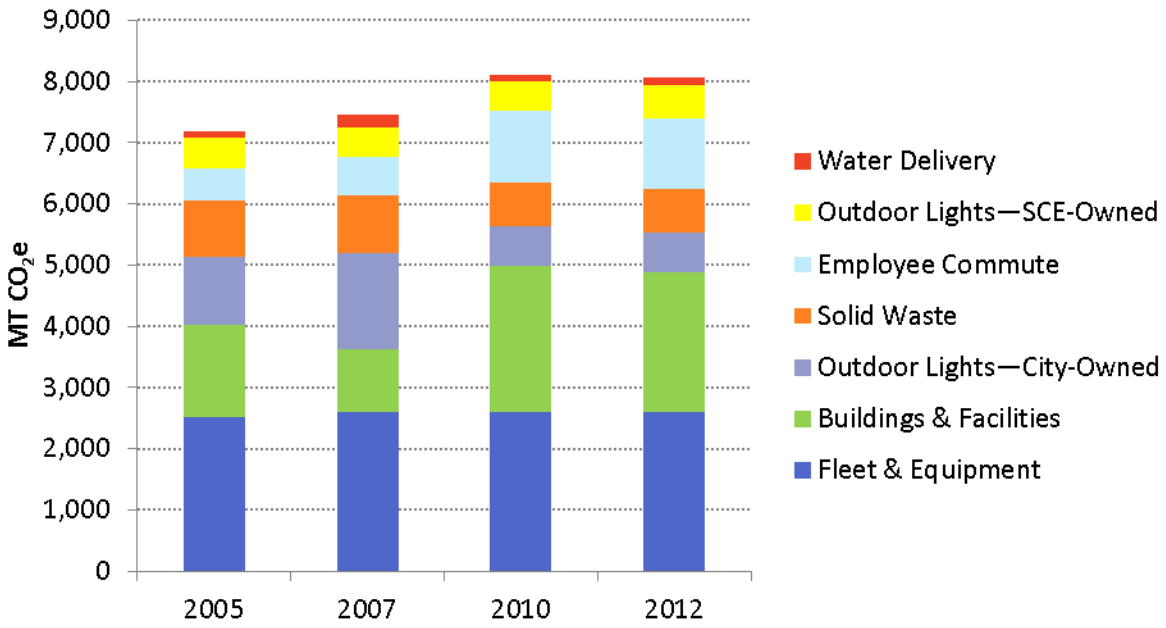


Figure 12 Municipal GHG Emissions for 2005, 2007, 2010, and 2012

Table 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)	3,936,848	2,141,762	5,211,828	5,468,451	39%
Natural Gas (therms)	58,223	79,039	166,989	102,505	76%
Outdoor Lights					
City-Owned (kWh)	3,629,352	5,460,241	2,294,375	2,014,756	-44%
SCE-Owned (kWh)	1,672,235	1,689,289	1,687,562	1,693,987	1%
Fleet & Equipment[1]					
City-Owned Fleet					
Gasoline (gallons)	77,007	76,482	76,482	76,482	-1%
Diesel (gallons)	22,837	19,794	19,794	19,794	-13%
CNG (standard cubic feet)	416,984	1,364,871	1,364,871	1,364,871	227%
Contracted Fleet					
Gasoline (gallons)	11,568	11,387	11,387	11,387	-2%
Diesel (gallons)	949	1,131	1,131	1,131	19%
LNG (gallons)	264,603	274,865	274,865	274,865	4%
Employee Commute					
Gasoline (vehicle miles traveled)	1,251,819	1,527,802	2,810,571	2,810,571	125%
Diesel (vehicle miles traveled)	0	795	33,104	33,104	--
Full-time Equivalent Employees[1]	613	715	715	715	17%
Solid Waste[1]					
Generated Waste (tons)	2,896	2,922	2,922	2,922	1%
Water Delivery					
Electricity (kWh)	356,744	678,407	399,307	385,378	8%

[1] Data for 2010 and 2012 were not available; 2007 data were used as a proxy.

Inventory Forecasts

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. The most relevant growth factors are used to project emissions by sector. Compound annual growth rates were developed using the growth projections from 2012 to 2020 and from 2021 to 2035, as shown Table 16.

In general, the City is expecting modest growth to 2020 and 2035 as population, housing, and jobs are all 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 16 Growth Factors for 2012, 2020, and 2035

Sector	Demographic Indicator	2012	2020	2035	2012-2020 CAGR	2020-2035 CAGR
Transportation	Vehicle Miles Traveled	538,339,762	490,579,902	507,671,090	-1.15%	0.23%
Solid Waste, Water, Wastewater, Off-road Sources	Service Population (Population + Jobs)	96,256	100,300	104,600	0.52%	0.28%
Commercial/ Industrial Energy	Jobs	67,007	69,700	73,000	0.49%	0.31%
NA[1]	Population	30,615	30,700	32,000	0.03%	0.28%
Residential Energy	Households	29,016	30,700	32,000	0.71%	0.28%
Municipal Jobs	Municipal Emissions[2]	715 FTE	715 FTE	715 FTE	0%	0%

[1] Not Applicable. Population data are shown for informational purposes but are not used for forecasting any sector.
[2] The number of jobs in the City is used as an indicator for all municipal operation emissions. As the City is not anticipating significant growth in municipal services, the number of jobs in 2020 and 2035 is assumed constant. 2012 data was not provided, therefore 2007 data was assumed
FTE: Full-time employees; CAGR: Compound annual growth rate.

Community Business-as-Usual Forecast

The City's BAU emissions in 2020 are estimated to be 527,294 MT CO_2e, or a 1% increase from baseline (2005) emissions. By 2035, emissions are estimated to increase nearly 5% from the baseline level to 546,714 MT CO_2e (Table 17).

Table 17 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	246,707	265,512	257,228	-3%	266,190	0%
Commercial Energy	142,679	137,031	142,859	4%	147,528	8%
Residential Energy	95,616	101,010	106,415	5%	110,921	10%
Solid Waste	16,840	7,406	7,699	4%	8,029	8%
Water	15,576	10,332	10,741	4%	11,201	8%
Off-road Sources	4,492	1,906	2,141	12%	2,625	38%
Wastewater	258	203	211	4%	220	8%
Total	522,168	523,400	527,294	0.7%	546,714	4%
% Change from 2005		0.2%	1.0%		4.7%	

Municipal Business-as-Usual Forecast

The City is not anticipating much 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 (Table 18). However, since 2012 emissions were slightly higher than the baseline year emissions, future municipal emissions are also projected to be higher than in 2005. In 2020 and 2035, municipal emissions are estimated to be 12% above baseline emissions.

Table 18 Municipal 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
Vehicle Fleet	2,515	2,591	2,591	0%	2,591	0%
Outdoor Lights	1,611	1,186	1,186	0%	1,186	0%
Buildings & Facilities	1,506	2,293	2,293	0%	2,293	0%
Solid Waste	934	719	719	0%	719	0%
Employee Commute	517	1,150	1,150	0%	1,150	0%
Water Delivery	108	123	123	0%	123	0%
Total	7,191	8,062	8,062	0%	8,062	0%
% Change from 2005		12%	12%		12%	

Adjusted Business-as-Usual Forecasts

State measures have been approved and/or adopted that will reduce GHG emissions in the City. These measures 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 legislation is 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[1]. 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.

[1] CARB Advanced Clean Cars Summary Sheet

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 obtains over 99% of their water from the Palos Verdes District served by the California Water Service Company, and less than 1% from Golden State Water Company. Therefore, the level of implementation of SB X7-7 was estimated using an annualized reduction rate from California Water Service Company's goal.

Community Adjusted Business-as-Usual Forecast

The City's Adjusted BAU emissions in 2020 are estimated to be 470,593 MT CO_2e in 2020 and 407,422 MT CO_2e in 2035 (Table 19). This change represents a nearly 10% decrease from 2005 by 2020 and nearly 22% 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 Commercial/Industrial Energy will increase. Emissions from Solid Waste are expected to increase over time but account for 2% of total emissions. Water &Wastewater emissions are expected to decrease over time.

Table 19 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	251,199	267,418	208,315	45%	137,734	35%
Commercial/ Industrial Energy	142,679	137,031	141,846	31%	145,549	37%
Residential Energy	95,616	101,010	105,935	23%	109,961	27%
Solid Waste	16,840	7,406	7,699	2%	8,029	2%
Water & Wastewater	15,834	10,535	6,798	1%	6,149	2%
Total	522,168	523,400	470,593	100%	407,422	100%
% Change from 2005		<1%	-10%		-22%	

Municipal Adjusted Business-as-Usual Forecast

The City's Municipal Adjusted BAU emissions in 2020 are estimated to be 7,799 MT CO_2e, which 8% above the 2005 baseline level (Table 20). Emissions are expected to remain constant through 2035, since the City is not anticipating major changes in municipal services through 2035. 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 20 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	2,515	2,591	2,409	31%	2,409	31%
Outdoor Lights	1,611	1,186	1,186	15%	1,186	15%
Buildings & Facilities	1,506	2,293	2,293	29%	2,293	29%
Solid Waste	934	719	719	9%	719	9%
Employee Commute	517	1,150	1,069	14%	1,069	14%
Water Delivery	108	123	123	2%	123	2%
Total	7,191	8,062	7,799	100%	7,799	100%
% Change from 2005		12%	8%		8%	

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[2]. 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 would need to reduce 26,750 MT CO_2e emissions below the Adjusted BAU scenario to meet the reduction target. In 2035, the City would need to reduce 141,116 MT CO_2e emissions below the Adjusted BAU scenario to meet the State-aligned target (Table 21 and Figure 13). To sustain the progress achieved to date and continue progress beyond 2020, the City would need to implement new reduction measures or augment existing efforts. Early implementation of measures demonstrates the City's commitment to the EECAP and allows the City to phase implementation of new strategies so that ongoing reductions may be achieved. Ongoing implementation would also provide additional reductions that further help mitigate climate change and provide additional coverage if the State measures do not achieve their anticipated reductions.

[2] 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.

Table 21 State-Aligned Community GHG Reduction Targets

Sector	2005	2012	2020	2035
BAU Emissions (MT CO_2e)	522,168	523,400	527,294	546,714
Adjusted BAU Emissions (MT CO_2e)	522,168	523,400	470,593	407,422
State-Aligned Target (% change from 2005)			-15%	-49%
State-Aligned Target (% change from 2012)			-15%	-49%
State-Aligned Emissions Goal (MT CO_2e)			443,843	266,306
Reductions from Adjusted BAU needed to meet the Target (MT CO_2e)			26,750	141,116

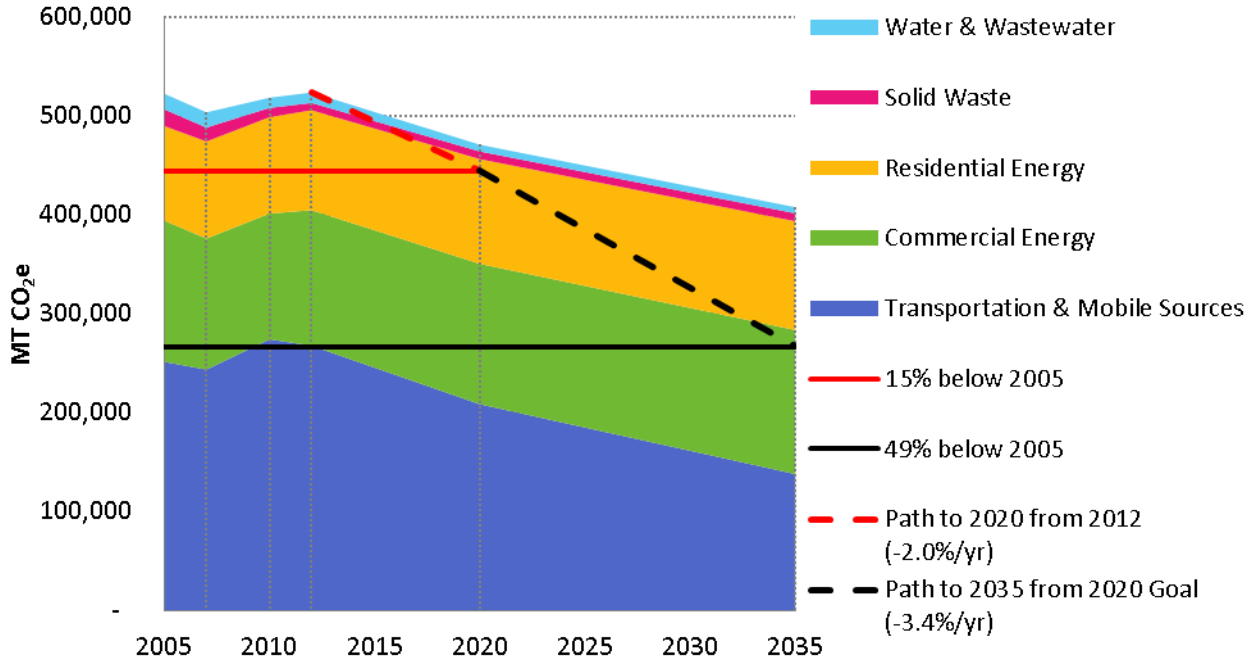


Figure 13 Community Emissions Inventories, Projections, and Targets

Recommended Municipal Targets

In 2020, the City would need to reduce its emissions by 1,687 MT CO_2e from the 2020 Adjusted BAU forecast to achieve a reduction goal consistent with the State (Table 22 and Figure 14). In addition, the City will need to implement measures to continue to achieve 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 would need to reduce municipal operation emissions by 4,132 MT CO_2e from a 2035 Adjusted BAU forecast to meet a 49% reduction goal (below 2005 levels).

Table 22 State-Aligned Municipal GHG Reduction Targets

Sector	2005	2012	2020	2035
BAU Emissions (MT CO_2e)	7,191	8,062	8,062	8,062
Adjusted BAU Emissions (MT CO_2e)	7,191	8,062	7,799	7,799
State-Aligned Target (% change from 2005)			-15%	-49%
State-Aligned Target (% change from 2012)			-24%	-55%
State-Aligned Emissions Goal (MT CO_2e)			6,112	3,667
Reductions from Adjusted BAU needed to meet the Target (MT CO_2e)			1,687	4,132

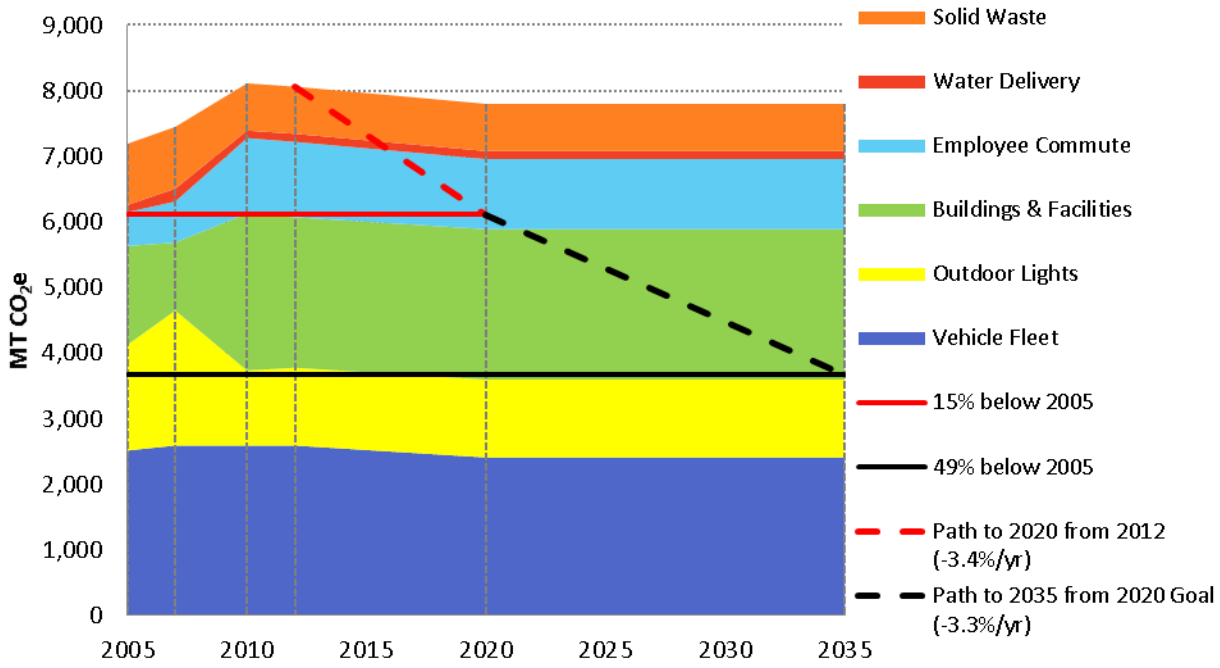


Figure 14 Municipal Emissions Inventories, Projections, and Targets

Chapter 3
Energy Profile

Key Findings

Community

- Energy accounted for 45% of all community GHG emissions in 2012.
- Residents emit more GHGs from natural gas consumption than electricity consumption.
- Energy use is declining in Commercial/Industrial electricity and natural gas.

Municipal

- Energy accounted for 45% of all municipal GHG emissions in 2012.
- Buildings & Facilities and City-owned Outdoor Lights account for the majority of electricity use in municipal operations.

The EECAP ultimately will focus on increasing energy efficiency and reducing GHG emissions from energy; therefore, it is important for the City to understand its current energy consumption to make informed decisions for reducing energy-related emissions.

Community Energy Use

Community energy use consists of electricity and natural gas. Emissions from Commercial/Industrial and Residential energy use account for nearly 46% of the total community emissions in 2005 and 45% in 2012. Table 23 shows the breakdown in activity (kWh or therms) and GHG emissions by sector and energy source.

Table 23 Activity Data and GHG Emissions of Energy in 2005 and 2012 (Community)

	2005		2012			
Sector	Activity (kWh or therms)	Emissions (MT CO_2e)	Activity (kWh or therms)	Emissions (MT CO_2e)	% Change in Activity 2005-2012	% Change in Emissions 2005-2012
Commercial/ Industrial						
Electricity	342,048,319	103,912	334,749,071	107,047	-2.1%	3.0%
Natural Gas	7,290,573	38,767	5,638,732	29,984	-22.7%	-22.7%
Residential						
Electricity	146,624,086	44,543	153,829,706	49,192	4.9%	10.4%
Natural Gas	9,604,693	51,073	9,744,860	51,818	1.5%	1.5%
Total (MT CO_2e)		238,295		238,041		-0.1%

Commercial electricity use increased 2% between 2005 and 2012; however, emissions increased by 3%. Similarly, Residential electricity use increased by about nearly 5% but emissions increased by more than 10%. The difference between the change in activity data and emissions data 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 Redondo Beach, Commercial/Industrial natural gas consumption (therms) decreased by 23% from 2005 to 2012; therefore the emissions also declined 23%. Residential natural gas therms used and GHG emissions declined 1.5% from 2005 to 2012. Figure 15 shows the trend in electricity and natural gas emissions from 2005 to 2012 for the Commercial/Industrial and Residential sectors.

Energy Indicators

Increasing energy efficiency may be best achieved through targeted strategies. The following indicators from SCAG may be useful in identifying opportunities for energy conservation measures:

- The average household size is 2.3.
- Approximately 33 percent of households are single-person households.
- Over 51 percent of households are owner-occupied.
- 2,159 single-family housing permits were issued between 2000 and 2012.
- 219 multi-family housing permits were issued between 2000 and 2012.
- Approximately 53 percent of residential units are single family homes.
- The median home sales price is $640,000.
- Job sectors with the highest share of jobs were Leisure, Education, Professional, and Retail, accounting for 63 percent of jobs.

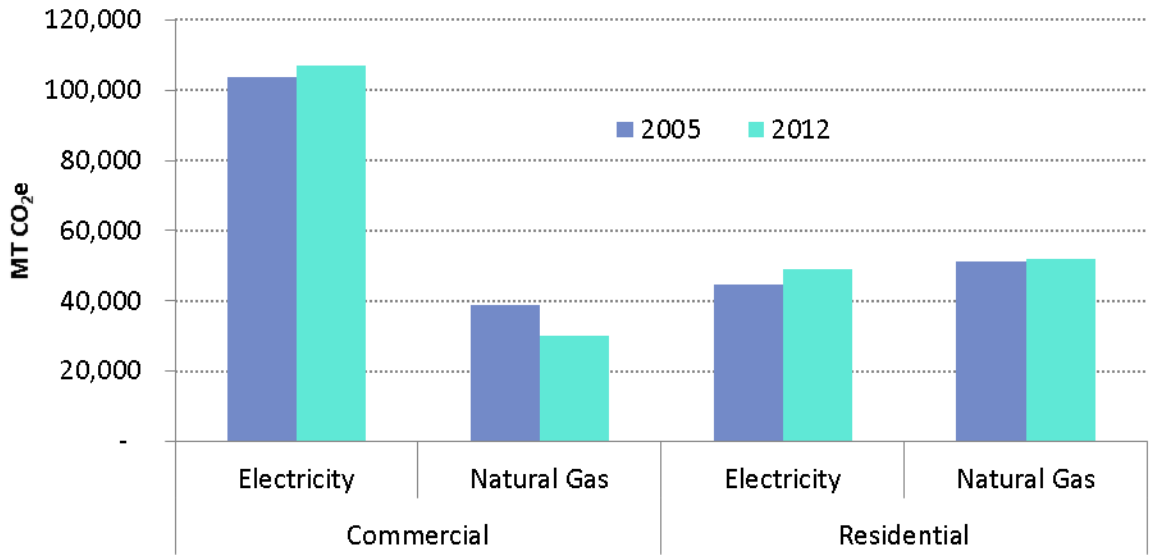


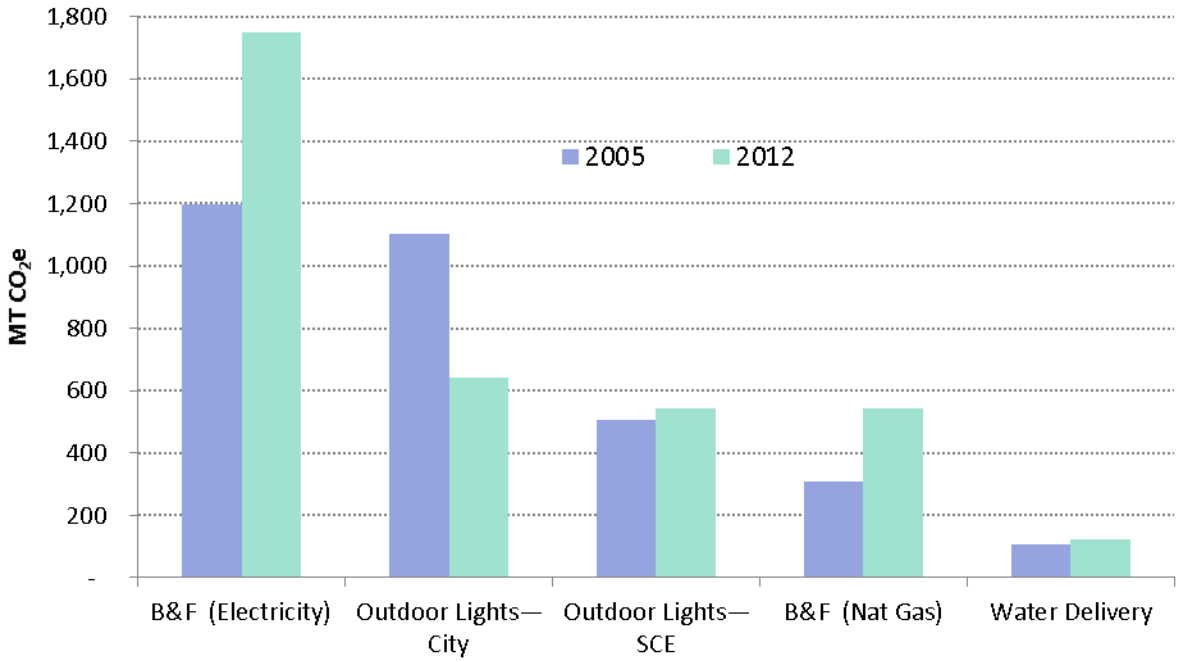
Figure 15 GHG Emissions for Community Electricity and Natural Gas, by Sector

Municipal Energy Use

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 45% of total emissions in 2005 and 2012. While both electricity and natural gas are used for Building & Facilities, Outdoor Lights and Water Delivery only use electricity. Emissions from energy increased 12% from 2005 to 2012; City-Owned Outdoor Lights showed decreases in energy-related emissions. Overall, electricity consumption (kWh) increased from 2005 to 2012, and electricity-based emissions increased 5%. As with community energy, municipal emissions use variable electricity emission factors and constant natural gas emission factors. Table 24 and Figure 16 show the trends in electricity and natural gas emissions from 2005 to 2012 for the municipal energy sector.

