# SUB-REGIONAL CLIMATE ACTION PLAN

SOUTH BAY CITIES
COUNCIL OF GOVERNMENTS

**South Bay Cities** 2018

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*Walter Siembab, Research Director of the SBCCOG; Concept Development of the "Sustainable South Bay Strategies"*
*Mohja Rhoads, PhD. Lead Author of the "Sub-Regional LUT Emissions Reduction Strategies: Sustainable South Bay Neighborhoods"*

*South Bay Cities Council of Governments' Climate Action Team:*
*Jacki Bacharach, Executive Director of the SBCCOG*
*Kim Fuentes, Deputy Executive Director of the SBCCOG*
*Steve Lantz, Transportation Director*
*Aaron Baum, Environmental Analyst*
*Erin Cornelius, Environmental Analyst*
*Buck Doyle, SBCCOG Intern*
*Amanda Maki, Former Environmental Analyst*

*Technical Review and Additional Research Provided by:*
*Marlon Boarnet, PhD*
*Fehr & Peers*
*Michael Manville, PhD and Taner Osman, PhD; "An Outcome-Based Approach to Technological Change for Local Governments"*
*Pro Forma Advisors; "Economic Support for Climate Plan: South Bay Cities, CA"*
*Susan Shaheen, PhD, Elliot Martin, PhD, Adam Cohen, MCRP*

## Sub-Regional South Bay
## January 2018

# CLIMATE ACTION PLAN

Prepared by:

SOUTH BAY CITIES
COUNCIL OF GOVERNMENTS

In Consultation with:

studioeleven FEHR PEERS

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*Climate action planning efforts vary in scope, size and focus. One common aim of this work is to establish greenhouse gas inventories and future forecasts. Another major component is developing the framework for selecting, evaluating, and organizing strategies that help advance local climate planning goals. For example, individual agencies may implement policies, optional or mandatory, related to land use development that operate outside the CEQA process. Within the CEQA process, a qualified CAP framework offers the ability to streamline future CEQA greenhouse gas analyses by being able to tier off the climate action plan. Depending on local factors, such as anticipated levels of development, a qualified CAP is not necessary and agencies would continue to utilize the framework for informing the selection and evaluation of climate planning strategies within the local context. The South Bay Cities Council of Governments CAP framework is unqualified, and offers cities a planning tool with optional strategies. The analysis and optional strategies in the CAP can be used in the future, by way of example, to help create a Qualified Climate Reduction Strategy under CEQA, to create GHG thresholds to be used in CEQA analysis and can be used to update the City's General Plan.*

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# Introduction


## The South Bay Cities Council of Governments is committed to providing a more livable, equitable, and economically vibrant sub-region.

As a part of these efforts, the South Bay Cities Council of Governments (SBCCOG), has developed a Sub-Regional Climate Action Plan (CAP) to provide policy guidance and sustainability resources for the 15 South Bay cities in support of their efforts to reduce Greenhouse Gas (GHG) emissions. The SBCCOG's CAP serves as a guide for action and consists of the following three sections:

1. Sub-regional inventories and GHG emission reduction goals as adopted by the SBCCOG in the Sub-Regional Energy Efficiency Chapter.
2. South Bay-specific land use and transportation policies, tools for quantification and, strategies for reducing GHG emissions.
3. Goals and measures that the majority of the South Bay Cities have chosen for reducing GHG emissions in the sectors of:
    - o Solid Waste
    - o Urban Greening
    - o Energy Generation and Storage

## Purpose and Need for the Sub-Regional Climate Action Plan

Jurisdictions in California are proactively working to find innovative solutions to address climate change. Many communities have taken local control of the issue by developing plans or strategies that will lower GHG emissions across various sectors in a manner that is most feasible for their community. The SBCCOG's CAP is a valuable tool in this effort. It identifies both community-specific and multi-jurisdictional strategies to lower GHG emissions from a range of sources including transportation, land use, energy generation and consumption, water, and waste. This CAP will allow South Bay cities to:

- Understand the interconnected nature of GHG emissions across the sub-region
- Provide strategies at the local level and across jurisdictions that will result in GHG emissions reductions
- Provide strategies and resources that will assist cities with their respective plans to reduce GHG emissions

Ultimately, the goal of this Sub-Regional CAP is to assist the region with options that will help to:

- Continue support for a South Bay community of neighborhoods that are safe, healthy, and environmentally sustainable
- Promote and encourage the adoption and growth of zero emission vehicles
- Advance strategies for housing and buildings that reduce energy and water usage
- Promote behavior change that reduces waste
- Transform built environments into green spaces
- Advance strategies to encourage and support the market for renewable energy and storage