Table 24 Activity Data and GHG Emissions of Energy in 2005 and 2012 (Municipal)

Sector	2005 Activity (kWh or therms)	2005 Emissions (MT CO_2e)	2012 Activity (kWh or therms)	2012 Emissions (MT CO_2e)	% Change in Activity 2005-2012	% Change in Emissions 2005-2012
Buildings & Facilities						
Electricity	3,936,848	1,196	5,468,451	1,748	39%	46%
Natural Gas	58,223	310	102,505	545	76%	76%
Outdoor Lights—SCE Owned						
Electricity	1,672,235	508	1,693,987	542	1%	7%
Outdoor Lights—City Owned						
Electricity	3,629,352	1,103	2,014,756	644	-44%	-42%
Water Delivery						
Electricity	356,744	108	385,378	123	8%	14%
Total (MT CO_2e)		3,225		3,602		12%



Note: B&F indicates Buildings and Facilities.

Figure 16 GHG Emissions for Municipal Electricity and Natural Gas, by Sector

Chapter 4
Energy Efficiency Strategies

Key Findings

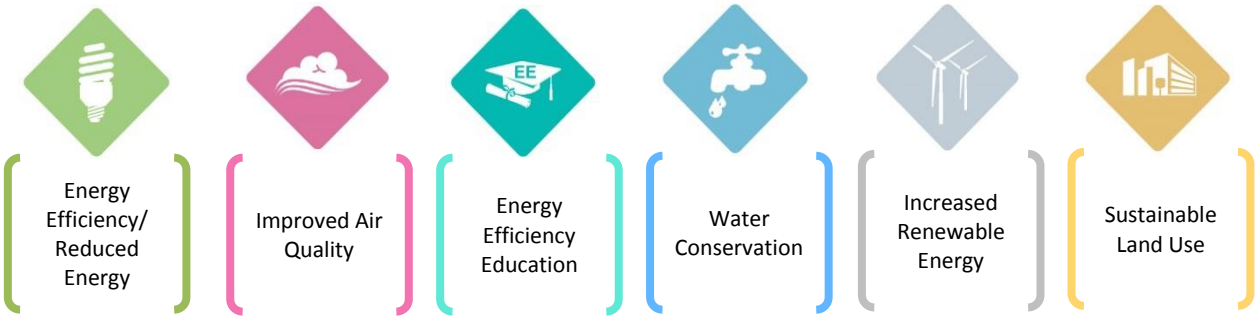
Community

- The City plans to implement energy efficiency (EE) strategies which increase EE in both existing and new residential and commercial development, increase EE through water efficiency, and decrease energy demand through reducing the urban heat island effect.
- The City, through its partnership with the South Bay COG, will obtain educational content, energy audit services, and assistance identifying potential funding sources to help implement strategies.
- These actions combined with state measures will lead to a 15% reduction from 2005 levels by 2020 and 47% reduction from 2005 levels by 2035.

Municipal

- The City plans to implement EE strategies which increase EE in municipal buildings and City infrastructure, promote EE through education, outreach, and planning efforts, and reduce energy consumption in the long term.
- The City, through its partnership with the South Bay COG, will obtain recognition for EE achievements and energy audit services.
- These actions combined with state measures will lead to a less than 1% reduction from 2005 levels by 2020 and 17% reduction from 2005 levels by 2035.

The City will achieve significant GHG emissions reductions through legislation adopted and implemented at the State level and quantified in Chapter 3. This Chapter summarizes existing programs and the proposed reduction measures to be implemented by the City or SBCCOG to further reduce GHG emissions. Each measure includes the energy (kilowatt hours and/or therms) savings, GHG reduction potential, and additional community co-benefits. The co-benefits describe the additional community benefits from implementing the reduction measure beyond the GHG emissions reduced. The following icons are used to indicate the co-benefits for each measure:



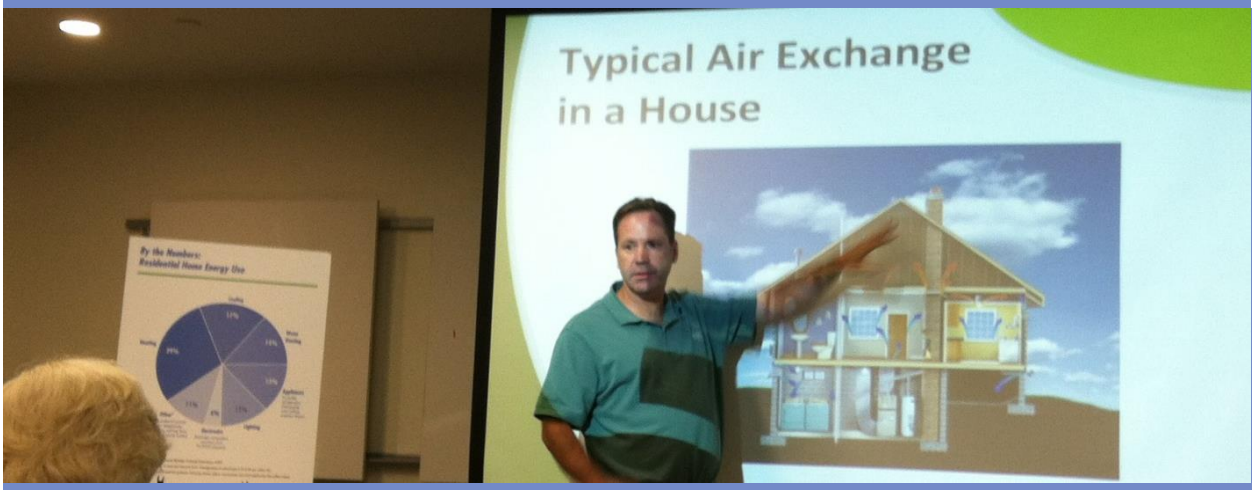
Community Energy Efficiency Strategies

Goal 1: Increase Energy Efficiency (EE) in Existing Residential Units

Measure 1.1: EE Training, Education, and Recognition

GHG Reduction Potential
Supporting Measure

Estimated Energy Savings in 2020
Supporting Measure



Co-Benefits

Opportunities for residents to improve energy efficiency in their homes range from changes to behavior that they can start today to physical modifications or improvements they can make to their homes. This measure will provide City staff with a framework to educate community members about behavioral and technological changes that can increase energy efficiency.

Actions:

- Post links on website/social media and provide materials at public events
- Email list for email blasts of new information or trainings
- Establish an annual EE Fair
- Create a resource center
- Hire/Designate Energy Advocate
- Partner with South Bay Cities Council of Governments (SBCCOG) and Utilities to obtain educational content

Measure 1.2: Increase Participation in Existing EE Programs

GHG Reduction Potential	Estimated Energy Savings in 2020
2020 – 50 $MTCO_2e$	78,373 kWh
2035 – 236 $MTCO_2e$	4,620 Therms

Co-Benefits

The City will work to increase residents' participation in existing energy efficiency programs that are low-cost or even provide a financial benefit to the resident. As part of the South Bay Energy Efficiency Partnership with SCE and SCG, the City will continue outreach efforts that are largely led by SBCCOG to promote energy awareness and existing programs and incentives that are offered for energy efficiency. Some examples of programs and resources are listed below:

- **Rebate programs** through SCE and SCG for appliances, air conditioner alternatives, electric water heaters, light bulbs, space heaters, water heaters, pool heaters, showerheads, washers, and insulation.
- **Demand Response programs** through SCE that provide on-bill credits including the Summer Discount Plan and Save Power Days Program.
- **Technical and financial assistance programs** through SCG's Direct Install Weatherization Program for income-qualified renters and homeowners.

As programs change over time, continued and up-to-date outreach is necessary. The actions detailed below would provide a variety of channels for ongoing communication to the City's residents.

Action:

- Partner with SBCCOG and Utilities for outreach events

Measure 1.3: Establish, Promote, or Require Home Energy Evaluations

GHG Reduction Potential	Estimated Energy Savings in 2020
Supporting Measure	Supporting Measure

Co-Benefits

Home energy evaluations are necessary to identify cost-effective opportunities for energy saving and for residents to take practical actions to achieve energy efficiency. Home energy evaluations can be established or promoted by a variety of existing programs.

Actions:

- Require third-party inspector to verify Title 24 or greater compliance to home upgrades (Alternative: Enhanced enforcement of Title 24 compliance)
- Promote home energy audits through programs such as Energy Upgrade California or other State programs
- Establish free "Energy Checkup" program with the assistance of the SBCCOG if funding can be obtained

Measure 1.4: Promote, Incentivize, or Require Residential Home Energy Renovations

GHG Reduction Potential	Estimated Energy Savings in 2020
2020 – 8,862 $MTCO_2e$	20,774,141 kWh
2035 – 42,096 $MTCO_2e$	417,341 Therms

Co-Benefits

Approximately 71 percent of residential buildings in the City were built before the adoption of Title 24. Buildings built before adoption of Title 24 are not energy efficient, and renovations would achieve higher energy efficiency. Many programs and incentives across the state or country help promote home energy renovations, including city-supervised funding, permit process improvements and city ordinance.

Actions:

- Promote existing incentivized programs such as Energy Upgrade California
- Promote Financing Programs such as PACE (Properly Assessed Clean Energy)
- Establish online permitting to facilitate permit processing

Goal 2: Increase Energy Efficiency in New Residential Development

Measure 2.1: Encourage or Require EE Standards Exceeding Title 24

GHG Reduction Potential
Supporting Measure

Estimated Energy Savings in 2020
Supporting Measure

Co-Benefits

This measure will develop City staff to become resources in encouraging and implementing energy efficiency building measures beyond that required in current Title 24 Standards. As part of the 2010 California Green Building Standards (CALGreen), a two-tiered system was designed to allow local jurisdictions to adopt codes that go beyond state standards. The two tiers contain measures that are more stringent and achieve an increased reduction in energy usage by 15% (Tier 1) or 30% (Tier 2) beyond Title 24. This measure will also ensure that as Title 24 Standards are updated, City staff are well-informed and can implement updates quickly and effectively.

Action:

- Establish online permitting to facilitate permit processing

Goal 3: Increase Energy Efficiency in Existing Commercial Units

Measure 3.1: EE Training and Education

GHG Reduction Potential
Supporting Measure

Estimated Energy Savings in 2020
Supporting Measure

Co-Benefits

Education is at the core of attaining energy efficiency goals. Creating a specific education measure will emphasize the critical role of education in achieving energy efficiency. An education measure will also provide City staff with a framework to interact with and educate community members about behavioral and technological changes that can increase energy efficiency.

Actions:

- Post links on website/social media and provide materials at public events
- Email list for e-mail blasts of new information or trainings
- Establish an annual EE Fair
- Create a resource center
- Hire/Designate Energy Advocate
- Partner with SBCCOG and Utilities to obtain educational content

Measure 3.2: Increase Participation in Existing EE Programs

GHG Reduction Potential	Estimated Energy Savings in 2020
2020 – 709 $MTCO_2e$	1,934,443 kWh
2035 – 3,369 $MTCO_2e$	17,049 Therms

Co-Benefits

The City will work to increase businesses' participation in existing energy efficiency programs that are low-cost or provide a financial benefit to the business. As part of the South Bay Energy Efficiency Partnership with SCE and SCG, the City will continue outreach efforts to promote the energy awareness and existing programs and incentives that are offered for energy efficiency. These outreach efforts are largely led by the SBCCOG. Some examples of programs and resources are listed below.

- **Rebate programs** through SCE and SCG for appliances, air conditioner alternatives, electric water heaters, light bulbs, space heaters, water heaters, and insulation.
- **Demand Response programs** though SCE that provide on-bill credits including the Summer Discount Plan and Save Power Days Program.

As programs change over time, continuous and up-to-date outreach will be necessary. The actions detailed below would provide a variety of channels for ongoing communication to the City's businesses.

Action:

- Partner with SBCCOG and Utilities for outreach events

Measure 3.3: Incentivize or Require Non-residential Energy Audits

GHG Reduction Potential	Estimated Energy Savings in 2020
2020 – 1,250 $MTCO_2e$	3,052,912 kWh
2035 – 5,936 $MTCO_2e$	51,425 Therms

Co-Benefits

Commercial energy audits are necessary to identify cost-effective opportunities for energy savings and for business owners to take practical actions to achieve energy efficiency. The audits can be established or promoted through various existing programs.

Actions:

- Promote energy audits such as through Energy Upgrade California or other state programs
- Require early adoption of AB 1103 for small buildings (5,000-10,000 square feet)

Measure 3.4: Promote or Require Commercial Energy Retrofits

GHG Reduction Potential	Estimated Energy Savings in 2020
2020 – 15,379 $MTCO_2e$	39,185,638 kWh
2035 – 73,052 $MTCO_2e$	535,680 Therms

Co-Benefits

As most commercial buildings were built before the adoption of Title 24, most of the facilities and equipment are not energy efficient. Therefore, retrofits are necessary to achieve higher energy efficiency. Many programs and incentives across the State or country help promote non-residential energy retrofits, including city-supervised funding, permit process improvements, and city ordinance.

Actions:

- Promote existing incentivized programs such as Energy Upgrade California
- Develop or promote a green building program
- Promote Financing Programs such as PACE (Properly Assessed Clean Energy)
- Establish online permitting to facilitate permit processing

Goal 4: Increase Energy Efficiency in New Commercial Development

Measure 4.1 Encourage or Require EE Standards Exceeding Title 24

GHG Reduction Potential
Supporting Measure

Estimated Energy Savings in 2020
Supporting Measure

Co-Benefits

City planners have a unique opportunity to inform developers of new energy efficiency opportunities and encourage them to adopt these technologies in new development. This measure will develop City staff to be resources in encouraging and implementing energy efficiency beyond that required by current Title 24 Standards. This will also ensure that as Title 24 Standards are updated, City staff are well-informed and can implement updates quickly and effectively.

Action:

- Establish online permitting to facilitate permit processing

Goal 5: Increase Energy Efficiency through Water Efficiency (WE)

Measure 5.1: Promote or Require WE through SBX7-7

GHG Reduction Potential
2020 – 715 $MTCO_2e$
2035 – 3,396 $MTCO_2e$

Estimated Energy Savings in 2020
2,235,594 kWh

Co-Benefits

SB X7-7, or The Water Conservation Act of 2009, requires all water suppliers to increase water use efficiency. The legislation set an overall goal of reducing per capita urban water consumption by 20 percent from a baseline level by 2020. This goal can be met by taking a variety of actions, including targeted public outreach and promoting water efficiency measures such as low-irrigation landscaping. Additional water conservation information, resource materials, education, and incentives are available through the West Basin Water District.

Actions:

- Post links on website/social media and provide materials at public events
- Email list for e-mail blasts of new information or trainings
- Require low-irrigation landscaping
- Partner with SBCCOG and Water District to obtain educational content
- Partner with SBCCOG and Water District for outreach events

Measure 5.2: Promote WE Standards Exceeding SB X7-7

GHG Reduction Potential
2020 – 3 MT CO_2e
2035 – 14 MT CO_2e

Estimated Energy Savings in 2020
9,422 kWh

Co-Benefits

In addition to SB X7-7, more actions are being studied or have been taken to exceed water efficiency standards. These efforts include education and outreach practices that could be combined with residential and commercial EECAP actions that emphasize the reuse of recycled/gray water and promote harvesting rainwater. Approximately 1,873 kWh can be saved for every acre foot (AF) of water use replaced by recycled water.[3]

Actions:

- Allow recycled or grey water uses for non-municipal uses
- Work with Water District to increase recycled water potential
- Promote rainwater harvesting rebates and demonstrations

[3] California Sustainability Alliance, The Role of Recycled Water in Energy Efficiency and Greenhouse Gas Reduction, May 2, 2008.

Goal 6: Decrease Energy Demand through Reducing Urban Heat Island Effect

Measure 6.1: Promote Tree Planting for Shading and EE

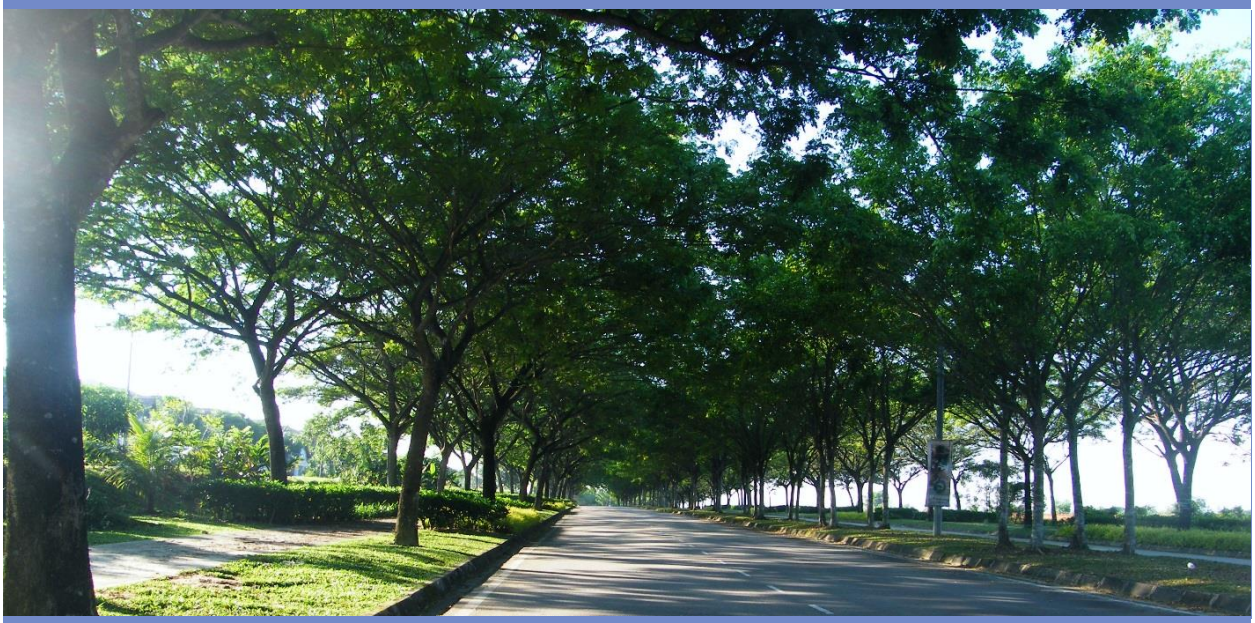
GHG Reduction Potential

2020 – 295 $MTCO_2e$

2035 – 1,399 $MTCO_2e$

Estimated Energy Savings in 2020

921,139 kWh



Co-Benefits

Trees and plants naturally help cool an environment by providing shade and evapotranspiration (the movement of water from the soil and plants to the air), making vegetation a simple and effective way to reduce urban heat islands. Shaded surfaces may be 20–45°F (11–25°C) cooler than the peak temperatures of un-shaded materials. In addition, evapotranspiration, alone or in combination with shading, can help reduce peak summer temperatures by 2–9°F (1–5°C). Furthermore, trees and plants that directly shade buildings can reduce energy use by decreasing demand for air conditioning.

Actions:

- Encourage tree planting at plan check
- Work with community to develop a tree-planting group
- Develop a City tree planting program

Summary of Community Reductions

By implementing these local reduction measures, the City would reduce its community GHG emissions associated with energy use by approximately 5% compared to the 2020 business-as-usual (BAU) emissions and 24% compared to the 2035 BAU emissions. Figure 17 depicts the sectors where the anticipated reductions will take place with the corresponding potential decreases, and Table 25 summarizes the energy efficiency strategies and the potential GHG reductions.

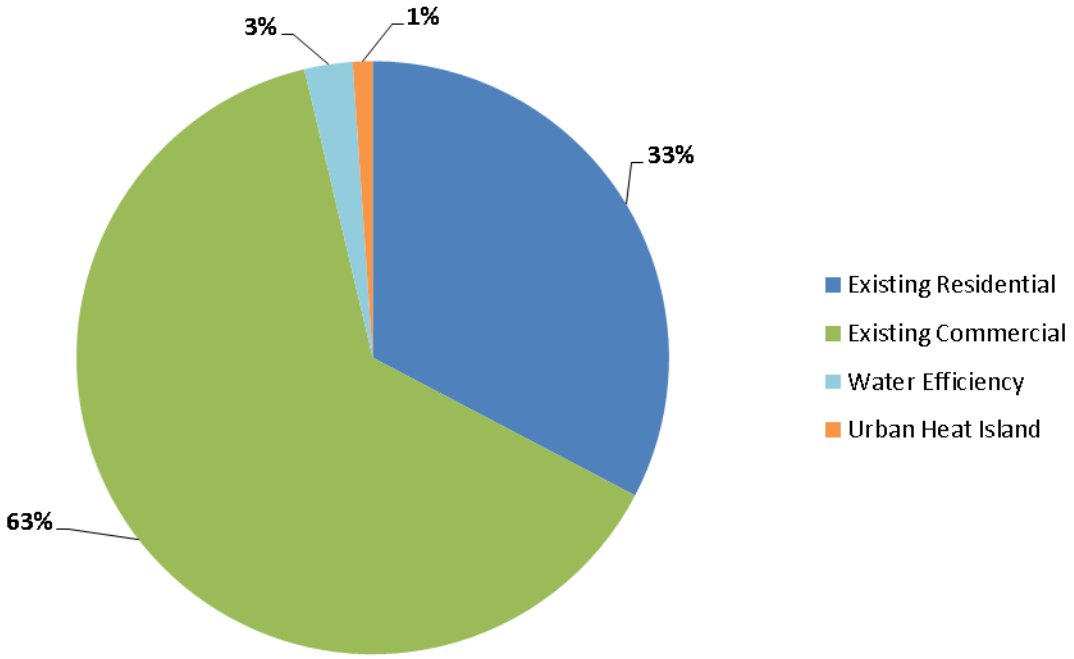


Figure 17 Local Reduction Quantification by Goal

Table 25 Community Energy Efficiency Strategies and GHG Reduction Potential

Measure No.	Measures	2020 Reductions			2035 Reductions		
		MT CO_2e	kWh	Therms	MT CO_2e	kWh	Therms
Goal 1: Increase Energy Efficiency (EE) in Existing Residential Units							
Measure 1.1	EE Training and Education	Supporting Measure					
Measure 1.2	Increase Participation in Existing EE Programs	50	78,373	4,620	236	372,271	21,947
Measure 1.3	Establish, Promote, or Require Home Energy Evaluations	Supporting Measure					
Measure 1.4	Promote, Incentivize, or Require Residential Home Energy Renovations	8,862	20,774,141	417,341	42,096	98,677,168	1,982,368
Goal 2: Increase Energy Efficiency in New Residential Development							
Measure 2.1	Encourage or Require EE Standards Exceeding Title 24	Supporting Measure					
Goal 3: Increase Energy Efficiency in Existing Commercial Units							
Measure 3.1	EE Training and Education	Supporting Measure					
Measure 3.2	Increase Participation in Existing EE Programs	709	1,934,443	17,049	3,369	9,188,606	80,984
Measure 3.3	Promote or Require Non-Residential Energy Audits	1,250	3,052,912	51,425	5,936	14,501,330	244,270
Measure 3.4	Promote or Require Commercial Energy Retrofits	15,379	39,185,638	535,680	73,052	186,131,781	2,544,478
Goal 4: Increase Energy Efficiency in New Commercial Development							
Measure 4.1	Encourage or Require EE Standards Exceeding Title 24	Supporting Measure					
Goal 5: Increase Energy Efficiency through Water Efficiency (WE)							
Measure 5.1	Promote or Require WE through SBX7-7	715	2,235,594	-	3,396	10,619,071	-
Measure 5.2	Promote WE Standards Exceeding SB X7-7	3	9,422	-	14	44,753	-
Goal 6: Decrease Energy Demand through Reducing Urban Heat Island Effect							
Measure 6.1	Promote Tree Planting for Shading and EE	295	921,139	-	1,399	4,375,411	-
Total		27,263	68,191,661	1,026,115	129,499	323,910,390	4,874,047

Municipal Energy Efficiency Strategies

Goal 1: Participate in Education, Outreach, and Planning Efforts for Energy Efficiency

Measure 1.1 Increase Energy Savings through the SCE Energy Leader Partnership

GHG Reduction Potential	Estimated Energy Savings in 2020
Supporting Measure	Supporting Measure

Co-Benefits

The Southern California Edison (SCE) Energy Leader Partnership (ELP) Program is a framework that offers enhanced rebates and incentives to cities that achieve measurable energy savings, reduce peak-time electricity demand, and plan for energy efficiency. This program also provides resources to cities to identify energy efficiency projects and technical assistance to implement them. The ELP has a tiered incentive structure with threshold criteria required to trigger advancement to the next level of participation. The City is currently at the Gold Level.

Goal 2: Increase Energy Efficiency in Municipal Buildings

Measure 2.1: Conduct Municipal Energy Audit

GHG Reduction Potential
Supporting Measure

Estimated Energy Savings in 2020
Supporting Measure

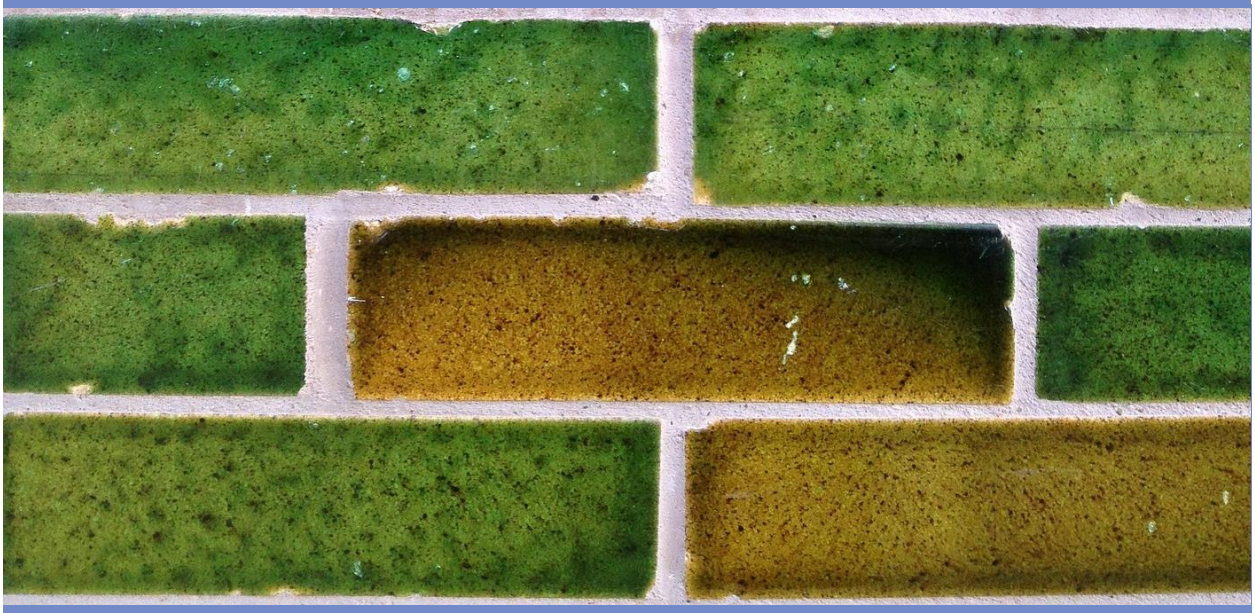
Co-Benefits

Knowledge of building energy use is an effective way to determine energy inefficiencies and opportunities for retrofits and upgrades. Initial energy benchmarking was conducted for the buildings and facilities within the City in order to provide a baseline for comparison. Annual review of energy use within each building should be conducted to see trends and determine if the energy efficiency retrofits are affective. These annual reviews of energy use can also assist in determining when calibrating HVAC equipment, or other maintenance is required to keep the building at peak efficiency. Energy audits are a comprehensive review of both energy use and key components of the building. Energy audits provide an improved understanding of energy use, reveal energy inefficiencies of the building or building energy appliances, and offer recommendations on how to improve or correct the energy inefficiencies through retrofits or upgrades. Therefore, energy audits should be conducted on a routine basis of every 3 to 5 years.

Measure 2.2: Require Green Building Certification

GHG Reduction Potential
Measure Under Consideration

Estimated Energy Savings in 2020
Measure Under Consideration



Co-Benefits

LEED—Leadership in Energy & Environmental Design—is a rating system for buildings, homes, and communities developed by the U.S. Green Building Council (USGBC). Under this measure, the City could improve energy efficiency by requiring LEED certification, or certification through another green building rating system, for its municipal buildings.

Measure 2.3: Implement Water Leak Detection Program

GHG Reduction Potential
Measure Under Consideration

Estimated Energy Savings in 2020
Measure Under Consideration

Co-Benefits

Losing water from unrepaired leaks and operating at unnecessarily high-pressure results in wasted water, energy, and GHGs. The City can avoid this waste by conducting annual water audits to detect and repair leaks, developing a pressure management strategy, and devising a long-term water loss control plan.

Measure 2.4: Participate in Demand Response Programs

GHG Reduction Potential
Supporting Measure

Estimated Energy Savings in 2020
Supporting Measure

Co-Benefits

Electricity is supplied to buildings immediately upon demand. During hours of peak demand, such as the late afternoon, the electricity grid is often put under stress to supply the increased demand. Demand Response Programs offer incentives (e.g. discounted rates and bill credits) to electricity consumers to reduce their energy demand, or shift their demand to off-peak hours, in response to grid stress.

Measure 2.5: Participate in Direct Install Program

GHG Reduction Potential

2020 – 71 MT CO_2e

2035 – 224 MT CO_2e

Estimated Energy Savings in 2020

223,095 kWh

Co-Benefits

SCE offers a Direct Install Program to reduce energy costs and save money. The program is funded by the utility ratepayers and includes a free assessment of the building by a contractor and installation of free energy-efficient replacement equipment. Examples of the energy-efficient equipment include fluorescent lighting, LED signs, window film, and programmable thermostats. In 2014, 12 municipal buildings participated in this program and saved over $42,200 as a result.

Measure 2.6: Adopt a Procurement Policy for EE Equipment

GHG Reduction Potential	Estimated Energy Savings in 2020
2020 – 78 $MTCO_2e$	196,842 kWh
2035 – 246 $MTCO_2e$	2,911 Therms

Co-Benefits

Energy efficient procurement policies can reduce government facility energy costs by about 5 to 10 percent.[4] As municipal appliances wear out, the City would replace them with Energy Star or energy efficient equipment. Energy Star offers an appliance calculator to estimate money and energy saved by purchasing its products. Since the city has already significantly reduced its energy consumption through other measures, it is assumed that the reduction potential of the procurement policy would be closer to 5 percent.

[4] Lawrence Berkeley National Laboratory (LBNL), Potential Energy, Cost, and CO2 Saving from Energy-Efficient Government Purchasing, 2002.

Measure 2.7: Install Cool Roofs

GHG Reduction Potential Measure Under Consideration	Estimated Energy Savings in 2020 Measure Under Consideration

Co-Benefits

Surfaces with low albedo, or solar reflectance, amplify urban heat island effect. Many surfaces in an urban environment consist of building roofs. Roofs affect not only the temperature of the surrounding urban environment, but also the interior temperature of the attached building below. Upgrading roofs to materials with high albedo can reduce outdoor and indoor temperatures, thereby also reducing demand on energy for air conditioning. Replacing a 1,000 sq. ft. dark roof with a white roof can offset approximately 10 MT CO_2e.[5]

[5] Calthorpe Associates, Cambridge Systematics, Davis Energy Group, and Local Government Commission, Energy Aware Planning Guide, 2009.

Measure 2.8: Increase Recycled Water Use

GHG Reduction Potential
Measure Under Consideration

Estimated Energy Savings in 2020
Measure Under Consideration

Co-Benefits

The West Basin Municipal Water District (WBMWD) uses its Edward C. Little Water Recycling Facility to provide its cities with recycled water. One of its five types of "designer" or custom-made recycled water includes Tertiary Water (Title 22), used for irrigation. The City uses reclaimed water at selected parks and medians. Approximately 1,873 kWh can be saved for every acre foot (AF) of water use replaced by recycled water.[6]

[6] California Sustainability Alliance, The Role of Recycled Water in Energy Efficiency and Greenhouse Gas Reduction, May 2, 2008.

Measure 2.9: Retrofit HVAC Equipment

GHG Reduction Potential	Estimated Energy Savings in 2020
Measure Under Consideration	Measure Under Consideration

Co-Benefits

Heating, ventilation, and air conditioning (HVAC) equipment at municipal facilities have been identified as potential retrofit opportunities and can qualify for incentives through the SCE ELP (Measure 1.1). HVAC units account for approximately 32 percent of a non-residential building's energy use. By replacing aging equipment with newer, more efficient equipment, the City will reduce energy consumption and associated GHG emissions. Newer, higher efficiency units are approximately 47% more efficient than older models.

Measure 2.10: Track Additional Energy Savings

GHG Reduction Potential

2020 – 22 $MTCO_2e$

2035 – 68 $MTCO_2e$

Estimated Energy Savings in 2020

67,866 kWh

Co-Benefits

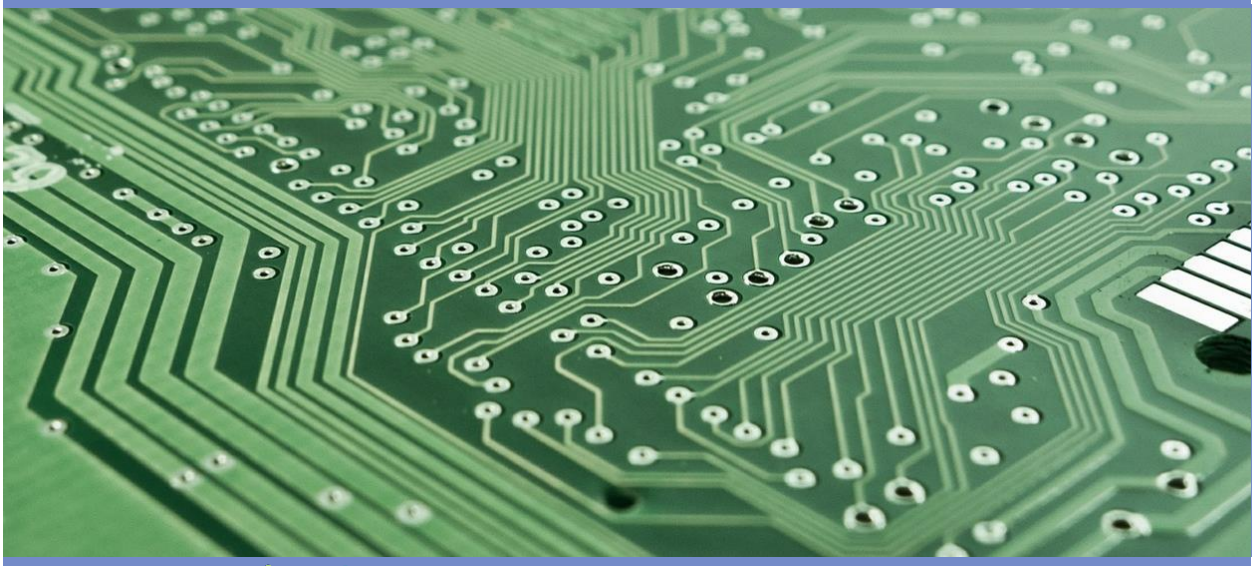
According to SBCCOG's Project Tracker database, the City has achieved additional municipal energy savings since the data for last inventory was calculated. These savings are not categorized into specific projects.

This measure allows the ability for the City to take advantage of additional energy efficiency opportunities as they arise. The various additional energy efficiency opportunities need to be documented in the Project Tracker database in order to keep the database current and allow the City to determine the effectiveness of the energy savings.

Measure 2.11: Utilize an Energy Management System

GHG Reduction Potential
Supporting Measure

Estimated Energy Savings in 2020
Supporting Measure



Co-Benefits

Detailed information about facility energy consumption, including hourly energy profiles and energy consumption of individual building systems, can be monitored on a regular basis through an energy management system. This tool allows City staff to observe "real-time" energy consumption and analyzes building energy consumption trends using utility bill information. Using this tool, the long-term impacts of efficiency projects can be monitored.

Goal 3: Increase Energy Efficiency in City Infrastructure

Measure 3.1: Retrofit Traffic Signals and Outdoor Lighting

GHG Reduction Potential
2020 – 415 $MTCO_2e$
2035 – 1,305 $MTCO_2e$

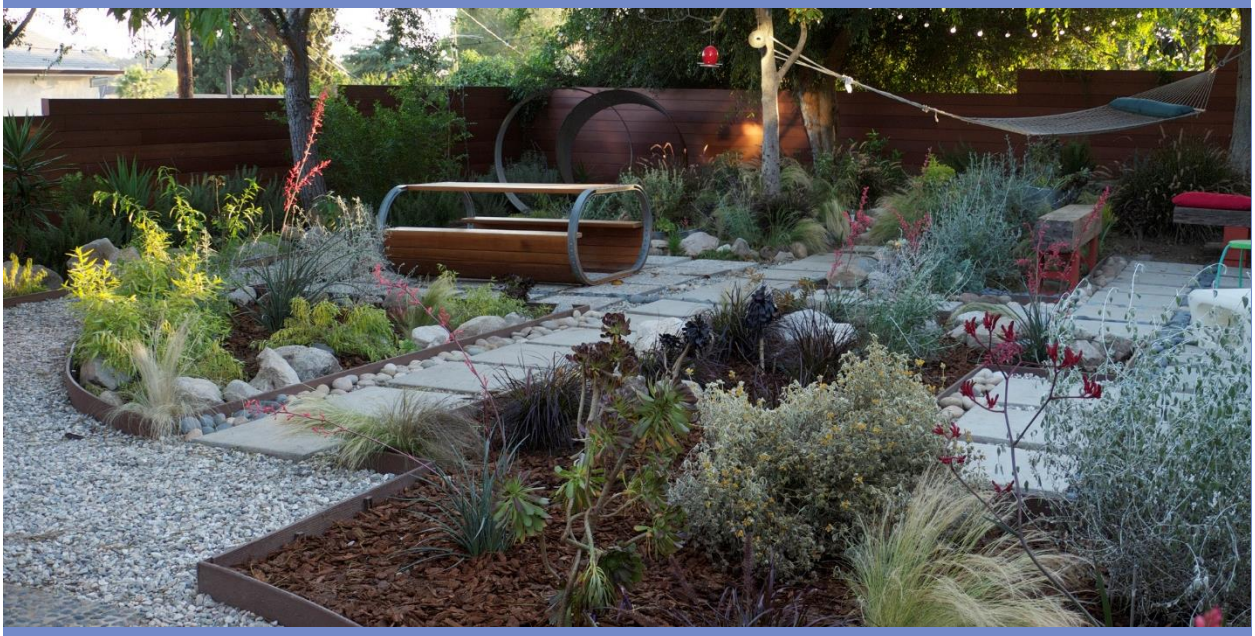
Estimated Energy Savings in 2020
1,298,375 kWh

Co-Benefits

Since 2001, SCE has offered its municipalities rebates on LED Traffic Signal Lamps. The program is part of a statewide effort to conserve energy and promote energy efficiency. Retrofitting a standard incandescent traffic signal with LED lamps using the SCE rebate can result in a payback of less than one year. Other outdoor lights (e.g. streetlights, park lighting, etc.) can also be retrofitted.

Measure 3.2: Upgrade or Incorporate Water-Conserving Landscape

GHG Reduction Potential	Estimated Energy Savings in 2020
Measure Under Consideration	Measure Under Consideration



Co-Benefits

The City can reduce water consumption and associated energy use by converting traditional landscaping to water conserving landscaping. An average acre of lawn in the United States uses about 652,000 gallons of water a year.[7] The City can participate in SoCal WaterSmart's Public Agency Landscape (PAL) program to receive a no-cost landscape irrigation audit and incentives to replace older landscape equipment with new, water-efficient models.[8]

[7] ICLEI, Climate and Air Pollution Planning Assistant (CAPPA), 2009.

[8] http://socalwatersmart.com/commercial/?page_id=3091

Measure 3.3: Plant Trees for Shade and Carbon Sequestration

GHG Reduction Potential	Estimated Energy Savings in 2020
Measure Under Consideration	Measure Under Consideration

Co-Benefits

Trees and vegetation naturally help cool an environment by providing shade and evapotranspiration (the movement of water from the soil and plants to the air) and reduce GHG emissions by sequestering carbon dioxide (CO_2). Trees planted near pavement can reduce surface temperatures of streets and parking lots, and trees planted strategically near windows or roofs of buildings can effectively reduce interior temperatures. The City could plant trees in City-owned spaces to reduce urban heat island effect and building energy use and increase carbon sequestration.

Goal 4: Reduce Energy Consumption in the Long Term

Measure 4.1: Develop an Energy Reinvestment Fund

GHG Reduction Potential
Supporting Measure

Estimated Energy Savings in 2020
Supporting Measure

Co-Benefits

An Energy Reinvestment Fund can be created with a portion of the documented savings achieved through these energy efficiency strategies. These funds are then reinvested in future energy efficiency improvements, thereby providing a means for leveraging greater and greater energy savings.

Summary of Municipal Reductions

By implementing these local reduction measures, the City would reduce its municipal GHG emissions associated with energy use by approximately 7% compared to the 2020 business-as-usual (BAU) emissions and 23% compared to the 2035 BAU emissions. Table 26 summarizes the strategies and the potential GHG reductions for municipal operations.