## Alignment with California's Climate Change Action Plan

Since the 1990s, the State of California has adopted a number of policies to address Climate Change, with legislation such as Assembly Bill 32 (AB 32), Senate Bill 32 (SB 32), and the 2017 Climate Change Scoping Plan Update. All these documents set ambitious targets for reductions in greenhouse gas emissions within the State with the most recent being a 40 percent reduction in GHG by 2030 compared to 1990 levels. Apart from setting targets, the State has also passed a variety of laws over the past 20 years to encourage the development of renewable energy sources, apply financial disincentives for carbon emissions from business and industry, reduce energy and water usage, increase building energy efficiency, and reduce emissions from waste and mobile sources such as fossil-fuel based transportation. The Sub-Regional CAP advances these goals and facilitates the South Bay Cities' efforts to deploy specific initiatives and programs that target the reduction of GHG emissions, while integrating these efforts with the other priorities such as economic development, regional mobility and connectivity, and improving the local air and water quality.

Table 1 summarizes the key policies and legislation to address Climate Change adopted by the State of California.

Table 1: Regulatory Setting

| Bill & Year of Issuance | Title | Description | Implementing Agency |
|---|---|---|---|
| Public Law (PL) 88-206 (1963) | Clean Air Act | Federal policy to address global climate change through monitoring, reporting, and regulation of GHG emissions. | USEPA |
| 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. | California Air Resources Board (CARB) |
| Executive Order S-20-04 (2004) | California Green Building Initiative | Reduce energy use in state-owned buildings 20% from a 2003 baseline by 2015. | California Energy Commission (CEC) |
| 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. | CARB |
| Assembly Bill (AB) 32 (2006) | Global Warming Solutions Act | State must reduce GHG emissions to 1990 levels by 2020. | CARB |
| 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. | CEC |
| Senate Bill (SB) 1078 (2006), 107 (2017), and X1-2 (2011), and Executive Order S-14-08 (2008) and S-21-09 (2011) | Renewable Portfolio Standard | California investor-owned utilities must provide at least 33% of their electricity from renewable resources by 2020. | California Public Utilities Commission |
| Assembly Bill 118 (Nunez, Chapter 750, 2007) (2007) | Alternative Fuels and Vehicles Technologies | The bill would create the Alternative and Renewable Fuel and Vehicle Technology Program, to be administered by the Energy Commission, to provide funding to public projects to develop and deploy innovative technologies that transform California's fuel and vehicle types to help attain the state's climate change policies. | CEC |
| 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 |
| 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 |
| Senate Bill 375 (Steinberg, Chapter 728, 2008) (2008) | Sustainable Communities + Climate Protection Act | Requires Air Resources Board to develop regional greenhouse gas emission reduction targets for passenger vehicles. ARB is to establish targets for 2020 and 2035 for each region covered by one of the State's 18 metropolitan planning organizations. MPOS to develop and incorporate a sustainable communities strategy which will be the land use allocation in the RTP. | Regional Planning Agencies |
| 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 |
| SB X7-7 (2009) | Statewide Water Conservation | The carbon intensity of transportation fuels in California must be lowered 10% by 2020. | Department of Water Resources |
| AB 1092 (Levine Chapter 410, 2013) (2013) | Building Standards: Electric Vehicle Charging Infrastructure | Requires the Building Standards Commission to adopt mandatory building standards for the installation of future electric vehicle charging infrastructure for parking spaces in multifamily dwellings and nonresidential development. | California Building Standards Commission (CBSC) |
| California Code of Regulations (CCR) Title 24 (2016) | 2013 Building Efficiency Standards | Statewide green building code that raises the minimum environmental standards for construction of new buildings in California. | CEC |
| Senate Bill 32 (Chapter 249) (2016) | Global Warming Solutions Act: Emissions Limit | The California Global Warming Solutions Act of 2006 designates the State Air Resources Board as the state agency charged with monitoring and regulating sources of emissions of greenhouse gases. The state board is required to approve a statewide greenhouse gas emissions limit equivalent to the statewide greenhouse gas emissions level in 1990 to be achieved by 2020 and to adopt rules and regulations in an open public process to achieve the maximum, technologically feasible, and cost-effective greenhouse gas emissions reductions. This bill would require the state board to ensure that statewide greenhouse gas emissions are reduced to 40% below the 1990 level by 2030. | CARB |

## Roles and Responsibilities: Regional Agencies and Local Governments

### Regional Agencies

The State has acknowledged that local governments play an important role in helping California achieve its long-term GHG reduction goals. In Los Angeles County, the Southern California Association of Governments (SCAG), Los Angeles County Metropolitan Transportation Authority (Metro), South Coast Air Quality Management District (SCAQMD) as well as Cities all have sole or partial jurisdiction over a wide range of factors that affect GHG emissions. Council of Governments, like the SBCCOG, can provide cities with resources where sustainability innovations can be tested, policy guidance developed, and funding opportunities identified for the South Bay cities to reduce GHG emissions.