Table 26 Municipal Energy Efficiency Strategies and GHG Reduction Potential

		2020 Reductions			2035 Reductions		
Measure No.	Measures	MT CO_2e	kWh	Therms	MT CO_2e	kWh	Therms
Goal 1: Participate in Education, Outreach, and Planning for Energy Efficiency							
Measure 1.1	Increase Energy Savings through the SCE Energy Leader Partnership	Supporting Measure					
Goal 2: Increase Energy Efficiency in Municipal Buildings							
Measure 2.1	Conduct Municipal Building Energy Audit	Supporting Measure					
Measure 2.2	Require Green Building Certification	Under Consideration					
Measure 2.3	Implement Water Leak Detection Program	Under Consideration					
Measure 2.4	Participate in Demand Response Programs	Supporting Measure					
Measure 2.5	Participate in Direct Install Program	71	223,095	-	224	701,156	-
Measure 2.6	Adopt a Procurement Policy for Energy Efficient Equipment	78	196,842	2,911	246	618,648	9,149
Measure 2.7	Install Cool Roofs	Under Consideration					
Measure 2.8	Increase Recycled Water Use	Under Consideration					
Measure 2.9	Retrofit HVAC Equipment	Under Consideration					
Measure 2.10	Track Additional Energy Savings	22	67,866	-	68	213,293	-
Measure 2.11	Utilize an Energy Management System	Supporting Measure					
Goal 3: Increase the Energy Efficiency in City Infrastructure							
Measure 3.1	Retrofit Traffic Signals and Outdoor Lighting	415	1,298,375	-	1,305	4,080,609	-
Measure 3.2	Upgrade or Incorporate Water-Conserving Landscape	Under Consideration					
Measure 3.3	Plant Trees for Shade and Carbon Sequestration	Under Consideration					
Goal 4: Reduce Energy Consumption in the Long Term							
Measure 4.1	Develop an Energy Reinvestment Fund	Supporting Measure					
Total		587	1,786,179	2,911	1,844	5,613,705	9,149

Comparison to Targets

Community

By 2020, the statewide and local measures together would reduce the City's community GHG emissions from the 2020 BAU condition by approximately 16% or 83,964 MT CO_2e (from 527,294 MT CO_2e to 443,330 MT CO_2e). This reduction is equivalent to a 15% decrease below the 2005 levels, which achieves the 15% reduction target of the year 2020, as depicted in Figure 18. Additional reduction measures through 2035, as selected by the City, would result in reductions below the 49% reduction target (from 2005 levels) and would require additional reduction measures in order to achieve the 2035 reduction target. Table 27 summarizes the baseline 2005 emissions, the projected 2020 and 2035 BAU emissions, the 2020 and 2035 reduction targets, the reductions from state and local measures, and whether additional reductions are needed.

Table 27 Community Emissions and Targets

	2005 MT CO_2e	2020 MT CO_2e	2035 MT CO_2e
BAU Emissions	522,168	527,294	546,714
Reduction Target	—	443,843	266,306
State Measure Reductions	—	56,701	139,292
Local Measure Reductions	—	27,263	129,499
Additional Reductions Needed	—	Target Met	11,617

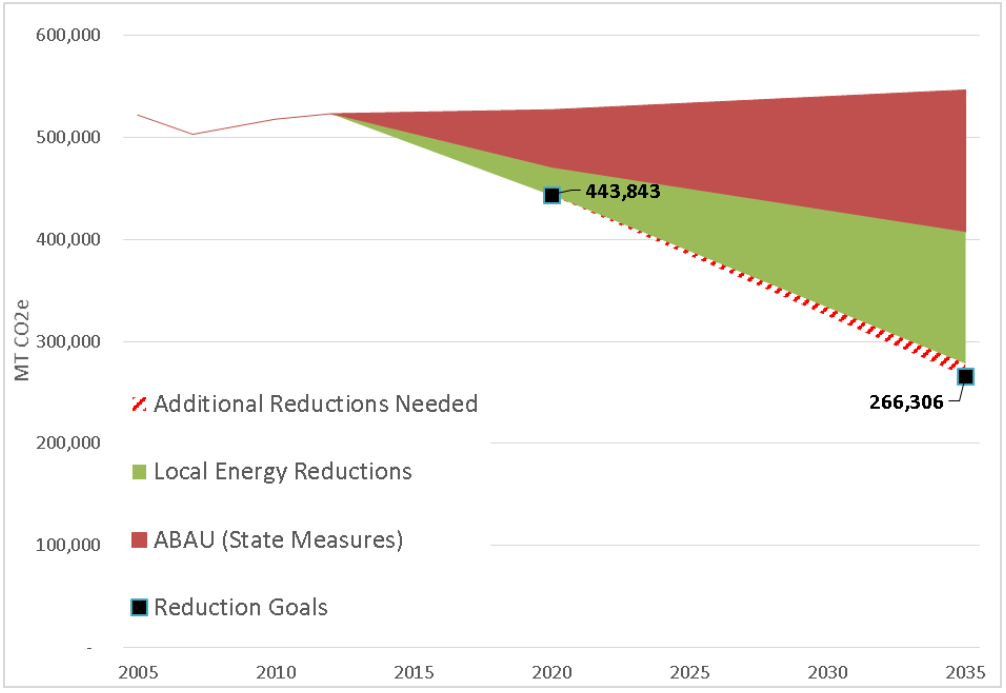


Figure 18 State and Local Reductions Comparison with Targets (Community)

The City of Redondo Beach will meet their reduction goal in 2020 with the help of both state and local reduction measures. Additional reductions are needed to meet the 2035 reduction goal.

Municipal

By 2020, the statewide and local measures together would reduce the City's municipal GHG emissions from the 2020 BAU condition by approximately 11% or 850 MT CO_2e (from 8,062 MT CO_2e to 7,212 MT CO_2e). This reduction is equivalent to a less than 1% decrease below the 2005 levels, which does not achieve the 15% reduction target of the year 2020, as depicted in in Figure 19. In addition, the reduction measures selected by the City would result in reductions below the 49% reduction target (from 2005 levels) by 2035 and would require additional local reduction measures in order to achieve the 2035 reduction target. Table 28 summarizes the baseline 2005 emissions, the projected 2020 and 2035 BAU emissions, the 2020 and 2035 reduction targets, the reductions from state and local measures, and whether additional reductions are needed.

Table 28 Municipal Emissions and Targets

	2005 MT CO_2e	2020 MT CO_2e	2035 MT CO_2e
BAU Emissions	7,191	8,062	8,062
Reduction Target	—	6,112	3,667
State Measure Reductions	—	263	263
Local Measure Reductions	—	587	1,844
Additional Reductions Needed	—	1,100	2,288

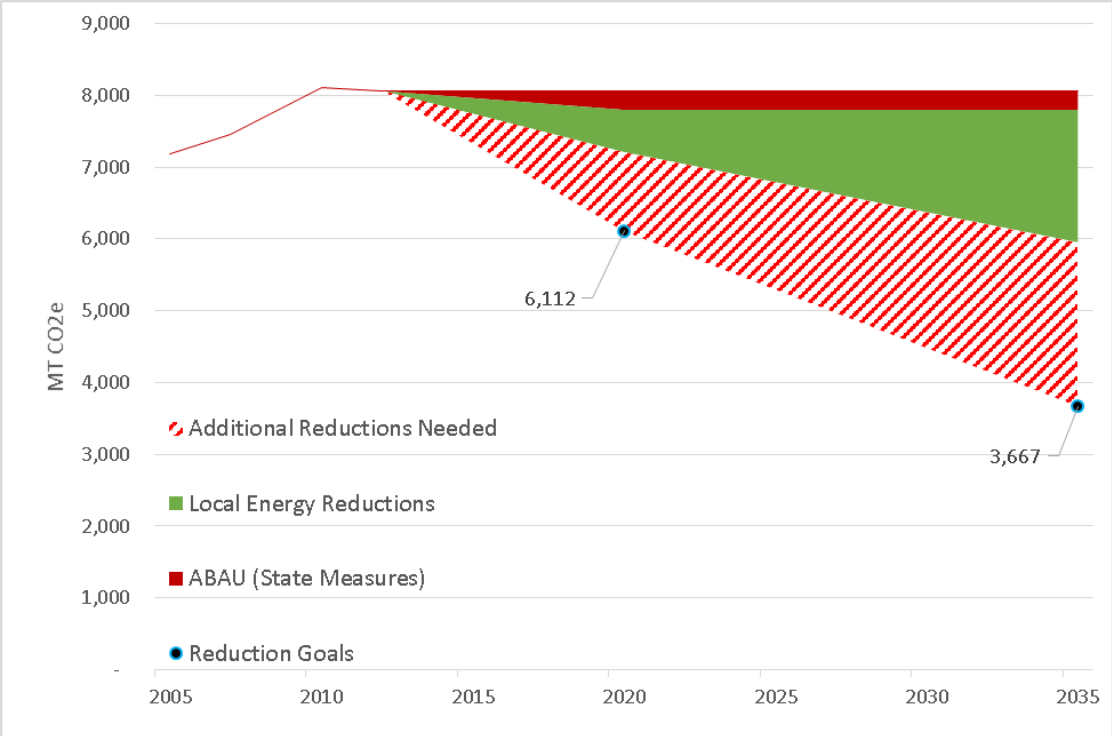


Figure 19 State and Local Reductions Comparison with Targets (Municipal)

The City of Redondo Beach will need additional reductions to meet their 2020 and 2035 reduction targets.


STOP

Chapter 5
Implementation

This section describes implementation steps for the EECAP to support achievement of the GHG reduction goals and energy efficiency for the community at large. Success in meeting the GHG emission reduction goal will depend on cooperation, innovation, and participation by the City, residents, businesses, and other local governmental entities. This section outlines key steps that the City would follow for the implementation of this EECAP.

Step 1—Administration and Staffing

The City would implement the following key internal administration and staffing actions:

1. Create an Energy Efficiency Team to support and guide the City's efforts to conserve energy and reduce emissions.
2. Designate an Implementation Administrator to oversee, direct and coordinate implementation of the EECAP as well as monitor and report the energy efficiency and GHG reduction efforts.

The City Energy Efficiency Team (Team) would be responsible for the implementing the EECAP, coordinating among all involved City departments, and recommending modifications and changes to the EECAP over time. The Team would include the following all departments and divisions to ensure coordinated leadership in plan implementation.

Step 2—Financing and Budgeting

Successful implementation of the EECAP will require a strong commitment from the City and community. Local, regional, state, and federal public sources of funding will be needed along with the substantial involvement of the private sector. The following financing options should be explored by the City:

- **State and federal grants and low-interest loans**—A variety of grant and loan programs exist in various sectors.
- **Support from local businesses, non-profits, and agencies**—Opportunities for public/private partnerships (like the SCE partnerships) exist to provide cooperation on many aspects of the EECAP including energy and water efficiency retrofits and raising public awareness regarding conservation strategies.
- **Self-funding and revolving fund programs**—Innovative programs to fund renewable energy investments.

- **Agreements with private investors**—Energy service companies and other private companies can finance up-front investments in energy efficiency and then be reimbursed through revenues from energy savings.
- **Local funding**—Various local governments have used targeted finance instruments for renewable energy resource development and energy efficiency improvement projects.

Given that financing is the key to implementing many measures, a review of current and potential funding sources was completed for the different sectors covered in the EECAP and is presented below to help early phase implementation. It is likely that there will be stronger legislation aimed at energy efficiency and renewable energy generation that will further curb GHG emissions. Such requirements are likely to influence energy prices (for electricity and natural gas), and may make currently cost-ineffective measures more economically feasible and allow the financing of a broader range of plan measures.

Energy Efficiency and Renewable Energy Financing

HERO Program. SBCCOG, in partnership with Renovate America, Inc. is offering homeowners and businesses in SBCCOG participating jurisdictions an opportunity to finance energy and water efficiency projects in their properties. The HERO Program is a Property Assessed Clean Energy (PACE) financing program and allows property owners to finance energy efficiency improvement projects and to repay the financing through special assessments on their property taxes. A wide range of products is eligible under the HERO program. Lighting upgrades, building insulation improvements, water efficiency enhancement, renewable energy production, water heating technologies, and mechanical system upgrades are a few to name. For a complete list of eligible products under the HERO program, visit the website at http://heroprogram.com and www.commercialhero.com.

Federal Tax Credits for Energy Efficiency. On October 3, 2008, former President Bush signed into law the "Emergency Economic Stabilization Act of 2008." This bill extended the Production Tax Credit for solar energy systems and fuel cells to 2016. New tax credits were established for small wind energy systems. Tax deductions for owners and designers of energy efficient commercial buildings were also extended. See http://www.energystar.gov/index.cfm?c=products.pr_tax_credits.

Southern California Edison Energy Efficiency/Renewable Energy Incentives

- Residential and commercial customers can qualify for a variety of rebate programs through SCE.
- SCE offers savings to customers who purchase qualified energy efficient appliances, heating and cooling systems, pool pumps, Energy Star, CFLs lighting fixtures and other energy efficient technologies.
- Multifamily residential developments can benefit from a variety of SCE's rebate programs. Using energy efficient products and technologies such as high-performance dual-pane windows, Energy Star labeled ceiling fans; Energy Star CFLs, proper insulation, energy efficient electric storage water heaters, refrigerators, LED lights, and cold vending machine controls would save both money and energy.
- SCE will provide free evaluation of mobile homes and provides free supply and installation of the energy upgrades that is recommended by their energy specialist.

- SCE and SCG residents can benefit from incentives up to $4,000 for detached single-family residential energy upgrades.
- SCE offers incentives, through utility rebate programs, for non-residential customers. This rebate is regardless of size and energy usage. Express efficiency rebates for lighting, refrigeration, and air conditioning technologies are available. In addition, SCE has a Custom Contracting Program in which non-residential users have the option of designing an energy retrofit conservation measure. Incentives are based on the type of measure installed and the reduction in energy usage over a 12-month period.

  See http://energy.gov/savings/sce-non-residential-energy-efficiency-programs

- SCE's Self-Generation Incentive Program (SGIP) provides financial incentives for the installation of new, qualifying customer self-generation equipment for their own on-site usage. Technologies currently eligible for SGIP incentives are generation related to wind, fuel cell, waste heat capture, and conventional CHP. The SGIP program is designed with business and large institutional customers in mind. Rebates for renewable generation—such as wind turbines or fuel cell—that generate less than 30 kilowatts of energy are available through the California Energy Commission's Emerging Renewables Program. Fuel cells of any size using non-renewable fuels may receive incentives under the SGIP program. See http://www.sce.com/b-rs/sgip/about-the-program.htm.

Southern California Gas Company

- The SGIP offers savings based on GHG emissions reductions and energy efficiency audits. Eligible technologies include but are not limited to renewable and waste energy capture technologies, conventional combined heat and power systems, emerging technologies such as fuel cells, biogas, and advanced energy storage.
- The SCG On-Bill Financing program offers qualified business customers zero percent financing from $5,000 to $100,000 per meter for qualifying electric and natural gas equipment. All government customers may receive from $5,000 to $250,000 per meter, and government can borrow up to $1,000,000 for one service account. The funds may be used for a wide variety of efficiency improvement projects, and the monthly loan payments will be added directly to the customer's bill. Monthly energy savings help to offset the monthly loan charges.
- SCG offers rebates on various types of energy efficient equipment such as pipe insulation, steam traps, boilers, and other equipment. A full list of the eligible equipment can be found at SCG's website at http://www.socalgas.com/for-your-business/rebates/industry/government/.
- Commercial customers can benefit from rebates and incentives for energy efficient equipment such as pipe and tank insulation, water heaters, steam traps, pool heaters, boilers, commercial cooking equipment, and other technologies.
- Single-family residential solar water heating systems qualify for up to $1,875 and commercial/multi-family customers can save up to $500,000 under the California Solar Initiative—Thermal Program. For a complete list and up-to-date savings, visit the SCG website at http://www.socalgas.com/for-your-business/rebates/.

California Energy Commission Energy Efficiency Financing. The CEC offers energy efficiency financing and low interest loans (up to 15 years) to cities and counties for installing energy-saving projects. Examples of projects include lighting systems, pumps and motors, streetlights and LED traffic signals, automated energy management systems/controls, building insulation, energy generation including renewable and combined heat and power projects, heating and air conditioning modifications, and wastewater treatment equipment. The CEC also offers the Energy Partnership Program Technical Assistance Grant, which would provide the City with up to $10,000 of technical assistance services, including a feasibility of energy efficiency opportunities for City facilities to maximize energy cost savings and GHG emissions reductions. See http://www.energy.ca.gov/efficiency/financing/.

California Energy Commission Bright Schools Program. This is a collaborative project of the CEC, California Conservation Corps, local utility companies, and other qualifying energy service companies to assist schools in undertaking energy efficiency projects. Project staff will guide schools through identifying and determining a project's feasibility, securing financing for the project, and purchasing and installing the new energy efficient equipment. See http://www.energy.ca.gov/efficiency/brightschools/index.html.

California Solar Initiative (CSI). In January 2006, the California Public Utilities Commission adopted the CSI to provide more than $3 billion in incentives for solar-energy projects with the objective of providing 3,000 megawatts of solar capacity by 2016. In December 2011, the Commission increased the CSI budget by $200 million in order to cover a budget shortfall. The action implements SB 585 signed by former Governor Jerry Brown on Sept. 22, 2011. The CSI program is administered by Pacific Gas & Electric, Southern California Edison, and CCSE for the SDG&E territory. The CSI incentive for non- residential buildings includes a transition to performance-based and expected performance-based incentives, with the aim of promoting effective system design and installation. The applicable rebate programs for municipal facilities include: (1) the general CSI Program of solar rebates for public agencies; (2) the CSI-Thermal Program for solar hot water rebates for municipal facilities; and (3) the CSI Research, Development, Demonstration, and Deployment Program. See http://energycenter.org/csi.

Water Conservation and Treatment Financing

Clean Water State Revolving Funds (CWSRF). CWSRFs fund water quality protection projects for wastewater treatment, nonpoint source pollution control, and watershed and estuary management. CWSRFs have funded over $74 billion, providing over 24,688 low-interest loans to date.

CWSRF's offer:

- **Low interest rates, flexible terms**—Nationally, interest rates for CWSRF loans average 2.3%, compared to market rates that average 5%. For a CWSRF program offering this rate, a CWSRF funded project would cost 22% less than projects funded at the market rate. CWSRFs can fund
- 100% of the project cost and provide flexible repayment terms up to 20 years.
- **Funding for nonpoint source pollution control and estuary protection**—CWSRFs provided more than $167 million in 2009 to control pollution from nonpoint sources and for estuary protection, more than $3 billion to date.

- **Assistance to a variety of borrowers**—The CWSRF program has assisted a range of borrowers including municipalities, communities of all sizes, farmers, homeowners, small businesses, and nonprofit organizations.
- **Partnerships with other funding sources**—CWSRFs collaborate with banks, nonprofits, local governments, and other federal and state agencies to provide the best water quality-financing source for their communities.

  See http://www.epa.gov/owm/cwfinance/cwsrf/index.htm

SoCal Water Smart. The SoCal Water Smart program offers rebates to customers of the Metropolitan Water District's member agencies for installing water-saving appliances. Qualifying products include high-efficiency clothes washers, rotating nozzles, and weather-based irrigation controllers. See http://socalwatersmart.com/home.

Step 3—Measure Implementation

After taking into account the reductions in energy and water usage and the GHG emissions resulting from statewide measures, the City would need to implement the local measures to reach its reduction targets for 2020 and 2035.

The City would develop an implementation schedule for the reduction measures. Prioritization would be based on the following factors:

- Cost effectiveness
- GHG reduction efficiency
- Availability of funding
- Level of City Control
- Ease of implementation
- Time to implement

Because the goals of this EECAP are aggressive, success in meeting the goals depends on some flexibility in the GHG reduction actions. The City is committed to flexibility in implementing the reduction measures and meeting the goals of the EECAP. The goals of each reduction measure can often be achieved through a variety of means, especially those related to building energy efficiency. For example, the City would adopt energy efficient design requirements for new development. Compliance with the energy efficient design programs can be achieved through many combinations of actions including, but not limited to, installing energy efficient appliances, lighting, and HVAC systems; installing solar water heaters; siting and orienting buildings to optimize conditions for natural heating, cooling, and lighting; installing top-quality windows and insulation; and incorporating natural shading, skylights, and reflective surfaces. Possible sources of funding to implement these measures are presented in Chapter 3.

Step 4—Public Participation

The residents and businesses in the City are integral to the success of GHG reduction efforts. Their involvement is essential in order to reach the reduction goals because the EECAP depends on a combination of state and local government efforts, public and private sources of finance, and the voluntary commitment, creativity, and participation of the community at large. The City will need to strike a balance between development and environmental stewardship to keep the economy strong and, at the same time, protect the environment. Education programs should be developed for

stakeholders such as businesses, business groups, residents, developers, and property owners outlining the benefits of the EECAP's cost-saving measures to encourage participation in efforts to reduce GHG emissions in all possible sectors.

Step 5—Monitoring

The City will use a system for monitoring the reductions in energy use from local and statewide measures. If promising new strategies emerge, the City will evaluate how to incorporate these strategies into the EECAP. Further, state and federal action would also result in changes that would influence the level of the City's GHG emissions.

A customized emissions inventory software package developed through the State Energy Efficiency Collaborative (SEEC) has been established for City's use in tracking emissions. The EECAP Implementation Coordinator would be responsible for maintaining records of reduction measure implementation and insuring that the periodic updates to the emissions inventory are completed using the emission inventory worksheet. A simple energy efficiency measure-tracking tool will be provided to track the implementation of the measures. In this way, the City can see (1) emissions estimates without implementation of the EECAP; (2) emissions estimates predicted with full implementation of the EECAP; and (3) progress-to-date as data are entered annually. This will demonstrate progress toward the goal and identify whether adjustments need to be made to programs to meet the reduction goal.

Step 6—Beyond Energy

The EECAP is focused on energy efficiency. However, land use, transportation, and waste are also important sectors in the City's emissions profile that could also be targeted for emissions reduction strategies. The SBCCOG has secured funding through the California Strategic Growth Council to develop GHG reduction measures for the land use, transportation, and waste sectors that will further the City's GHG reduction potential and commitment to a lower-emissions future.

Chapter 6
References

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Appendix A

Inventory, Forecasting, and Target-Setting Report

City of Redondo Beach

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

January 2015

Prepared for:

SOUTH BAY CITIES
COUNCIL OF GOVERNMENTS

Prepared by:
ATKINS
3570 Carmel Mountain Lane, Suite 300
San Diego, California 92130

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

Contents

Tables

Figures

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 Redondo Beach increased emissions less than 1% from 2005 to 2012, from 522,168 MT CO_2e to 523,400 MT CO_2e.
- Commercial Energy, Solid Waste, Water, Wastewater, and Off-road Sources sector emissions decreased while On-road Transportation and Residential Energy sectors increased emissions from 2005 to 2012.
- Energy-related emissions account for nearly 46% of the total community emissions in 2005 and 45% of total emissions in 2012.
- Under the Adjusted Business-as-Usual (BAU) forecast, emissions will be 470,593 MT CO_2e in 2020 and 407,422 MT CO_2e in 2035. These emissions levels are nearly 10% lower in 2020 than 2005 and nearly 22% lower in 2035 than 2005.
- The State recommends a 15% reduction below 2005 levels by 2020, which would require the City to reduce community emissions 26,750 MT CO_2e from an Adjusted BAU forecast by 2020. This is about a 6% reduction from the 2020 Adjusted BAU emissions level.
- 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 141,116 MT CO_2e from a 2035 Adjusted BAU forecast. This is a 35% reduction from the 2035 Adjusted BAU emissions level and the 2005 level.