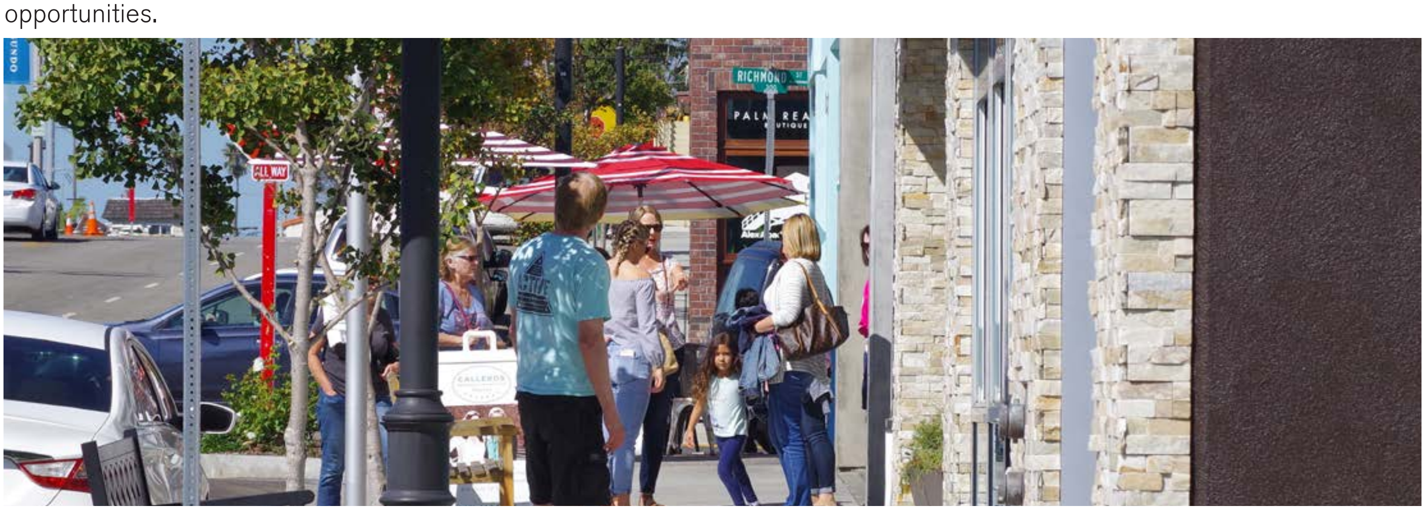
### South Bay Cities Council of Governments

The 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

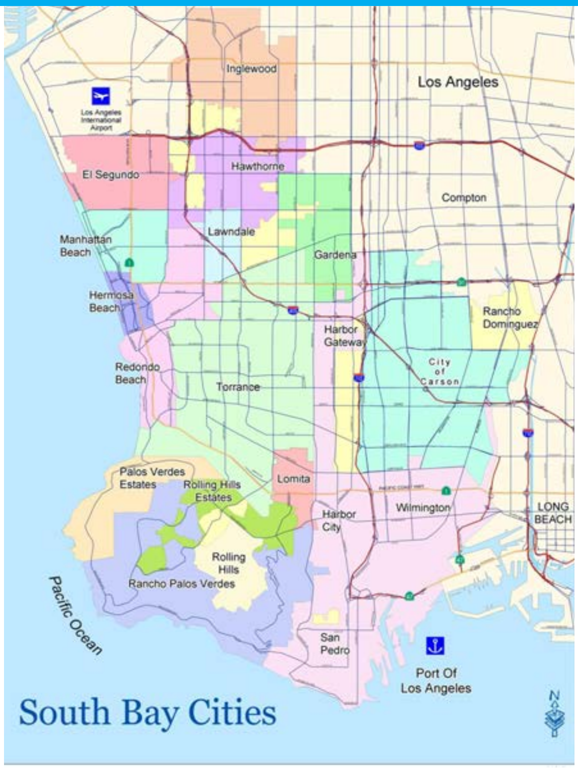
The SBCCOG has demonstrated its commitment to increasing environmental quality and awareness among its residents, local businesses, and jurisdictions while maintaining economic prosperity through effective sub-regional coordination. It has operated the South Bay Environmental Services Center (SBESC) for almost 15 years assisting cities and the South Bay community with information and programs on sustainable practices. Developing the sub-regional CAP effort also helps the SBCCOG meet the first goal 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.*

This Sub-Regional CAP received funding from SCE's 2013-2014 Local Government Partnership Strategic Plan Pilots program and the Strategic Growth Council. With this funding, the SBCCOG assisted the 15 participating cities (excluding Los Angeles) to develop individual CAPs, resulting in a cost-effective process for the cities, as well as sub-regional coordination related to climate change goals. In addition, the SBCCOG developed the Sub-Regional CAP that identifies the cumulative efforts and larger strategies for the South Bay and identifies synergies that may compound the success of each city's CAP by coordinating implementation of shared strategies and positioning the sub-region for unique funding opportunities.



# South Bay Profile




Encompassing 105.11 square miles, the South Bay is geographically located on the south end of Santa Monica Bay, the South Bay contains fifteen cities plus portions of the City of Los Angeles and unincorporated portions of the County of Los Angeles. The area is bounded by the Pacific Ocean on the south and west and, generally, by the City of Los Angeles on the north and east.

The 15 cities can be grouped into three areas: Beach, Inland, and Peninsula. The inland cities include Carson, Gardena, Hawthorne, Inglewood, Lawndale, Lomita, and Torrance. These cities are characterized by wide arterial boulevards and flat terrain. The beach cities include El Segundo, Hermosa Beach, Manhattan Beach, and Redondo Beach and are characterized by a higher proportion of local, slow speed streets and open space access to the beach. The peninsula cities include Palos Verdes Estates, Rancho Palos Verdes, Rolling Hills Estates, and Rolling Hills and are located on steeper terrain overlooking the other cities and the ocean.

Fig 1: South Bay Member Cities; Source - South Bay Association of Realtors

The South Bay is economically, geographically, and socially unique. It encompasses a wide variety of incomes and ethnicities. The South Bay houses around 1 million people, 384,183 households and 430,000 employees. The largest cities are Torrance and Inglewood and the smaller cities are the beach and peninsula cities. The wealthier communities are in the beach and peninsula cities. Several of the communities (located adjacent to major freeways) in Carson, Gardena, Hawthorne, Inglewood, Lawndale, and Lomita score as the top 10% most pollution-burdened census tracts in California as described in the Cal. Enviro-Screen tool.

The South Bay is a built-out, relatively dense sub-region of Los Angeles County and is characterized as a “mature suburban” community. Past development patterns have resulted in a community that is heavily reliant on automobility as a primary means of transportation and there is virtually no rail and little frequent bus service to provide residents; only portions of the Green Line (rail) and Silver Line (bus), and under-construction Crenshaw/LAX rail line lie within the South Bay boundaries. A future extension of the Green Line to Torrance is funded, but is not scheduled to open until 2030. With the Green Line and future Crenshaw/LAX line, only 5% of South Bay households are within ½ mile of rail. Importantly, another characteristic of travel in the South Bay is that, trips are short in length: most trips generated in the South Bay stay in the South Bay.

# GHG Emissions Overview


## Inventories

The first step towards reducing GHG emissions is estimating the baseline and future expected emissions. These estimates are categorized by sources – commercial and residential energy, on-road transportation, solid waste, water, wastewater, and off-road sources.  Inventories for the South Bay cities were completed as part of a grant funded by Southern California Edison and The Gas Company.  Cities' inventories were compiled for the years of 2005, 2007, 2010, and 2012 to configure the sub-regional inventory. The baseline year is 2005, which means that the future emissions reductions will be measured against emissions that occurred in 2005. A complete report of the sub-regional inventory can be found in Appendix A - "Energy Efficiency CAP" including Methodology, Inventory & Forecast (inventory and forecast is listed in the "Energy Efficiency CAP Appendix A").

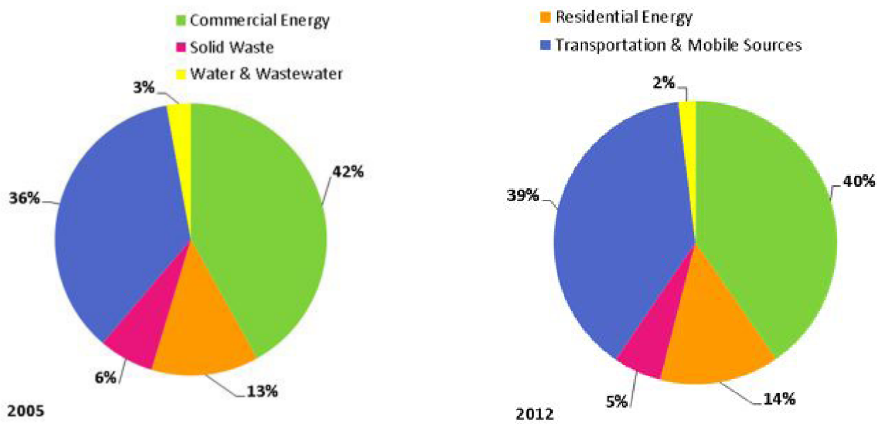



Figure 2: Community GHG Emissions by Sector for 2005 and 2012; Source - South Bay Subregion EECAP