Municipal

- Municipal emissions have increased 12% from 2005 to 2012, from 7,191 MT CO_2e to 8,062 MT CO_2e.
- Emissions in Solid Waste and City-Owned Outdoor Lights decreased, while emissions from Buildings & Facilities, Vehicle Fleet & Equipment, Employee Commute, Water Delivery, and SCE-Owned Outdoor Lights increased.
- Municipal emissions are a subset of community emissions and account for about 1% of total community emissions.
- Under the Adjusted BAU forecast, emissions will be 7,799 MT CO_2e in 2020 and 2035. These emissions levels are 8% higher than 2005 emission levels. The City will need to reduce emissions by 1,687 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 4,132 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 Redondo 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 "Commercial/Industrial", 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 or City-Owned as described later.

Cap-and-Trade Covered Entities

The City is home to residential, commercial, and industrial users, each of which uses energy. Industrial users include major industrial facilities that emit substantial GHGs that are regulated under the State's Cap-and-Trade Program. These facilities are known as "covered entities" and derive energy for their industrial uses largely from natural gas, and to a lesser extent, electricity and other energy sources. The emissions associated with covered entities are already regulated at the State level and therefore, the City does not have significant local control over the GHG emissions. The current protocol recommends excluding the covered entities' GHG emissions from the City's inventories. In an effort to be consistent with protocol, data were reviewed to determine to what extent covered entities are included.

Data provided by SCG and SCE for this inventory report are protected under privacy restrictions which fall under the 15/15 rule.[3] Each utility provides data with these protections applied consistent with their individual corporate reporting protocols. The utilities do not specify if covered entities are included in the data provided. In comparing data from past inventory years, the electricity data are consistent and natural gas data are significantly reduced, leading to the conclusion that once the 15/15 rule was applied, major natural gas users, including covered entities, were likely removed from the total natural gas data. If additional information becomes available that either allows the City to better separate out the energy usage from covered entities or provides better clarity of the current data aggregation, SBCCOG recommends that the City review the information and determine whether adjustments to the inventories and/or associated reports are warranted. If adjustments are made, SBCCOG recommends they be consistent among all inventory years and with current quantification methodology.

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 & Facilities** includes energy use by the government, including electricity and natural gas.
  - **SCE-Owned Outdoor Lights** includes electricity for streetlights on fixtures owned by SCE and outdoor lights.
  - **City-Owned Outdoor Lights** includes electricity for streetlights on fixtures owned by the City, traffic control signals, and outdoor lights.
  - **Water Delivery** includes electricity for sewer and stormwater 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.

[3]The 15/15 rule requires that any aggregated information provided by the Utilities must be made up of at least 15 customers and a single customer's load must be less than 15% of an assigned category. If the number of customers in the compiled data is below 15, or if a single customer's load is more than 15% of the total data, categories must be combined before the information is released. The Rule further requires that if the 15/15 Rule is triggered for a second time after the data has been screened once already using the 15/15 Rule, the customer be dropped from the information provided.

- **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 Redondo Beach increased emissions less than 1% from 2005 to 2012, from 522,168 MT CO_2e to 523,400 MT CO_2e.**
- **Commercial Energy, Solid Waste, Water, Wastewater, and Off-road Sources sector emissions decreased while On-road Transportation and Residential Energy sectors increased emissions from 2005 to 2012.**

As shown in Figure 1 and Table 3, the Transportation sector was the largest contributor to emissions in both 2005 (49%) and 2012 (51%) by producing 246,707 MT CO_2e in 2005 and 265,512 MT CO_2e in 2012. This change represents a nearly 8% increase in emissions from 2005 to 2012. Commercial/Industrial energy is the second-largest contributor to emissions, adding 28% in 2005 and 26% in 2012. While the proportion of emissions did not change significantly over time, the total emissions decreased by 4% from 2005 to 2012, from 142,679 MT CO_2e to 137,031 MT CO_2e. The proportion of emissions from the Residential sector was also steady, at 18% in 2005 and 19% in 2012, although total emissions increased by less than 6%, from 95,616 MT CO_2e in 2005 to 101,010 MT CO_2e in 2012. Solid Waste comprised 3% of the total (16,840 MT CO_2e) in 2005, and was reduced to 1% of the total (7,406 MT CO_2e) in 2012. Water emissions also comprised of 3% of the total (15,576 MT CO_2e) in 2005 and reduced to 2% (10,332 MT CO_2e) in 2012. Wastewater and Off-road Sources made up the remaining emissions in each year. Wastewater and Off-road Sources emissions declined from 2005 to 2012. Off-road Sources comprise a

very small percentage of overall emissions, but are variable primarily due to construction-related emissions, which are based on the level of development estimated in the City each year.

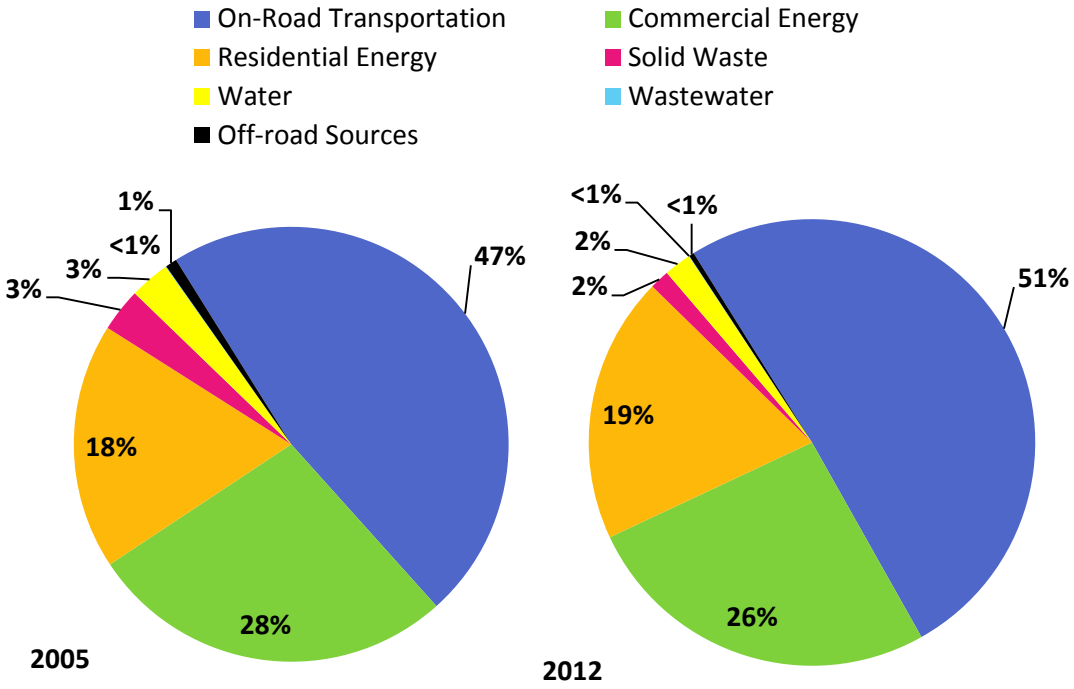


Figure 1. Community-Wide GHG Emissions by Sector for 2005 and 2012

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	246,707	265,512	7.6%
Commercial Energy	142,679	137,031	-4.0%
Residential Energy	95,616	101,010	5.6%
Solid Waste	16,840	7,406	-56.0%
Water	15,576	10,332	-33.7%
Off-road Sources	4,492	1,906	-57.6%
Wastewater	258	203	-21.3%
Total	522,168	523,400	0.2%

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.

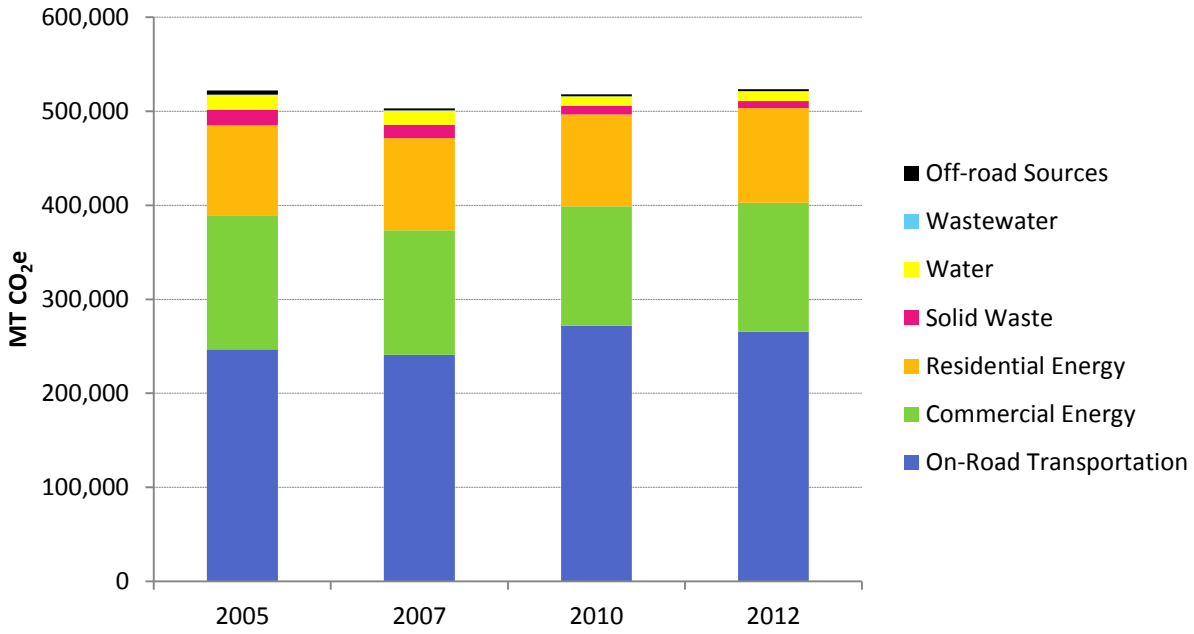


Figure 2. Community GHG Emissions for 2005, 2007, 2010, and 2012

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	246,707	47%	241,068	48%	272,095	53%	265,512	51%
Commercial Energy	142,679	27%	132,378	26%	127,008	25%	137,031	26%
Residential Energy	95,616	18%	98,093	19%	97,497	19%	101,010	19%
Solid Waste	16,840	3%	14,125	3%	9,270	2%	7,406	1%
Water	15,576	3%	15,109	3%	10,118	2%	10,332	2%
Off-road Sources	4,492	1%	2,264	<1%	1,892	<1%	1,906	<1%
Wastewater	258	<1%	200	<1%	203	<1%	203	<1%
Total	522,168		503,237		518,083		523,400	
% Change from 2005	--		-3.6%		-0.8%		0.2%	

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. Residential electricity, Residential natural gas, recycled water, wastewater, and some Off-road Sources (industrial, light commercial, recreation, and agriculture) increased from 2005 to 2012, while Commercial electricity, Commercial natural gas, Solid Waste, Water, and some Off-road Sources (Lawn and Garden, and Construction) decreased from 2005 to 2012. Wastewater and Off-road Source emissions use indicator data to attribute county-level emissions to the City and the indicator data are also shown in Table 5. Notably, while On-road Transportation emissions increased nearly 8% between 2005 and 2012, vehicle miles traveled increased by 14%. The difference reflects that for each vehicle mile traveled, fewer emissions are generated due to improvements in the fuel efficiency of vehicles.

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	471,782,607	465,368,722	538,938,917	538,339,762	14.1%
Residential Energy[1]					
Electricity (kWh)	146,624,086	154,752,638	153,965,618	153,829,706	4.9%
Natural Gas (therms)	9,604,693	10,070,195	10,000,521	9,744,860	1.5%
Commercial/Industrial Energy[1]					
Electricity (kWh)	342,048,319	347,205,566	335,044,830	334,749,071	-2.1%
Natural Gas (therms)	7,290,573	6,099,800	5,748,231	5,638,732	-22.7%
Solid Waste					
Landfilled (tons)	65,115	52,029	37,585	29,881	-54.1%
ADC (tons) [2]	5,215	6,696	123	278	-94.7%
Water and Wastewater					
Water (MG)[3]	2,933	2,935	2,745	2,802	-4.5%
Recycled Water (MG)[3]	20	20	17	20	1.1%
Wastewater (City portion of countywide residents)	0.67%	0.67%	0.68%	0.68%	0.9%
Off-road Sources[4] (% of LA County emissions attributed to the City)					
Lawn & Garden (% Households)	0.90%	0.89%	0.89%	0.89%	-2.0%
Construction (% Building permits)	1.62%	0.77%	0.60%	0.59%	-63.9%
Industrial (% Manufacturing jobs)	0.47%	0.49%	0.49%	0.49%	4.1%
Light Commercial (% Other jobs)	0.69%	0.72%	0.71%	0.72%	3.9%
Recreation (Population weighted by income)	1.10%	1.10%	1.12%	1.10%	0.1%
Agriculture (% Ag. Jobs)	0.22%	0.23%	0.27%	0.34%	54.5%

1 2010 Electricity data provided as a single number by SCE. Data were apportioned using Residential/Non-residential proportion in 2012.

2 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.

3 Includes Golden State Water, Cal Water, and Municipal water. 2005 and 2007 Cal Water data was unknown; therefore 2009 data was used as proxy.

4 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 below for more methodology details.

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 mirrors the small increase in Residential Energy emissions.

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

	2005	2007	2010	2012	% Change 2005-2012
Population	65,931	65,738	66,716	67,007	1.6%
Households	28,740	28,784	29,011	29,016	1.0%
Jobs	30,079	31,294	28,666	29,249	-2.8%
Service Population (Population + Jobs)	96,010	97,032	95,382	96,256	0.3%

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 nearly 46% of the total community emissions in 2005 and 45% 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 Community 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	342,048,319	103,912	334,749,071	107,047	-2.1%	3.0%
Natural Gas	7,290,573	38,767	5,638,732	29,984	-22.7%	-22.7%
Residential						
Electricity	146,624,086	44,543	153,829,706	49,192	4.9%	10.4%
Natural Gas	9,604,693	51,073	9,744,860	51,818	1.5%	1.5%
Total (MT CO_2e)		238,295		238,041		-0.1%

Commercial electricity use increased 2% between 2005 and 2012; however, emissions increased by 3%. Similarly, Residential electricity use increased by about nearly 5% but emissions increased by more than 10%. The difference between the change in activity data and emissions data 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 Redondo Beach, Commercial/Industrial natural gas consumption (therms) decreased by 23% from 2005 to 2012; therefore the emissions also declined 23%. Residential natural gas therms used and GHG emissions declined 1.5% 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.

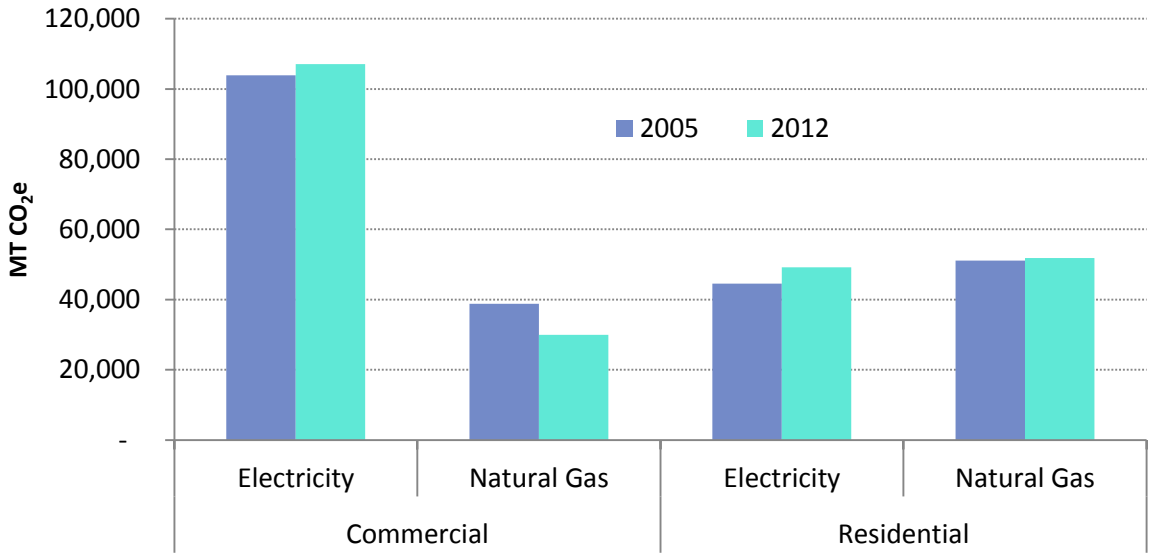


Figure 3. GHG Emissions for Community Electricity and Natural Gas, by Sector

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 increased 12% from 2005 to 2012, from 7,191 MT CO_2e to 8,062 MT CO_2e.**
- **Emissions in the Solid Waste and City-Owned Outdoor Lights sectors decreased while Buildings & Facilities, Fleet & Equipment, Employee Commute, SCE-Owned Outdoor Lights, and Water Delivery increased.**
- **Emissions from municipal operations account for about 1% of community emissions.**

The City's Vehicle Fleet & Equipment sector had the largest percentage of emissions in 2005 (35%) and 2012 (32%). Although its percentage of the total emissions decreased, the sector's emissions increased 3% over the period, from 2,515 MT CO_2e to 2,591 MT CO_2e. Buildings & Facilities was the sector with the second largest percentage of emissions in 2005 (21%) and 2012 (28%) and emissions increased 52% over the period, from 1,506 to 2,293 MT CO_2e (Figure 4 and Table 8). A few projects that took place between 2005 and 2012 are the main contributors to the large increase in emissions for the Buildings & Facilities sector. The Community Service Department was relocated to a new office in 2011. Also, the first half of the "Reinventing the Pier" project was completed in 2012, which created about 30 new accounts that used energy. City-Owned Outdoor Lights accounted for 15% of emissions in 2005 (1,103 MT CO_2e) and its emissions decreased 42% by 2012, accounting for 8% of the total emissions (644 MT CO_2e). Solid Waste emissions also decreased over the period, from 934 MT CO_2e in 2005 (13%) to 719 MT CO_2e in 2012 (9%). Employee Commute increased emissions 122% over the same period (from 517 MT CO_2e to 1,150 MT CO_2e), and became the third highest-emitting sector for 2012. SCE-Owned Outdoor Lights accounted for 7% of emissions in 2005 and 2012, and emission increased from 508 to 542 MT CO_2e in that period. Some City-Owned Outdoor Lights accounts have been re-categorized to SCE-Owned Outdoor Lights from 2005 to 2012 for improved accuracy of categorization. This change may partially contribute to the increase in SCE-Owned Outdoor Lights emissions as well as the decrease in City-Owned Outdoor Lights. Emissions from the Water Delivery sector accounts for the remaining emissions, accounting for 2% of total emissions. Emissions from this sector increased slightly from 2005 to 2012.

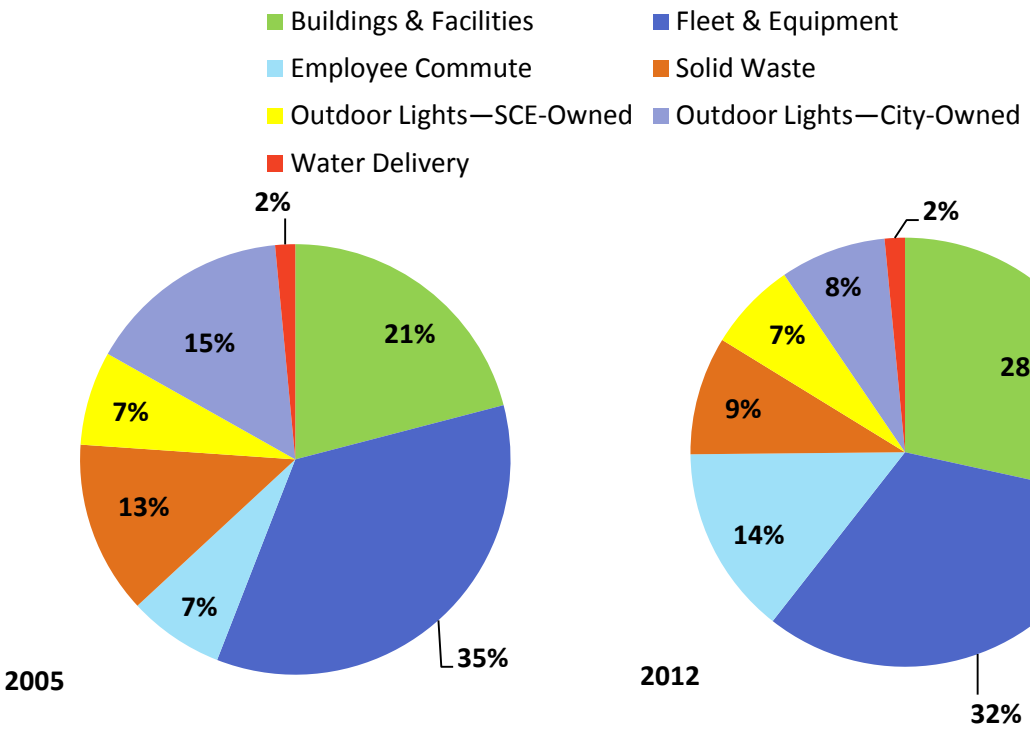


Figure 4. Municipal GHG Emissions by Sector for 2005 and 2012

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	2,515	2,591	3%
Buildings & Facilities	1,506	2,293	52%
Outdoor Lights—City-Owned	1,103	644	-42%
Solid Waste	934	719	-23%
Employee Commute	517	1,150	122%
Outdoor Lights—SCE-Owned	508	542	7%
Water Delivery	108	123	14%
Total	7,191	8,062	12.1%

Note: City-Owned Outdoor Lights includes streetlights, traffic signals, and area lighting. SCE-Owned Outdoor Lights includes streetlights and outdoor lighting. Water Delivery includes sewer and stormwater 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 were highest in 2010 (8,112 MT CO_2e) and were the lowest in 2005 (7,191 MT CO_2e), although the proportion of emissions from each sector has remained relatively constant over the four years.