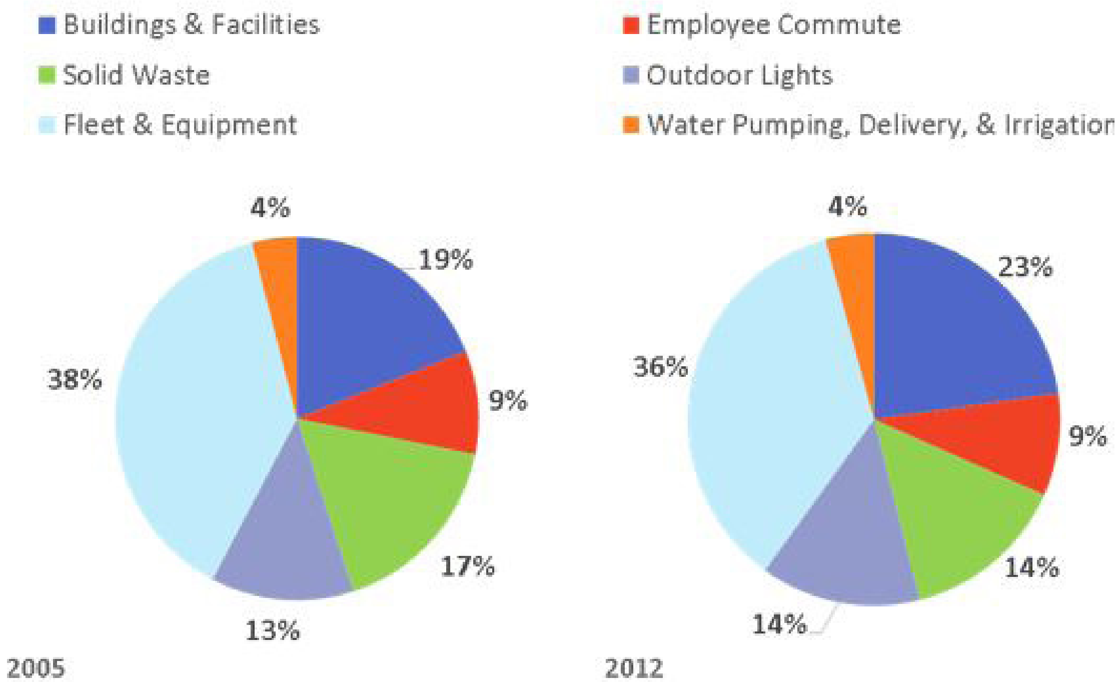



Figure 3: Municipal GHG Emissions for 2005, 2007, 2010, and 2012; Source - South Bay Sub-Region EECAP

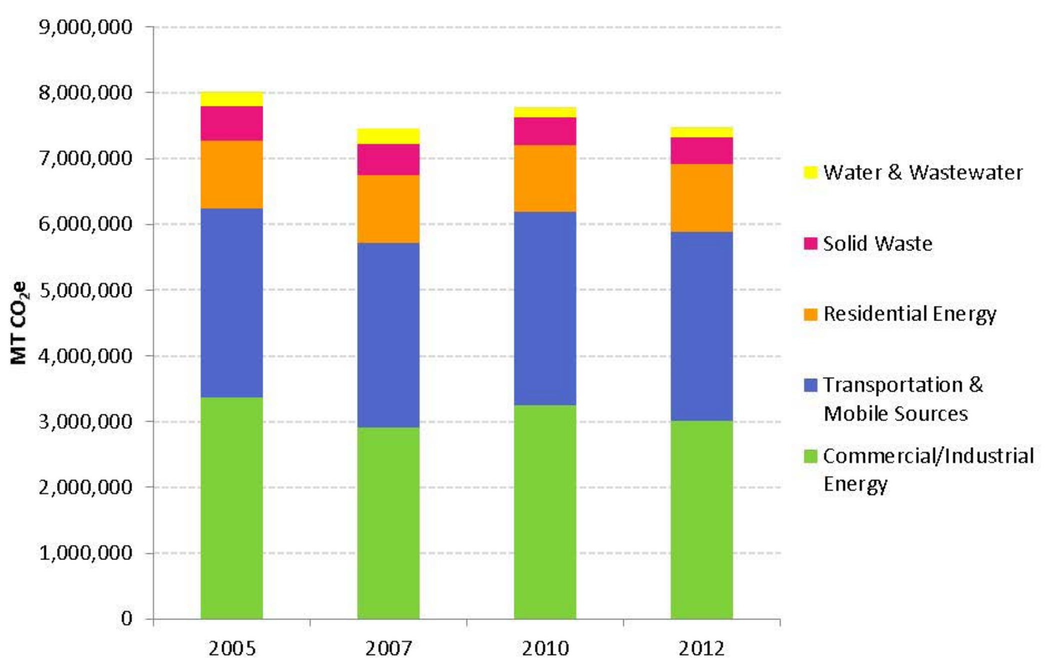



Figure 4: Community GHG Emissions for 2005, 2007, 2010, and 2012; Source - South Bay Sub-Region EECAP

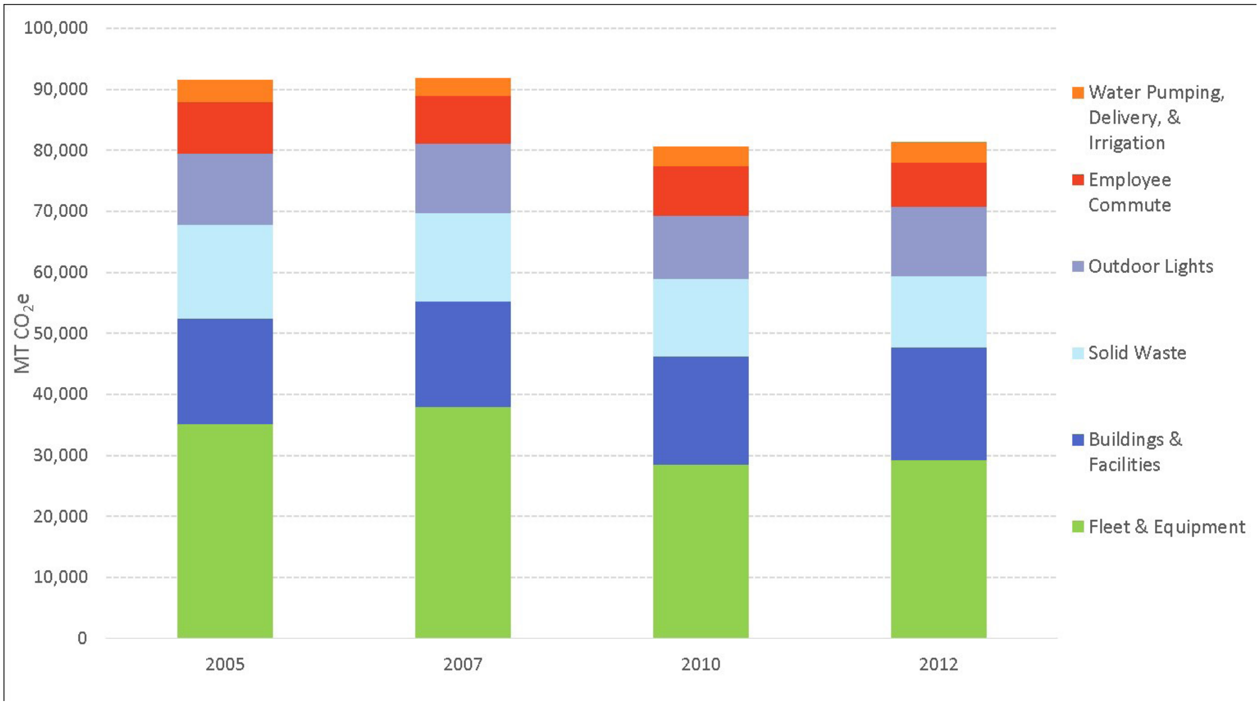



Figure 5: Municipal GHG Emissions for 2005, 2007, 2010, and 2012; Source - South Bay Sub-Region EECAP

## Forecasts and Target Setting

Emission estimates for future years are scenarios based on assumptions about the future. The 2020 Business As Usual (2020 BAU) scenario assumes no new policies, plans, programs, or regulations designed to reduce GHG emissions will be adopted or implemented before 2020. This scenario would be the "worst case". The 2020 and 2035 Adjusted Business As Usual (ABAU) scenarios, in comparison, do take into account the expected reduction impacts resulting from federal and state mandated laws such as higher vehicle fuel efficiency standards and increases in the percentage of renewable energy production.

In 2015, the South Bay Cities set GHG emission reduction goals consistent with the State's AB 32 GHG emission reduction targets. These goals and targets were affirmed by the SBCCOG for the sub-region and were calculated as a 15 percent decrease from 2005 levels by 2020 as recommended in the State AB 32 Scoping Plan. A longer-term goal was established for 2035 to reduce emissions by 49% below 2005 levels. These goals put the South Bay sub-region on a path towards helping the State meet its long-term 2050 goal to reduce emissions by 80% below 1990 levels.