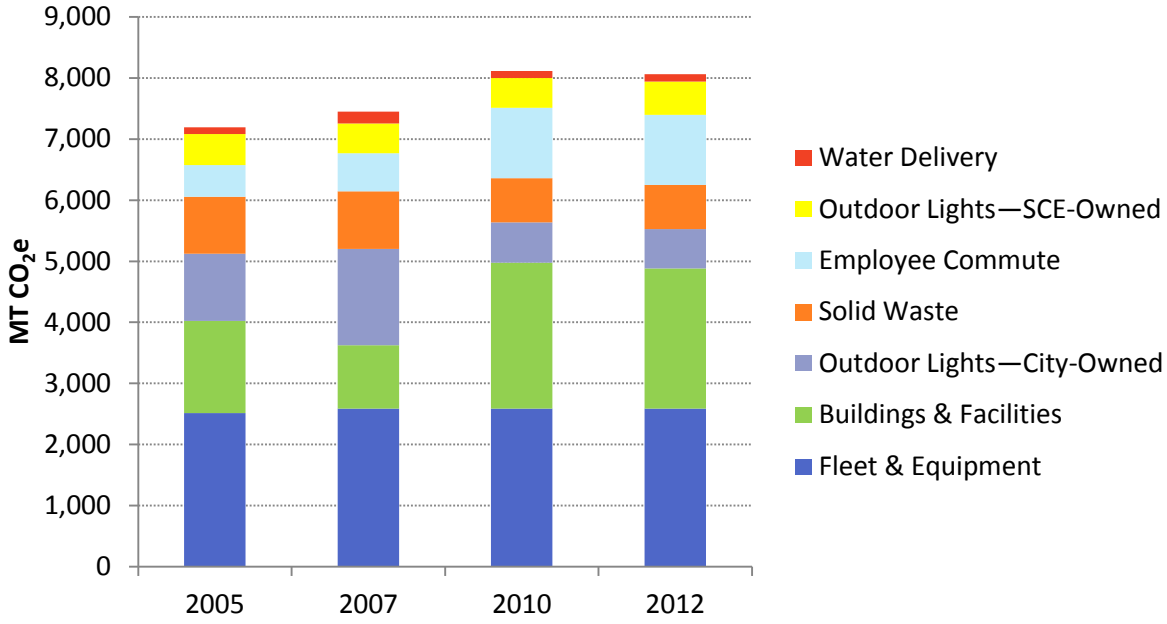


Figure 5. Municipal GHG Emissions for 2005, 2007, 2010, and 2012

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	2,515	35%	2,591	35%	2,590	32%	2,591	32%
Buildings & Facilities	1,506	21%	1,037	14%	2,389	29%	2,293	28%
Outdoor Lights—City-Owned	1,103	15%	1,572	21%	660	8%	644	8%
Solid Waste	934	13%	942	13%	719	9%	719	9%
Employee Commute	517	7%	625	8%	1,153	14%	1,150	14%
Outdoor Lights—SCE-Owned	508	7%	486	7%	486	6%	542	7%
Water Delivery	108	2%	195	3%	115	1%	123	2%
Total	7,191		7,448		8,112		8,062	

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					
Electricity (kWh)	3,936,848	2,141,762	5,211,828	5,468,451	39%
Natural Gas (therms)	58,223	79,039	166,989	102,505	76%
Outdoor Lights					
City-Owned (kWh)	3,629,352	5,460,241	2,294,375	2,014,756	-44%
SCE-Owned (kWh)	1,672,235	1,689,289	1,687,562	1,693,987	1%
Fleet & Equipment[1]					
City-Owned Fleet					
Gasoline (gallons)	77,007	76,482	76,482	76,482	-1%
Diesel (gallons)	22,837	19,794	19,794	19,794	-13%
CNG (standard cubic feet)	416,984	1,364,871	1,364,871	1,364,871	227%
Contracted Fleet					
Gasoline (gallons)	11,568	11,387	11,387	11,387	-2%
Diesel (gallons)	949	1,131	1,131	1,131	19%
LNG (gallons)	264,603	274,865	274,865	274,865	4%
Employee Commute					
Gasoline (vehicle miles traveled)	1,251,819	1,527,802	2,810,571	2,810,571	125%
Diesel (vehicle miles traveled)	0	795	33,104	33,104	--
# FTE[1,2]	613	715	715	715	17%
Solid Waste[1]					
Generated Waste (tons)	2,896	2,922	2,922	2,922	1%
Water Delivery					
Electricity (kWh)	356,744	678,407	399,307	385,378	8%

1 Data for 2010 and 2012 were not available; 2007 data were used as a proxy.

2 FTE is full time-equivalent employees.

Energy

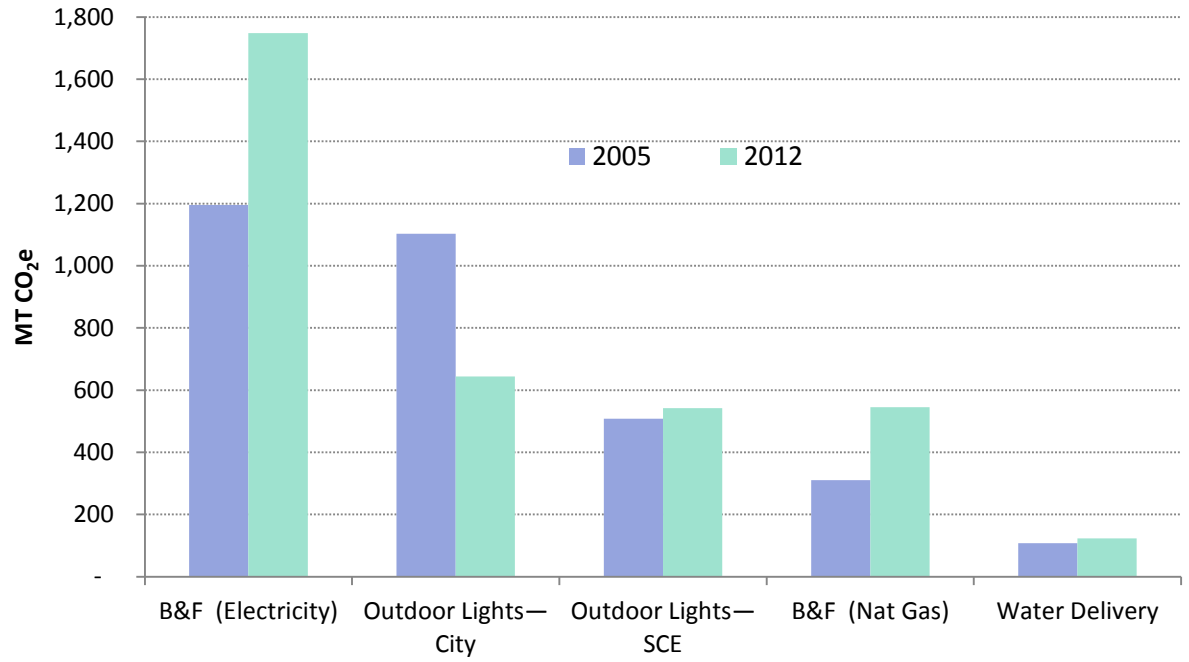
As with the community emissions, the EECAP will focus on increasing energy efficiency and reducing GHG gases from energy within municipal operations. The City has more direct control over energy-related emissions than other sectors, such as Employee Commute. Municipal energy use includes Buildings & Facilities, SCE-Owned Outdoor Lights, City-Owned Outdoor Lights, and Water Delivery. Energy accounted for 45% of total emissions in 2005 and 2012. While both electricity and natural gas are used for Building & Facilities, Outdoor Lights and Water Delivery only use electricity. Emissions from energy increased 12% from 2005 to 2012; City-Owned Outdoor Lights showed decreases in energy-

related emissions. Overall, electricity consumption (kWh) increased from 2005 to 2012, and electricity-based emissions increased 5%. 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	3,936,848	1,196	5,468,451	1,748	39%	46%
Natural Gas	58,223	310	102,505	545	76%	76%
Outdoor Lights						
SCE-Owned—Electricity	1,672,235	508	1,693,987	542	1%	7%
City-Owned—Electricity	3,629,352	1,103	2,014,756	644	-44%	-42%
Water Delivery						
Electricity	356,744	108	385,378	123	8%	14%
Total (MT CO_2e)		3,225		3,602		12%

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; NatGas is natural gas.

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, housing, and jobs are all 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 increase 1% from baseline levels by 2020 and nearly 5% by 2035.**

The City's BAU emissions in 2020 are estimated to be 527,294 MT CO_2e, or a 1% increase from baseline (2005) emissions. By 2035, emissions are estimated to increase nearly 5% from the baseline level to 546,714 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	538,339,762	490,579,902	507,671,090	-1.15%	0.23%
Solid Waste, Water, Wastewater, Off-road Sources	Service Population (Population + Jobs)	96,256	100,300	104,600	0.52%	0.28%
Commercial/ Industrial Energy	Jobs	67,007	69,700	73,000	0.49%	0.31%
NA[2]	Population	30,615	30,700	32,000	0.03%	0.28%
Residential Energy	Households	29,016	30,700	32,000	0.71%	0.28%
Municipal Jobs	Municipal Emissions[3]	715 FTE	715 FTE	715 FTE	0%	0%

Source: SCAG 2012

FTE: Full-time Equivalent employees. The number of employees in 2012 was not available; 2007 data were used.

1 CAGR is 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. As the City is not anticipating significant growth in municipal services, the number of jobs in 2020 and 2035 is assumed constant. 2012 data was not provided, therefore 2007 data was assumed.

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	246,707	265,512	257,228	-3%	266,190	0%
Commercial Energy	142,679	137,031	142,859	4%	147,528	8%
Residential Energy	95,616	101,010	106,415	5%	110,921	10%
Solid Waste	16,840	7,406	7,699	4%	8,029	8%
Water	15,576	10,332	10,741	4%	11,201	8%
Off-road Sources	4,492	1,906	2,141	12%	2,625	38%
Wastewater	258	203	211	4%	220	8%
Total	522,168	523,400	527,294	0.7%	546,714	4%
% Change from 2005		0.2%	1.0%		4.7%	

Municipal Business-as-Usual Forecast

- **BAU municipal emissions are expected to be 12% above baseline levels in 2020 and 2035.**

The City is not anticipating much 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 (Table 14). However, since 2012 emissions were slightly higher than the baseline year emissions, future municipal emissions are also projected to be higher than in 2005. In 2020 and 2035, municipal emissions are estimated to be 12% above baseline emissions.

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	2,515	2,591	2,591	0%	2,591	0%
Outdoor Lights	1,611	1,186	1,186	0%	1,186	0%
Buildings & Facilities	1,506	2,293	2,293	0%	2,293	0%
Solid Waste	934	719	719	0%	719	0%
Employee Commute	517	1,150	1,150	0%	1,150	0%
Water Delivery	108	123	123	0%	123	0%
Total	7,191	8,062	8,062	0%	8,062	0%
% Change from 2005		12%	12%		12%	

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[4]. 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.

[4] CARB Advanced Clean Cars Summary Sheet

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 obtains over 99% of their water from the Palos Verdes District served by the California Water Service Company, and less than 1% from Golden State Water Company. Therefore, the level of implementation of SB X7-7 was estimated using an annualized reduction rate from California Water Service Company's goal.

Community Adjusted Business-as-Usual Forecast

- **Emissions are expected to change under the Adjusted BAU forecast and will be nearly 10% lower in 2020 than 2005 and nearly 22% lower than 2005 levels by 2035.**

The City's Adjusted BAU emissions in 2020 are estimated to be 470,593 MT CO_2e in 2020 and 407,422 MT CO_2e in 2035 (Table 15). This change represents a nearly 10% decrease from 2005 by 2020 and nearly 22% 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 Commercial/Industrial Energy will increase. Emissions from Solid Waste are expected to increase over time but account for 2% of total emissions. Water &Wastewater emissions are expected to decrease over time.

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	251,199	267,418	208,315	45%	137,734	35%
Commercial/ Industrial Energy	142,679	137,031	141,846	31%	145,549	37%
Residential Energy	95,616	101,010	105,935	23%	109,961	27%
Solid Waste	16,840	7,406	7,699	2%	8,029	2%
Water & Wastewater	15,834	10,535	6,798	1%	6,149	2%
Total	522,168	523,400	470,593	100%	407,422	100%
% Change from 2005		<1%	-10%		-22%	

Municipal Adjusted Business-as-Usual Forecast

- **In 2020 and 2035, under an Adjusted BAU forecast, the City will be 8% above 2005 levels.**

The City's Municipal Adjusted BAU emissions in 2020 are estimated to be 7,799 MT CO_2e, which 8% above the 2005 baseline level (Table 16). Emissions are expected to remain constant through 2035, since the City is not anticipating major changes in municipal services through 2035. 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	2,515	2,591	2,409	31%	2,409	31%
Outdoor Lights	1,611	1,186	1,186	15%	1,186	15%
Buildings & Facilities	1,506	2,293	2,293	29%	2,293	29%
Solid Waste	934	719	719	9%	719	9%
Employee Commute	517	1,150	1,069	14%	1,069	14%
Water Delivery	108	123	123	2%	123	2%
Total	7,191	8,062	7,799	100%	7,799	100%
% Change from 2005		12%	8%		8%	

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[5]. 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 would need to reduce 26,750 MT CO_2e emissions below the Adjusted BAU scenario to meet the reduction target. In 2035, the City would need to reduce 141,116 MT CO_2e emissions below the Adjusted BAU scenario to meet the State-aligned target (Table 17 and Figure 7).

Table 17. State-Aligned Community GHG Reduction Targets

Sector	2005	2012	2020	2035
BAU Emissions (MT CO_2e)	522,168	523,400	527,294	546,714
Adjusted BAU Emissions (MT CO_2e)	522,168	523,400	470,593	407,422
State-Aligned Target (% change from 2005)			-15%	-49%
State-Aligned Target (% change from 2012)			-15%	-49%
State-Aligned Emissions Goal (MT CO_2e)			443,843	266,306
Reductions from Adjusted BAU needed to meet the Target (MT CO_2e)			26,750	141,116

[5] 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.

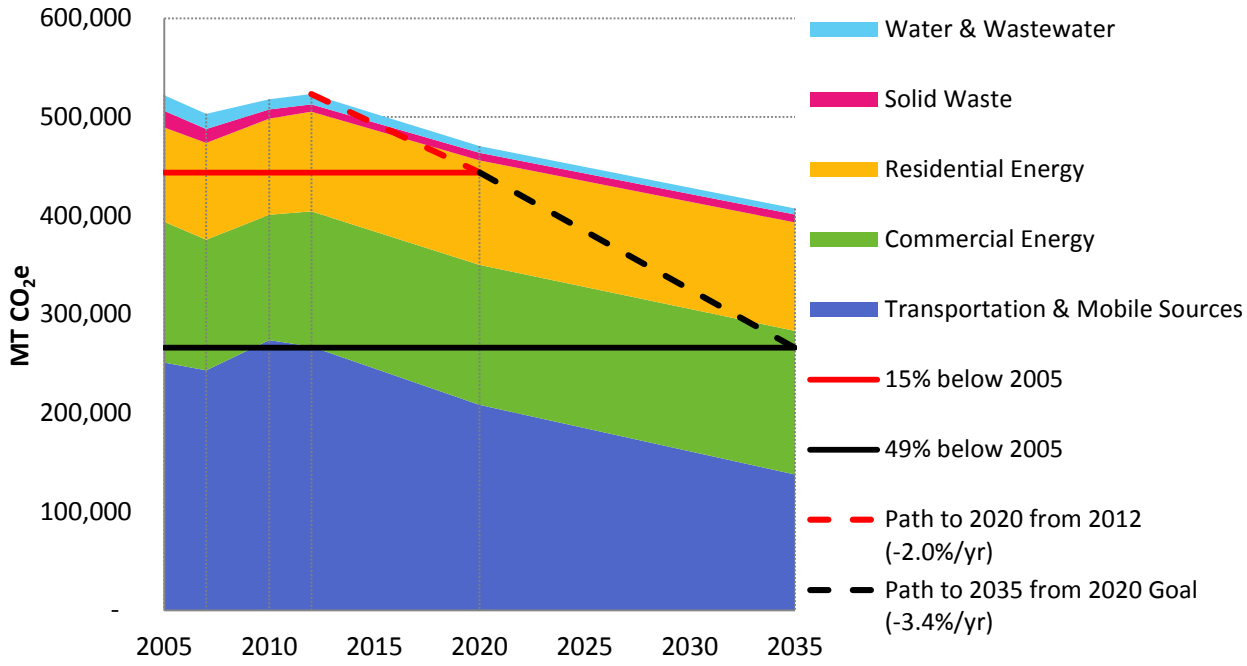


Figure 7. Community Emissions Inventories, Projections, and Targets

Recommended Municipal Targets

In 2020, the City would need to reduce its emissions by 1,687 MT CO_2e from the 2020 Adjusted BAU forecast to achieve a reduction goal consistent with the State (Table 18 and Figure 8). In addition, the City will need to implement measures to continue to achieve 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 would need to reduce municipal operation emissions by 4,132 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)	7,191	8,062	8,062	8,062
Adjusted BAU Emissions (MT CO_2e)	7,191	8,062	7,799	7,799
State-Aligned Target (% change from 2005)			-15%	-49%
State-Aligned Target (% change from 2012)			-24%	-55%
State-Aligned Emissions Goal (MT CO_2e)			6,112	3,667
Reductions from Adjusted BAU needed to meet the Target (MT CO_2e)			1,687	4,132

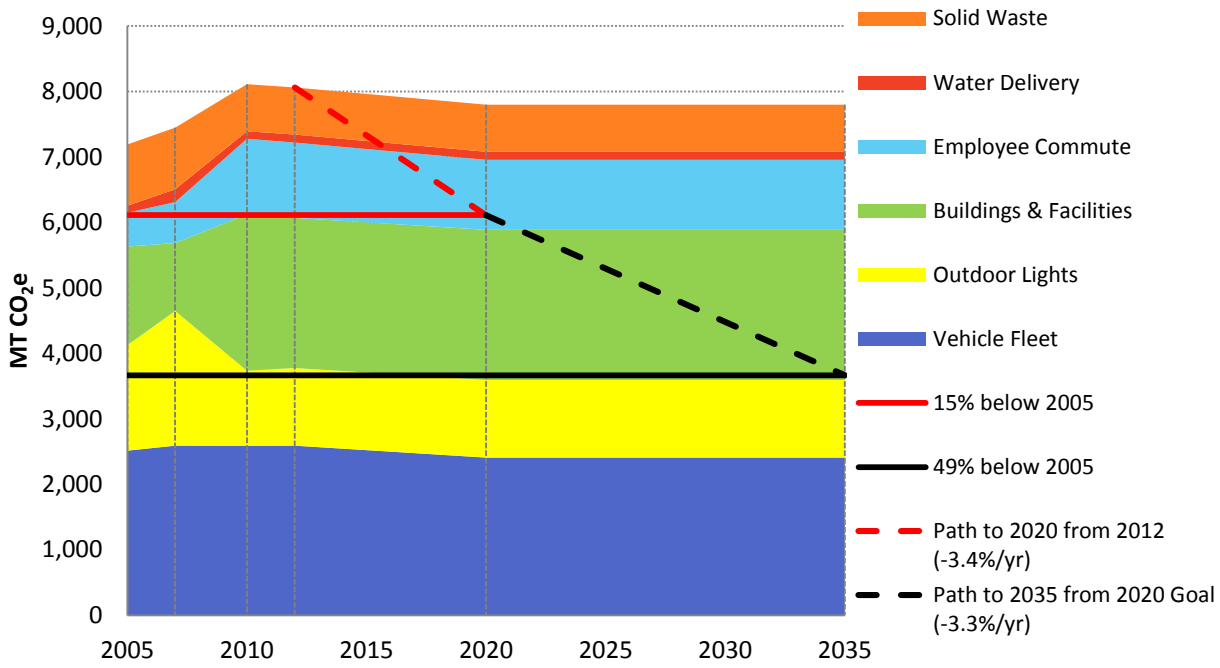


Figure 8. Municipal Emissions Inventories, Projections, and Targets

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/Industrial 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-2.

Table B-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	Golden State Water Company and California Water Service Company	
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.

Cap-and-Trade Entities

The City has major industrial facilities within its borders. Through the Cap-and-Trade Program, the State regulates the GHG emissions from some of these industrial facilities. The Cap-and-Trade Program currently includes electric utilities and large industrial facilities with emissions equal to or exceeding 25,000 MT CO_2e and will expand in 2015 to include suppliers of transportation, natural gas, and other fuels with annual emissions equal to or exceeding 25,000 MT CO_2e. Entities that are regulated as part of the Cap-and-Trade Program are called "covered entities" and must obtain compliance instruments equal to their entity's emissions. Each covered entity is required to procure emissions allowances and/or offset credits equal to their emissions. The allowances and offset credits are the two types of compliance instruments permitted in the Cap-and-Trade Program. Allowances are distributed by CARB to entities directly or by auction and may be traded in the free market. CARB-approved offset credits may be purchased from third-party registries to meet up to 8% of the entity's compliance obligation. Each compliance instrument is equivalent to 1 MT CO_2e.

Over time, the number of compliance instruments available at the State level will decline and emissions will decrease. The emissions associated with covered entities are already regulated at the State level and therefore, the City does not have significant local control over the GHG emissions. The current protocol recommends excluding the covered entities' GHG emissions from the City's inventories. In an effort to be consistent with protocol, data were reviewed to determine to what extent covered entities are included.

Emissions from covered entities that would be included in a city's inventory are from natural gas and electricity, and major industrial users generally utilize natural gas for their operations to a much larger extent than they utilize electricity. Data provided by SCG and SCE for this inventory report are protected under privacy restrictions which fall under the 15/15 rule.[1] Each utility provides data with these protections applied consistent with their individual corporate reporting protocols. The utilities do not specify if covered entities are included in the data provided. In comparing data from past inventory years, the electricity data are consistent and natural gas data are significantly reduced, leading to the conclusion that once the 15/15 rule was applied, major emitters, including many covered entities, were likely removed from the total natural gas data. If additional information becomes available that either allows the City to better separate out the energy usage from covered entities or provides better clarity of the current data aggregation, SBCCOG recommends that the City review the information and determine whether adjustments to the inventories and/or associated reports are warranted. If adjustments are made, SBCCOG recommends they be consistent among all inventory years and with current quantification methodology.

[1] The 15/15 rule requires that any aggregated information provided by the Utilities must be made up of at least 15 customers and a single customer's load must be less than 15% of an assigned category. If the number of customers in the compiled data is below 15, or if a single customer's load is more than 15% of the total data, categories must be combined before the information is released. The Rule further requires that if the 15/15 Rule is triggered for a second time after the data has been screened once already using the 15/15 Rule, the customer be dropped from the information provided.

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	471,782,607	465,368,722	538,938,917	538,339,762	14.1%
Residential Energy[1]					
Electricity (kWh)	146,624,086	154,752,638	153,965,618	153,829,706	4.9%
Natural Gas (therms)	9,604,693	10,070,195	10,000,521	9,744,860	1.5%
Commercial/Industrial Energy[1]					
Electricity (kWh)	342,048,319	347,205,566	335,044,830	334,749,071	-2.1%
Natural Gas (therms)	7,290,573	6,099,800	5,748,231	5,638,732	-22.7%
Solid Waste					
Landfilled (tons)	65,115	52,029	37,585	29,881	-54.1%
ADC (tons) [2]	5,215	6,696	123	278	-94.7%
Water and Wastewater					
Water (MG)[3]	2,933	2,935	2,745	2,802	-4.5%
Recycled Water (MG)[3]	20	20	17	20	1.1%
Wastewater (City portion of countywide residents)	0.67%	0.67%	0.68%	0.68%	0.9%
Off-road Sources[4] (% of LA County emissions attributed to the City)					
Lawn & Garden (% Households)	0.90%	0.89%	0.89%	0.89%	-2.0%
Construction (% Building permits)	1.62%	0.77%	0.60%	0.59%	-63.9%
Industrial (% Manufacturing jobs)	0.47%	0.49%	0.49%	0.49%	4.1%
Light Commercial (% Other jobs)	0.69%	0.72%	0.71%	0.72%	3.9%
Recreation (Population weighted by income)	1.10%	1.10%	1.12%	1.10%	0.1%
Agriculture (% Ag. Jobs)	0.22%	0.23%	0.27%	0.34%	54.5%

1 2010 Electricity data provided as a single number by SCE. Data were apportioned using Residential/Non-residential proportion in 2012.

2 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.

3 Includes Golden State Water, Cal Water, and Municipal water. 2005 and 2007 Cal Water data was unknown; therefore 2009 data was used as proxy.

4 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 below 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. The City participates in the South Coast Air Quality Management District's Average Vehicle Ridership Survey (Survey). Data from the City's 2012 Survey were compiled and used to estimate the average commute distance for employees in 2012. The data were also applied to 2010, since data for 2010 were not available.

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)	3,936,848	2,141,762	5,211,828	5,468,451	39%
Natural Gas (therms)	58,223	79,039	166,989	102,505	76%
Outdoor Lights					
City-owned (kWh)	3,629,352	5,460,241	2,294,375	2,014,756	-44%
SCE-owned (kWh)	1,672,235	1,689,289	1,687,562	1,693,987	1%
Fleet & Equipment[1]					
City-owned Fleet					
Gasoline (gallons)	77,007	76,482	76,482	76,482	-1%
Diesel (gallons)	22,837	19,794	19,794	19,794	-13%
CNG (standard cubic feet)	416,984	1,364,871	1,364,871	1,364,871	227%
Contracted Fleet					
Gasoline (gallons)	11,568	11,387	11,387	11,387	-2%
Diesel (gallons)	949	1,131	1,131	1,131	19%
LNG (gallons)	264,603	274,865	274,865	274,865	4%
Employee Commute					
Gasoline (vehicle miles traveled)	1,251,819	1,527,802	2,810,571	2,810,571	125%
Diesel (vehicle miles traveled)	0	795	33,104	33,104	--
# FTE[1,2]	613	715	715	715	17%
Solid Waste[1]					
Generated Waste (tons)	2,896	2,922	2,922	2,922	1%
Water Delivery					
Electricity (kWh)	356,744	678,407	399,307	385,378	8%

1 Data for 2010 and 2012 were not available; 2007 data were used as a proxy.

2 FTE is full time-equivalent employees.

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 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 (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.[2] These categorizations are

[2] 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.

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[3] 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

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[4] 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.

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

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.

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	30	416	2,166	28,740	27,883	65,931	79,370
	County	13,562	25,623	461,099	3,178,736	4,045,922	9,816,200	48,606
	%	0.22%	1.62%	0.47%	0.90%	0.69%		1.10%
2007	City	31	156	2,253	28,784	29,010	65,738	84,186
	County	13,562	20,303	461,099	3,224,053	4,045,922	9,780,800	51,439
	%	0.23%	0.77%	0.49%	0.89%	0.72%		1.10%
2010	City	29	45	1,777	30,609	26,860	66,716	91,964
	County	10,598	7,466	362,157	3,454,093	3,758,244	9,818,605	56,000
	%	0.27%	0.60%	0.49%	0.89%	0.71%		1.12%
2012	City	37	111	1,805	30,615	27,407	67,007	87,337
	County	10,798	18,926	369,005	3,454,093	3,829,313	9,889,632	53,880
	%	0.34%	0.59%	0.49%	0.89%	0.72%		1.10%

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[5].

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

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.

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%	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.

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.

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.[6] 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.[7] 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.[8] 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[9]; therefore, 16.8% reduction in electricity consumption may be expected in new commercial development.

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

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

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 obtains over 99% of their water from the Palos Verdes District served by the California Water Service Company, and less than 1% from Golden State Water Company. Therefore, the level of implementation of SB X7-7 was estimated using an annualized reduction rate from California Water Service Company's goal. California Water Service Company's Palos Verdes District has a baseline per-capita water use rate of 282 gallons per day and a 2020 per-capita goal of 225 gallons per day.

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%

Appendix C: 2005 and 2007 Inventory Updates

The South Bay Cities Council of Governments (SBCCOG) previously conducted emissions inventories for the community and municipal operations. This section details the approach used in the previous inventories, updates, and comparisons of previous and updated inventories.

Description of Previous Inventories

Community Inventory

SBCCOG conducted community inventories for the years 2005 and 2007 and projected emissions for 2020. Activities inventoried were on- and off-road transportation, electricity and natural gas usage, solid waste and wastewater generation. Emissions for 1990 were estimated to show likely trends in activity but the data is not as reliable as for the 2005 and 2007 inventories and therefore are excluded from further analysis.

Municipal Inventory

SBCCOG conducted municipal inventories for the years 2005 and 2007 and projected emissions for 2012 and 2015. Activities inventoried were building and facility energy consumption, including streetlights, park lights, and traffic signals; employee commute-related emissions; vehicle fleet emissions; and waste production in City facilities. As with the community inventories, 1990 emissions were inventoried but are not as accurate and are therefore excluded from further analysis.

Methodology for Revising and Developing New Inventories

There are many approaches to conducting a GHG emissions inventory, and the approach used in California is evolving.

Protocols

The Local Government Operations Protocol (LGOP), adopted by the California Air Resources Board (CARB) in 2008 and serving as a national standard for quantifying and reporting GHG emissions from local government operations, is the foundation of both previous and revised municipal inventories, and revision to the inventories is made according to additional guidance developed after 2007.

The previous community inventories, which were conducted with the best available approach at that time, followed the methodology in the draft International Local Government GHG Emissions Analysis Protocol (IEAP), a common international framework. Since then, other guidance documents recommend variations in methodology and are the current standard of practice in California. In 2012, a Community Protocol was released that provided guidance to U.S. cities conducting a communitywide inventory. In 2013, the Association of Environmental Professionals Climate Change Committee released a California Supplement to the Community Protocol, providing more detailed guidance for inventories being conducted in California. Other guidance regarding Global Warming Potential (GWP) factors and emission

factors has also been updated. The following describe the revisions to the 2005 and 2007 inventories to conform to current methodologies.

Demographics

The Southern California Association of Governments (SCAG) completes a growth forecast every four years as part of their Regional Transportation Plan (RTP) process, which also includes historical data. The previous inventories included demographic information from the 2008 RTP. The inventories were updated to reflect any changes to 2005 and 2007 demographics found in the most recent (2012) RTP (Table C-1).

Table C-1. Demographic Information

Year	Previous Inventory Data[4]			Current Data[1,2,3]		
	Population	Jobs	Households	Population	Jobs	Households
2005	66,910	30,079	28,889	65,931	30,079	28,740
2007	67,114	30,071	28,995	65,738	31,294	28,784
2010	N/Av	N/Av	N/Av	66,716	28,666	29,011
2012	N/Av	N/Av	N/Av	67,007	29,249	29,016
2020	71,016	31,246	31,002	69,700	30,600	30,700
2035	N/Av	N/Av	N/Av	73,000	31,600	32,000

N/Av: Data not available.

Sources:

1 Southern California Association of Governments. Population, Household, and Employment Integrated Growth Forecast. http://gisdata.scag.ca.gov/Pages/SocioEconomicLibrary.aspx (Accessed March 27, 2014). – (Population: 1990, 2005 & 2007)

2 Southern California Association of Governments. Regional Transportation Plan 2012 - 2035. Adopted April 2012. – (Population:2010, 2012, Population, jobs, Housing Units: 2020 & 2035)

3 Southern California Association of Governments. Local Profile. (Households, 2005, 2007, 2010, 2012; Jobs 2007, 2010, 2012) http://www.scag.ca.gov/Documents/RedondoBeach.pdf Accessed April 11, 2014. http://www.dof.ca.gov/research/demographic/reports/estimates/e-5/2011-20/view.php

4 2011 Redondo Beach Inventory Report

Global Warming Potentials

The GWP factors were updated to be consistent with CARB's Scoping Plan Update recommendations. The previous inventory used the Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report GWP factors. The State currently uses the Fourth Assessment Report GWP factors (C-2).

Table C-2. 100-Year Global Warming Potentials

Gas	Previous GWP	Updated GWP
CO_2	1	1
CH_4	21	25
N_2O	310	298

Previous GWP is based on the Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report, 1995. Updated GWP is based on the IPCC Fourth Assessment Report, 2007.

Emission Factors

Emission factors are used to estimate the amount of GHGs per unit of activity. For example, electricity would have a higher emission factor, or GHG output per kWh, if the electricity was generated from coal sources versus solar panels. Emission factors were updated to reflect the best available data to date. Previous emission factors are presented in the previous inventory reports. Emission factors used in the current inventories are presented in Appendix B.

Water Sector

The Community Protocol recommends including emissions related to the energy required to source, distribute, and treat water, known as the "embedded energy" in water. The previous inventories, which did not include a water sector, were updated to include the energy embedded in water. Calculation details are provided in Appendix B.

Off-road categories

The previous inventories included off-road emission sources from construction, lawn and garden, industrial, and light commercial equipment. In general, off-road sources are not known at the city level and are apportioned to cities from data available at the county level using the state-develop OFFROAD model. The off-road sources were previously allocated to cities based on population. Current protocol recommends allocating off-road sources according to known and applicable indicators as described in Table C-3. For example, the emissions from landscape equipment uses the number of households in the City compared to the total households in the county. The current inventories also include emissions from recreational vehicles, such as all-terrain vehicles. While many jurisdictions do not allow off-road activity within its city boundaries, emissions are attributed to the owner's city of residence. Recreational vehicles are allocated to cities based on the relative population and median income of the city compared to the county. These account for (1) areas with greater populations generally have greater recreational vehicles than areas with smaller populations and (2) income disparities among cities. Recreational vehicles are generally a luxury item and therefore population alone may not accurately account for ownership (and therefore emissions) of this subsector.

Table C-3. Off-Road Emissions Indicators

Subsector	Indicator[1]
Industrial Equipment	Industrial Jobs
Agricultural Equipment	Agricultural Jobs
Recreational Vehicles	Population adjusted for income level
Landscape Equipment	Households

[1] All data are relative to LA County.

Comparison of Previous Inventories with Revised and New Inventories

Community

Table C-4 details the activity data used for the 2005 and 2007 inventories.

Table C-4. Activity Data used in 2005 and 2007 Community Inventories

Sector	2005		2007	
	Previous	Revised	Previous	Revised
Electricity (kWh)	488,672,405	488,672,405	501,958,204	501,958,204
On-Road Transportation (vehicle miles traveled)	471,782,607	471,782,607	465,368,722	465,368,722
Natural Gas (therms)	64,817,781	16,895,266	74,616,180	16,169,995
Solid Waste (tons)	65,115	70,330	52,029	58,725
Water (MG)	N/Av	2,933	N/Av	2,935
Recycled Water (MG)	N/Av	20	N/Av	20
Wastewater	N/Av	*	N/Av	*
Off-Road Transportation	N/Av	*	N/Av	*

N/Av: Data not available.

*See Appendix B for methodology

Table C-5 shows the 2005 and 2007 GHG emissions by sector based on the updates described in the previous section.

Table C-5. Previous and Revised Community GHG Emissions for 2005 and 2007

Sector	2005		2007	
	Previous (MT CO_2e)	Revised (MT CO_2e)	Previous (MT CO_2e)	Revised (MT CO_2e)
On-Road Transportation	272,103	246,707	264,424	241,068
Electricity	148,453	148,455	144,488	144,487
Natural Gas	344,368	89,840	396,386	85,984
Solid Waste	12,753	16,840	10,128	14,125
Wastewater	N/Av	258	N/Av	200
Water	N/Av	15,576	N/Av	15,109
Off-Road Transportation	1,881	4,492	1,943	2,264
Total	779,558	522,168	817,369	503,237

N/Av: Data not available

Municipal

Municipal activity data did not change for 2005 and 2007; however, some of the emissions factors and the GWP factors have changed, which affect the emissions associated with the activity data. Table C-6 shows the 2005 and 2007 GHG emissions by sector based on the updates described in the previous section.

Table C-6. Previous and Revised Municipal GHG Emissions for 2005 and 2007

Sector	2005		2007	
	Previous (MT CO_2e)	Revised (MT CO_2e)	Previous (MT CO_2e)	Revised (MT CO_2e)
Electricity	2,915	2,807	2,991	2,675
Vehicle Fleet	4,012	2,515	4,250	2,591
Employee Commute	606	517	732	625
Natural Gas	311	310	393	420
Solid Waste	734	934	741	942
Water	N/Av	108	N/Av	195
Total	8,578	7,191	9,107	7,448

N/Av: Data not available

Appendix B

Greenhouse Gas Reduction Quantification Methodology

Appendix B: Greenhouse Gas Reduction Quantification Methodology

Community Reduction Measures

This section provides a detailed overview of the calculations and assumptions used to quantify greenhouse gas (GHG) emissions reductions for each of the community GHG reduction measures. The following information is provided for each measure.

- **Measure Description:** Describes the background and general information for each measure.
- **Action(s):** Details actions for the City to choose from to implement the measure and achieve the goal.
- **Assumptions:** Includes all assumptions used in calculating emissions reductions.

Each measure is classified as either a *quantifiable* measure or an *enhancing* measure. Both have *participation rates* that indicate the City's level of interest and commitment to implementing the specific measure. In addition, participation rates are influenced by measures which provide financial incentives since this typically increases public participation. Quantifiable measures also have unit savings that build upon population, housing units, or water usage, etc. The GHG reduction for each quantifiable measure is calculated by multiplying the participation rate by unit savings, number of units, and emission factors. Enhancing measures boost quantifiable measures by the percentage of the sum of enhancing measures' participation rates within the goal, but the enhanced participation rate cannot exceed the high end of the range.

The chosen participation rates of all measures are assumed to be achieved by 2020, so the rate of increase in annual reduction is calculated by dividing the reduction in 2020 by the number of years between the year that the plan is adopted and the year of 2020, which is four years for this plan. Assuming that the same rate of increase in annual reduction will be implemented between 2020 and 2035, the annual reduction in 2035 is calculated by multiplying the annual increase of reductions by fifteen years and adding this to the 2020 reduction amount.

Goal 1: Increase Energy Efficiency in Existing Residential Units

MEASURE 1.1: ENERGY EFFICIENCY (EE) TRAINING AND EDUCATION

Measure Description

Opportunities for residents to improve energy efficiency in their homes range from changes to behavior that they can start today to physical modifications or improvements they can make to their homes. Education of both the public and municipal employees is at the core of attaining energy efficiency goals. While most of the other measures include an outreach component, creating a specific education measure will emphasize the critical role of education in achieving energy efficiency. An education measure will also provide City staff with a framework to educate community members about behavioral and technological changes that can increase energy efficiency.

Actions

- ☐ Post links on website/social media and provide materials at public events
- ☐ Email list for e-mail blasts of new information or trainings
- ☐ Establish an annual energy efficiency fair
- ☐ Create a resource center
- ☐ Hire/designate Energy Advocate to promote and manage energy efficiency programs

Assumptions

- ☐ Participation rates are extrapolated from research on existing programs and studies
- ☐ For media, email and public events promotion the participation rate ranges from 5% to 7.5%
- ☐ For annual energy efficiency fairs the participation rate ranges from 10% to 25%
- ☐ For resource center the participation rate ranges from 10% to 15%
- ☐ For energy advocate the participation rate ranges from 25% to 30%

MEASURE 1.2: INCREASE PARTICIPATION IN EXISTING EE PROGRAMS

Measure Description

There are many energy efficiency opportunities that are low-cost for residents to initiate and result in cost savings over time. These opportunities are generally from existing programs. In the South Bay, both Southern California Edison (SCE) and Southern California Gas Company (SCG) offer many rebates and other incentives to purchase energy efficient appliances, lighting, and other low cost investments that facilitate energy efficiency. Through this measure, the City will work to increase residents' participation in existing energy efficiency programs that are low-cost or even provide a financial benefit to the resident. As programs change over time, continued and up-to-date outreach is necessary. The action below would provide a variety of channels for ongoing communication to the City's residents.

Actions

- ☐ Partner with SBCCOG and Utilities for outreach events
- ☐ Staff outreach to home owner associations (HOAs) and other housing groups

Assumptions

- ☐ Electricity saving is 1124 kWh per 1,000 service population
- ☐ Natural gas saving is 66 therms per 1,000 service population
- ☐ Participation rates are included within the reduction amounts and are set between 50% and 100%

MEASURE 1.3: ESTABLISH, PROMOTE, OR REQUIRE HOME ENERGY EVALUATIONS

Measure Description

Home energy evaluations are necessary to identify cost-effective opportunities for energy saving and for residents to take practical actions to achieve energy efficiency. Home energy evaluations can be established or promoted by a variety of existing programs.

Actions

- ☐ Require third-party inspector to verify Title 24 or greater compliance to home upgrades or enhance enforcement of Title 24 compliance
- ☐ Promote home energy audits through programs such as Energy Upgrade California
- ☐ Establish free "Energy Checkup" program

Assumptions

- ☐ Participation rate of energy audits and energy checkup ranges from 25% to 38%

MEASURE 1.4: PROMOTE, INCENTIVIZE, OR REQUIRE HOME ENERGY RENOVATIONS

Measure Description

Buildings built before adoption of Title 24 are not energy efficient, and renovations would achieve higher energy efficiency. Many programs and incentives across the state or country help promote home energy renovations, including city-supervised funding, permit process improvements and city ordinance.

Actions

- ☐ Promote existing incentivized programs such as Energy Upgrade California
- ☐ Develop or promote a green building program
- ☐ Promote Financing Programs such as PACE (Properly Assessed Clean Energy)
- ☐ Waive or reduce permit fees to facilitate permit processing
- ☐ Establish online permitting to facilitate permit processing
- ☐ Develop City-based revolving loan fund
- ☐ Develop a Point-of-Sale Energy Rating ordinance
- ☐ Develop a Residential Energy Conservation Ordinance (RECO)

Assumptions

- ☐ Independent and voluntary energy efficiency practices and measures participation rates range from 15% to 54%; it applies to total housing market and is percent measures and practices adopted
- ☐ California Solar Initiative (CSI) program participation rate ranges from 1% to 4%
- ☐ Energy reduction from Energy Upgrade California Program is 10% of historic energy use for single family houses and multi-family houses in Climate Zone 13
- ☐ HERO Program or loan fund participation rates range from 1% to 6%. Electricity saving is 4,000 kWh per household, but only applies to houses constructed before 1980
- ☐ Participation rates associated with waived/reduced permit fees or online permitting ranges from 1% to 5%
- ☐ Point-of-Sale energy rating can save 60 kWh of electricity per house sold, and the participation rate ranges from 85% to 100%
- ☐ Participation rate of Residential Energy Conservation Ordinance (RECO) ranges from 5% to 100%, and can save 1,720 kWh of electricity or 924 terms of natural gas per house sold

Goal 2: Increase Energy Efficiency in New Residential Development

MEASURE 2.1: ENCOURAGE OR REQUIRE EE STANDARDS EXCEEDING TITLE 24

Measure Description

City planners have a unique opportunity to encourage/inform developers of new energy efficiency opportunities in new development. This policy will develop City staff to become resources in encouraging and implementing energy efficiency building measures beyond that required in current Title 24 Standards. This policy will also ensure that as Title 24 Standards are updated, City staff are well-informed and can implement updates quickly and effectively.

Actions

- ☐ Educate City staff, developers, etc., on future Title 24 updates and the additional energy efficiency opportunities for new residential development
- ☐ Promote Tier 1, Tier 2, Green Building Ratings such as LEED, Build It Green/Green Point Rating System, or Energy Star certified buildings
- ☐ Waive or reduce permit fees to facilitate permit processing
- ☐ Establish online permitting to facilitate permit processing
- ☐ Create an Energy award program for net-zero-net energy homes
- ☐ Adopt a local ordinance to exceed Title 24 (2013)

Assumptions

- ☐ Participation rates are extrapolated from research on existing programs and studies
- ☐ For trainings on Title 24, participation rates range from 50% to 100%, and potential savings from compliance improvement is 14% for both electricity and natural gas. This assumes average new house energy consumption is equal to 2012 residential consumption divided by 2012 residential units.
- ☐ Participation rates for LEED program range from 6.25% to 25%, with 5% energy savings on electricity and natural gas
- ☐ Non-quantifiable actions are assumed to enhance participation rates of the other actions in this measure by 1% to 5%

Goal 3: Increase Energy Efficiency in Existing Commercial Units

MEASURE 3.1: EE TRAINING AND EDUCATION

Measure Description

Education is at the core of attaining energy efficiency goals. Creating a specific education measure will emphasize the critical role of education in achieving energy efficiency. An education measure will also provide City staff with a framework to interact with and educate community members about behavioral and technological changes that can increase energy efficiency.