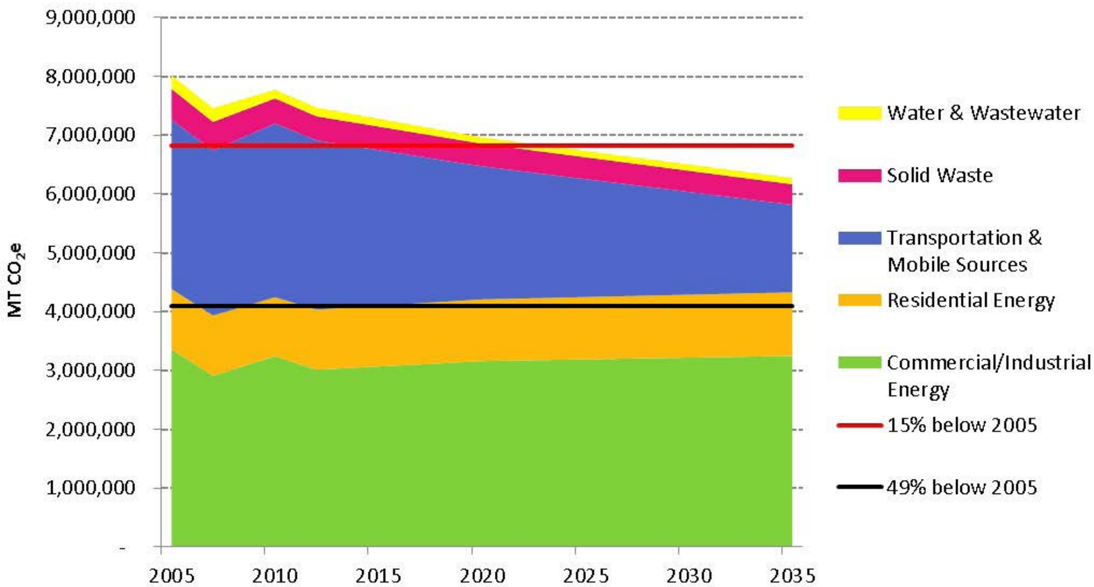



Figure 6: Community Emissions Inventories, Projections, and Targets; Source - South Bay Sub-Region EECAP

| Sector | 2005 | 2012 | 2020 | 2035 |
|---|---|---|---|---|
| BAU emissions (MT $CO_2$e) | 8,020,432 | 7,469,573 | 7,590,632 | 7,792,156 |
| Adjusted BAU Emissions (MT CO2e) | 8,020,432 | 7,469,573 | 6,963,872 | 6,270,736 |
| State-Aligned Target (% change from 2005) | | | -15% | -49% |
| State-Aligned Target (% change from 2012) | | | -9% | -45% |
| State-Aligned Emissions Goal (MT CO2e) | | | 6,817,367 | 4,090,420 |
| Reductions from Adjusted BAU needed to meet the Target (MT CO2e) | | | 146,505 | 2,180,316 |

Table 1: State-Aligned Community GHG Reduction Targets; Source - South Bay Sub-Region EECAP