Actions

- ☐ Post links on website/social media and provide materials at public events
- ☐ Email list for e-mail blasts of new information or trainings

- ☐ Establish an annual energy efficiency fair
- ☐ Create a resource center
- ☐ Hire/designate Energy Advocate to promote and manage energy efficiency programs

Assumptions

- ☐ Participation rates are extrapolated from research on existing programs and studies
- ☐ For media, email and public events promotion the participation rate ranges from 5% to 7.5%
- ☐ For annual energy efficiency fairs the participation rate ranges from 10% to 25%
- ☐ For resource center the participation rate ranges from 10% to 15%
- ☐ For energy advocate the participation rate ranges from 25% to 30%

MEASURE 3.2: INCREASE PARTICIPATION IN EXISTING EE PROGRAMS

Measure Description

There are many energy efficiency opportunities that are low-cost for businesses to initiate and result in cost-savings over time. These opportunities are generally from existing programs offered in the South Bay. Both SCE and SCG provide many rebates and other incentives to purchase energy efficient appliances, lighting, and other low cost investments that facilitate energy efficiency. Through Measure 3.2, the City will work to increase businesses' participation in existing energy efficiency programs that are low-cost or even provide a financial benefit to the business. Although these are considered "low-hanging fruit," many business owners may be unaware that the opportunities exist.

Actions

- ☐ Partner with SBCCOG and Utilities for outreach events
- ☐ Staff outreach to business groups

Assumptions

- ☐ Electricity saving is 27,754 kWh per 1,000 service population
- ☐ Natural gas saving is 245 therms per 1,000 service population
- ☐ Participation rates are included within the reduction amounts and are set between 10% and 100%

MEASURE 3.3: PROMOTE OR REQUIRE NON-RESIDENTIAL ENERGY AUDITS

Measure Description

Commercial energy audits are necessary to identify cost-effective opportunities for energy savings and for business owners to take practical actions to achieve energy efficiency. The audits can be established or promoted by various existing programs.

Actions

- ☐ Require third-party inspector to verify Title 24 or greater compliance to upgrades
- ☐ Promote energy audits such as through Energy Upgrade California or other state programs
- ☐ Require early adoption of AB 1103 for small buildings (5,000-10,000 square feet)

Assumptions

- ☐ Participate rate of energy audits ranges from 25% to 38%
- ☐ Buildings that were benchmarked consistently reduced energy use by an average of 2.4% per year, and the participation rate ranges from 10% to 50%

MEASURE 3.4: PROMOTE OR REQUIRE COMMERCIAL ENERGY RETROFITS

Measure Description

As most commercial buildings in the City were built before the adoption of Title 24, most commercial facilities and equipment are not energy efficient. Therefore, retrofits are necessary to achieve higher energy efficiency. Many programs and incentives across the state or country help promote non-residential energy retrofits, including city-supervised funding, permit process improvements and city ordinance.

Actions

- ☐ Promote existing incentivized programs such as Energy Upgrade California
- ☐ Develop or promote a green building program
- ☐ Promote Financing Programs such as PACE (Properly Assessed Clean Energy)
- ☐ Waive or reduce permit fees to facilitate permit processing
- ☐ Establish online permitting to facilitate permit processing
- ☐ Develop City-based revolving loan fund
- ☐ Develop a Commercial Energy Conservation Ordinance (CECO)

Assumptions

- ☐ Participating buildings in the PACE program typically reduce 25% of energy use, and the participation rate ranges from 2% to 20%
- ☐ Participation rate for Green Building Program ranges from 1% to 5%
- ☐ California Solar Initiative (CSI) program participation rate ranges from 1% to 25%
- ☐ Commercial HERO Program participation rate ranges from 1% to 25%
- ☐ Participation rates associated with waived/reduced permit fees or online permitting ranges from 1% to 5%
- ☐ Participation rate of Commercial Energy Conservation Ordinance (CECO) ranges from 2% to 5% and can save 10% of electricity and natural gas per square feet of commercial buildings

Goal 4: Increase Energy Efficiency in New Commercial Development

MEASURE 4.1: ENCOURAGE OR REQUIRE EE STANDARDS EXCEEDING TITLE 24

Measure Description

City planners have a unique opportunity to encourage/inform developers of new energy efficiency opportunities in new development. This policy will develop City staff to be resources in encouraging and implementing energy efficiency beyond that required in current Title 24 Standards. This will also ensure that as Title 24 Standards are updated, City staff are well-informed and can implement updates quickly and effectively.

Actions

- ☐ Educate City staff, developers, etc., on future Title 24 updates and the additional energy efficiency opportunities for new commercial development
- ☐ Promote Tier 1, Tier 2, Green Building Ratings such as LEED, Build It Green/Green Point Rating System, or Energy Star certified buildings
- ☐ Waive or reduce permit fees to facilitate permit processing
- ☐ Establish online permitting to facilitate permit processing
- ☐ Create an Energy award program for net-zero-net energy businesses
- ☐ Adopt a local ordinance to exceed Title 24 (2013)

Assumptions

- ☐ Participation rates are extrapolated from research on existing programs and studies
- ☐ For trainings on Title 24, participation rate ranges from 50% to 100%, and potential savings from compliance improvement is 14% for both electricity and natural gas. This assumes average new commercial building energy consumption is equal to 2012 commercial consumption divided by 2012 commercial units
- ☐ Participation rates for LEED program range from 6.25% to 25%, with 5% energy savings on electricity and natural gas
- ☐ Non-quantifiable actions are assumed to enhance participation rates of the other actions in this measure by 1% to 5%

Goal 5: Increase Energy Efficiency through Water Efficiency

MEASURE 5.1: PROMOTE OR REQUIRE WATER EFFICIENCY (WE) THROUGH SBX7-7

Measure Description

SB X7-7, or The Water Conservation Act of 2009, requires all water suppliers to increase water use efficiency. The legislation set an overall goal of reducing per capita urban water consumption by 20 percent from a baseline level by 2020. This goal can be met by taking a variety of actions, including targeted public outreach and promoting water efficiency measures such as low-irrigation landscaping.

Actions

- ☐ Post links on website/social media and provide materials at public events
- ☐ Email list for e-mail blasts of new information or trainings
- ☐ Require low-irrigation landscaping

Assumptions

- ☐ Participation rates are extrapolated from research on existing programs and studies
- ☐ For media, email and public events promotion the participation rate ranges from 5% to 7.5%
- ☐ Participation rate for water efficient landscape ordinance ranges from 40% to 90%
- ☐ Assumes half of water consumption is for outdoor use, and a water efficient landscape ordinance can save 20% of outdoor water use, so the overall reduction of water consumption is 10%

MEASURE 5.2: PROMOTE WE STANDARDS EXCEEDING SB X7-7

Measure Description

In addition to SB X7-7, more actions are being studied or have been taken to exceed water efficiency standards. These efforts include education and outreach practices that could be combined with residential and commercial actions that emphasize the reuse of recycled/grey water and promote harvesting rainwater.

Actions

- ☐ Staff time dedicated to work with HOAs, businesses, and other groups for outreach
- ☐ Allow recycled or grey water uses for non-municipal uses
- ☐ Work with Water District to increase recycled water potential
- ☐ Promote rainwater harvesting rebates and demonstrations

Assumptions

- ☐ Participation rates are extrapolated from research on existing programs and range from 25% to 50%
- ☐ Assumes five rain events per year, 100 gallons capacity onsite, and tanks emptied between rain events; 1,000 square feet of roof surface captures 625 gallons of water for every one inch of rainfall
- ☐ Rain harvesting program participation rate ranges from 5% to 50%

Goal 6: Decrease Energy Demand through Reducing Urban Heat Island Effect

MEASURE 6.1: PROMOTE TREE PLANTING FOR SHADING AND EE

Measure Description

Trees and plants naturally help cool an environment by providing shade and evapotranspiration (the movement of water from the soil and plants to the air), making vegetation a simple and effective way to reduce urban heat islands. Shaded surfaces may be 20–45°F (11–25°C) cooler than the peak temperatures of un-shaded materials. In addition, evapotranspiration, alone or in combination with shading, can help reduce peak summer temperatures by 2–9°F (1–5°C). Furthermore, trees and plants that directly shade buildings can reduce energy use by decreasing demand for air conditioning.

Actions

- ☐ Encourage tree planting at plan check
- ☐ Work with community to develop a tree-planting group
- ☐ Develop a City tree planting program

Assumptions

- ☐ Participation rates are extrapolated from research on existing programs and studies, and range from 15% to 80%, and 2% to 50% on energy savings

☐ Assume 2.5% reduction in cooling load for residential and nonresidential land uses due to reduced urban temperatures

MEASURE 6.2: INCENTIVIZE OR REQUIRE LIGHT-REFLECTING SURFACES

Measure Description

Replacing surface areas with light-reflecting materials can decrease heat absorption and lower outside air temperature. Both roofs and pavements are ideal surfaces for taking advantage of this advanced technology.

Cool roof is built from materials with high thermal emittance and high solar reflectance—or albedo—to help reflect sunlight (and the associated energy) away from a building. These properties help roofs to absorb less heat and stay up to 50–60°F (28–33°C) cooler than conventional materials during peak summer weather. Cool roofs may be installed on low-slope roofs (such as the flat or gently sloping roofs typically found on commercial, industrial, and office buildings) or the steep-sloped roofs used in many residences and retail buildings.

Cool pavement is built from materials that reflect more solar energy, enhance water evaporation, or have been otherwise modified to remain cooler than conventional pavements. This pavement can be created with existing paving technologies as well as newer approaches such as the use of coatings, permeable paving, or grass paving. Cool pavements save energy by lowering the outside air temperature, allowing air conditioners to cool buildings with less energy, and reducing the need for electric street lighting at night.

Actions

☐ Pass an ordinance requiring or incentivizing enhanced cool roofs

☐ Pass an ordinance requiring or incentivizing cool pavements

Assumptions

☐ Participation rates are extrapolated from research on existing programs and studies, and range from 10% to 50%, and 30% to 100% on energy savings

☐ Assumes 20% energy reduction by replacing traditional roofs and pavements with light-reflecting materials

Municipal Reduction Measures

This section provides a detailed overview of the calculations and assumptions used to quantify GHG emissions reductions for each of the municipal GHG reduction measures. The following information is provided for each measure.

- **Measure Description:** Describes the background and general information for each measure.
- **Action(s):** Details actions for the City to choose from to implement the measure and achieve the goal.
- **Assumptions:** Includes all assumptions used in calculating emissions reductions.

Each measure is classified as either a *quantifiable* measure or a *supporting* measure. Quantifiable measures have unit savings that build upon consumption data, energy intensity of water sources, rates of

reduction, etc. The GHG reduction for each quantifiable measure is calculated by multiplying the unit savings, number of units, and emission factors. Supporting measures are presented as best management practices; however, their effects on quantifiable measures were not established.

The rate of increase in annual reduction is calculated by dividing the reduction in 2020 by the number of years between the last inventory year (2012) and the year of 2020, which is seven years for this plan. Assuming that the same rate of increase in annual reduction will be implemented between 2020 and 2035, the annual reduction in 2035 is calculated by multiplying the annual increase of reductions by fifteen years and adding this to the 2020 reduction amount.

Goal 1: Participate in Education, Outreach, and Planning Efforts for Energy Efficiency

MEASURE 1.1: INCREASE ENERGY SAVINGS THROUGH THE SCE ENERGY LEADER PARTNERSHIP

Measure Description

The Southern California Edison (SCE) Energy Leader Partnership (ELP) Program is a framework that offers enhanced rebates and incentives to cities that achieve measurable energy savings, reduce peak-time electricity demand, and plan for energy efficiency. This program also provides resources to cities to identify energy efficiency projects and technical assistance to implement them. The ELP has a tiered incentive structure with threshold criteria required to trigger advancement to the next level of participation.

Actions

☐ Participate in the SCE ELP and pursue energy efficiency projects which help the City advance within the tiered inventive structure.

Assumptions

☐ This is a supporting measure without enhancing metrics or data to support GHG and energy reduction quantification.

Goal 2: Increase Energy Efficiency in Municipal Buildings

MEASURE 2.1: CONDUCT MUNICIPAL BUILDING ENERGY AUDIT

Measure Description

Knowledge of building energy use is an effective way to determine energy inefficiencies and opportunities for retrofits and upgrades. Energy audits are a comprehensive review of both energy use and key components of the building. Energy audits provide an improved understanding of energy use, reveal energy inefficiencies of the building or building energy appliances, and offer recommendations on how to improve or correct the energy inefficiencies through retrofits or upgrades.

Actions

☐ Conduct annual reviews of energy use for each building to see trends and determine if energy efficiency retrofits are affective.

☐ Conduct municipal energy audits on a routine basis of every 3 to 5 years.

Assumptions

☐ This is a supporting measure without enhancing metrics or data to support GHG and energy reduction quantification.

MEASURE 2.2: REQUIRE GREEN BUILDING CERTIFICATION

Measure Description

LEED—Leadership in Energy & Environmental Design—is a rating system for buildings, homes, and communities developed by the U.S. Green Building Council (USGBC). Under this measure, the City could improve energy efficiency by requiring LEED certification, or certification through another green building rating system, for its municipal buildings.

Actions

☐ Identify existing buildings planned for retrofit.

☐ Determine the level of LEED certification to be achieved.

Assumptions

☐ Upgrading an existing building with energy efficiency upgrades to meet LEED Silver certification can achieve up to 40 percent in energy savings.

MEASURE 2.3: IMPLEMENT WATER LEAK DETECTION PROGRAM

Measure Description

Losing water from unrepaired leaks and operating at unnecessarily high-pressure results in wasted water, energy, and GHGs. The City can avoid this waste by conducting annual water audits to detect and repair leaks, developing a pressure management strategy, and devising a long-term water loss control plan.

Actions

☐ Conduct annual water audits to fix leaks.

☐ Develop a pressure management strategy.

☐ Devise a long-term water loss control plan.

Assumptions

☐ The average energy intensity (kWh/acre foot (AF)) of the water supply is projected to decrease as less water is imported.

☐ From 2015 to 2035, the average energy intensities of water supplied by the West Basin Municipal Water District (WBMWD) are: 2,111 kWh/AF in 2015; 2,087 kWh/AF in 2020; and 2,045 kWh/AF in 2035.

MEASURE 2.4: PARTICIPATE IN DEMAND RESPONSE PROGRAMS

Measure Description

Electricity is supplied to buildings immediately upon demand. During hours of peak demand, such as the late afternoon, the electricity grid is often put under stress to supply the increased demand. Demand

Response Programs offer incentives (e.g. discounted rates and bill credits) to electricity consumers to reduce their energy demand, or shift their demand to off-peak hours, in response to grid stress.

Actions

☐ Participate in Demand Response Programs.

Assumptions

☐ This is a supporting measure without enhancing metrics or data to support GHG and energy reduction quantification.

MEASURE 2.5: PARTICIPATE IN DIRECT INSTALL PROGRAM

Measure Description

SCE offers a Direct Install Program to reduce energy costs and save money. The program is funded by the utility ratepayers and includes a free assessment of the building by a contractor and installation of free energy-efficient replacement equipment. Examples of the energy-efficient equipment include fluorescent lighting, LED signs, window film, and programmable thermostats.

Actions

☐ Participate in Direct Install Program.

Assumptions

☐ Energy and cost savings data were provided by SBCCOG.

MEASURE 2.6: ADOPT A PROCUREMENT POLICY FOR EE EQUIPMENT

Measure Description

By adopting a procurement policy for energy efficient equipment, the City would replace equipment as it wears out with Energy Star or energy efficient equipment. Energy Star offers an appliance calculator on its website to estimate money and energy saved by purchasing its products.

Actions

☐ Adopt a procurement policy for energy efficient equipment.

☐ Replace municipal equipment with Energy Star or energy efficient equipment.

Assumptions

☐ Energy efficient procurement policies can reduce government facility energy costs by about 5 to 10 percent.

MEASURE 2.7: INSTALL COOL ROOFS

Measure Description

Surfaces with low albedo, or solar reflectance, amplify urban heat island effect. Many surfaces in an urban environment consist of building roofs. Roofs affect not only the temperature of the surrounding urban environment, but also the interior temperature of the attached building below. Upgrading roofs to materials with high albedo can reduce outdoor and indoor temperatures, thereby also reducing demand on energy for air conditioning.

Actions

☐ Install cool roofs on existing and proposed municipal buildings.

Assumptions

☐ Approximately 10 MT CO_2e can be reduced for every 1,000 sq. ft. of dark roof replaced with cool roof materials.

MEASURE 2.8: REQUIRE NEW OR RETROFITTED BUILDINGS TO EXCEED TITLE 24

Measure Description

California's current energy efficiency standards for buildings, called the 2013 Title 24 Standards, became effective July 1, 2014 and include significant changes to energy efficiency requirements in new development. Title 24 Standards are scheduled for updates and improvements every three years with the ultimate goal of zero net energy commercial buildings by 2030. Because of the update schedule, rulemaking process, and applicability dates, it is possible to implement proposed or adopted energy efficiency mandates before they are legally required. The City can implement early adoption of the energy efficiency mandates by requiring all new municipal buildings to exceed Title 24 by a specific amount, such as a percentage of energy savings above the requirement.

Actions

☐ Require new or retrofitted buildings to exceed Title 24.

☐ Establish a percentage of energy savings above Title 24 requirements.

Assumptions

☐ Based on the percentage of energy savings above Title 24 as selected by the City.

MEASURE 2.9: INCREASE RECYCLED WATER USE

Measure Description

The West Basin Municipal Water District (WBMWD) uses its Edward C. Little Water Recycling Facility to provide its cities with recycled water. One of its five types of "designer" or custom-made recycled water includes Tertiary Water (Title 22), used for irrigation.

Actions

☐ Work with the WBMWD to use its existing infrastructure to pipe recycled water through the City.

☐ Use recycled water to irrigate City-owned landscapes.

Assumptions

☐ Approximately 1,873 kWh can be saved for every acre foot (AF) of water use replaced by recycled water.

MEASURE 2.10: RETROFIT HVAC EQUIPMENT & WATER PUMPS

Measure Description

Project which retrofit heating, ventilation, and air conditioning (HVAC) and/or water pump equipment at municipal facilities can qualify for incentives through the SCE ELP (Measure 1.1). By replacing aging

equipment with newer, more efficient equipment, the City will reduce energy consumption and associated GHG emissions.

Actions

☐ Replace HVAC and/or water pump equipment with more energy efficient equipment.

Assumptions

☐ HVAC units account for approximately 32% of a (commercial) building's energy use, and newer, higher efficiency units are approximately 47% more efficient than older models.

MEASURE 2.11: TRACK ADDITIONAL ENERGY SAVINGS

Measure Description

This measure allows for the City to take advantage of additional energy efficiency opportunities as they arise. The various additional energy efficiency opportunities need to be documented in SBCCOG's Project Tracker database in order to keep the database current and allow the City to determine the effectiveness of the energy savings.

Actions

☐ Continually monitor building performance and identify cost-effective actions to reduce energy use.

☐ Document energy savings in SBCCOG's Project Tracker database.

Assumptions

☐ Energy and cost savings data were provided by SBCCOG.

MEASURE 2.12: UTILIZE AN ENERGY MANAGEMENT SYSTEM

Measure Description

Detailed information about facility energy consumption, including hourly energy profiles and energy consumption of individual building systems, can be monitored on a regular basis through an energy management system. This tool allows City staff to observe "real-time" energy consumption and analyzes building energy consumption trends using utility bill information. Using this tool, the long-term impacts of efficiency projects can be monitored.

Actions

☐ Utilize an energy management system.

Assumptions

☐ This is a supporting measure without enhancing metrics or data to support GHG and energy reduction quantification.

Goal 3: Increase Energy Efficiency in City Infrastructure

MEASURE 3.1: RETROFIT TRAFFIC SIGNALS AND OUTDOOR LIGHTING

Measure Description

Since 2001, SCE has offered its municipalities rebates on LED Traffic Signal Lamps. The program is part of a statewide effort to conserve energy and promote energy efficiency. Retrofitting a standard incandescent traffic signal with LED lamps using the SCE rebate can result in a payback of less than one year. Other outdoor lights (e.g. streetlights, park lighting, etc.) can also be retrofitted.

Actions

☐ Retrofit traffic signals and outdoor lighting with LED technology.

Assumptions

☐ Energy and cost savings data were provided by SBCCOG.

MEASURE 3.2: UPGRADE OR INCORPORATE WATER-CONSERVING LANDSCAPE

Measure Description

The City can reduce water consumption and associated energy use by converting traditional landscaping to water conserving landscaping. The City can participate in SoCal WaterSmart's Public Agency Landscape (PAL) program to receive a no-cost landscape irrigation audit and incentives to replace older landscape equipment with new, water-efficient models.

Actions

☐ Convert traditional landscaping to water conserving landscaping.

Assumptions

☐ Approximately 2,282 kWh can be saved annually for every acre of landscaping converted to water conservation landscaping.

MEASURE 3.3: PLANT TREES FOR SHADE AND CARBON SEQUESTRATION

Measure Description

Trees and vegetation naturally help cool an environment by providing shade and evapotranspiration (the movement of water from the soil and plants to the air) and reduce GHG emissions by sequestering carbon dioxide (CO2). Trees planted near pavement can reduce surface temperatures of streets and parking lots, and trees planted strategically near windows or roofs of buildings can effectively reduce interior temperatures. The City could plant trees in City-owned spaces to reduce urban heat island effect and building energy use and increase carbon sequestration.

Actions

☐ Plant new (as opposed to replacement) trees annually.

Assumptions

☐ The average mature tree can save an average of 170 kWh and absorb as much as 48 lbs. of CO_2 per year.

Goal 4: Reduce Energy Consumption in the Long Term

MEASURE 4.1: DEVELOP AN ENERGY REINVESTMENT FUND

Measure Description

An Energy Reinvestment Fund can be created with a portion of the documented savings achieved through these energy efficiency strategies. These funds are then reinvested in future energy efficiency improvements, thereby providing a means for leveraging greater and greater energy savings.

Actions

☐ Develop an energy reinvestment fund to reinvest cost savings from energy efficiency projects into future energy efficiency improvements.

Assumptions

☐ This is a supporting measure without enhancing metrics or data to support GHG and energy reduction quantification.

MEASURE 4.2: PURCHASE CARBON OFFSETS

Measure Description

In 2015, the City of Hermosa Beach set a goal of municipal carbon neutrality by 2020. In order to achieve this goal, the City of Hermosa Beach will need to purchase carbon offsets to balance the remaining energy related emissions in 2020 and 2035.

Actions

☐ Purchase carbon offsets to achieve municipal carbon neutrality.

Assumptions

☐ Amount of carbon offsets needed to be purchased is determined by the remaining energy related emissions in 2020 and 2035 after local reduction measures have been implemented.