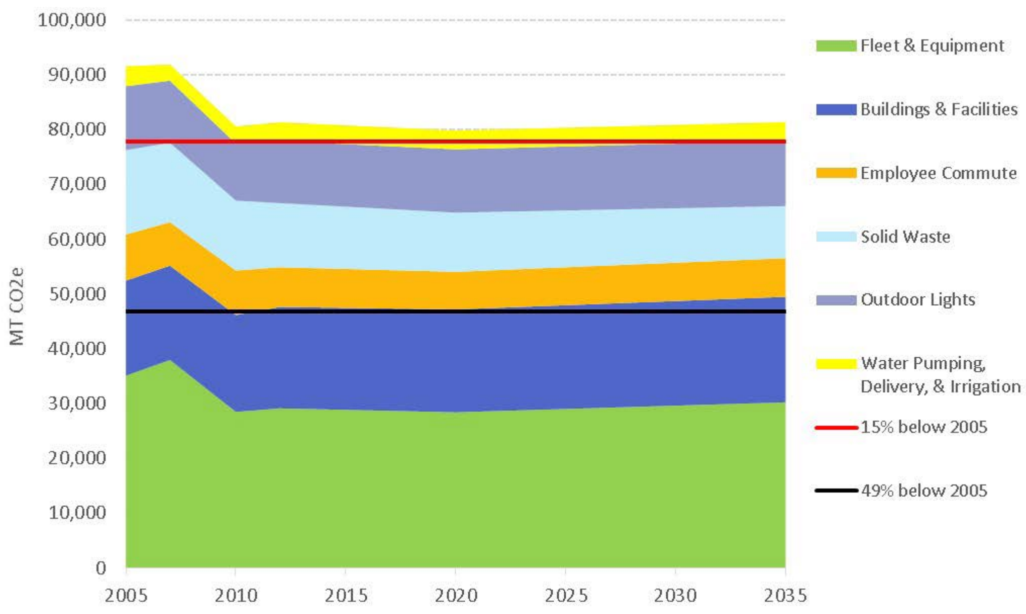



Figure 7: Municipal Emissions Inventories, Projections and Targets: Source-South Bay Sub-Region EECAP

| Sector | 2005 | 2012 | 2020 | 2035 |
|---|---|---|---|---|
| BAU emissions (MT $CO_2e$) | 91,569 | 81,301 | 82,628 | 84,309 |
| Adjusted BAU Emissions (MT CO2e) | 91,569 | 81,302 | 79,818 | 81,371 |
| State-Aligned Target (% change from 2005) | | | -15% | -49% |
| State-Aligned Target (% change from 2012) | | | -4% | -43% |
| State-Aligned Emissions Goal (MT CO2e) | | | 77,834 | 46,700 |
| Reductions from Adjusted BAU needed to meet the Target (MT CO2e) | | | 1,985 | 34,671 |

Table 2: State-Aligned Municipal GHG Reduction Targets; Source - South Bay Sub-Region EECAP

# Existing Sustainability Efforts


The SBCCOG's policies, plans, and programs continue to demonstrate the organization's ongoing commitment to sustainability, energy efficiency, and GHG emissions reductions. These include the following studies and programs:

## Environmental Services Center (SBESC)

The SBESC is the South Bay's clearinghouse for energy efficiency, water conservation, and environmental information, delivering workshops, materials, and outreach that promote programs from our environmental partners:

- City of Torrance
- Los Angeles County Metropolitan Transportation Authority (Metro)
- Los Angeles Department of Water & Power (LADWP)
- Sanitation Districts of Los Angeles County
- SoCalGas
- Southern California Edison (SCE)
- Water Replenishment District of Southern California
- West Basin Municipal Water District

The SBESC assists public agencies including cities, schools, and special districts, as well as businesses and residents of the South Bay to best utilize the many resources available to them through a variety of statewide and local energy efficiency, water conservation, and waste reduction programs.  SBESC services include: educational programs, energy audits, and implementation projects for our cities, school districts, and other public agencies.

## Energy Efficiency Strategies

### Energy Leadership Partnership (ELP)

The SBCCOG is the lead agency to coordinate and facilitate the South Bay Cities' participation in Southern California Edison's (SCE) Energy Leader Partnership program. 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 (PACE)

The SBCCOG is the lead agency for community-based outreach to support the South Bay Cities' participation in PACE which 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 the property tax, allowing the home or business owner to finance improvement projects that will result in GHG emissions reductions.  Types of programs include: cool roofs, insulation, windows, doors, heating and cooling equipment, lighting, and plumbing equipment.

## Solid Waste, Urban Greening and, Energy Generation and Storage

### Community Outreach

Through the SBESC, the SBCCOG continues to work with regional partners like the Los Angeles County Sanitation District and water wholesalers to provide community-based outreach and municipal demonstrations of water conservation and waste- recycling programs.

### Demonstration Projects

The SBCCOG continues to seek opportunities to demonstrate, test and develop renewable energy and storage technologies through grants from the California Energy Commission and other state and regional agencies.

## Land Use and Transportation

*South Bay Transportation Performance Study (2003 – 2008)*

The study established baseline knowledge about how previous infill development performs from a transportation perspective. The survey research was based on households in 8 neighborhoods to determine the capture rate by the nearest commercial center and mode to center. The study's findings showed that the characteristics of commercial centers result in different capture rates of trips originating in the adjacent neighborhood. This study produced a database of transportation behavior used in the 2017 CAP.

*Sustainable South Bay: An Integrated Land Use and Transportation Strategy (2009)*

Applied regression and case study analyses were used to determine the factors that cause a higher capture rate of commercial centers and walking mode choice by adjacent residents. Business density was measured as businesses per acre and were found to be the most influential factor. Additionally, the mix and variety of destinations also played a role in terms of the capture rate, but their impact was not quantified. The resultant findings were synthesized to become a core element of the Sustainable South Bay Strategy which was then adopted by the SBCCOG's Board of Directors in 2010.

*Sustainable Land Use: Proof of Concept (2010 – 2011)*

A detailed case study of a segment of Marine Ave. between the City of Hawthorne and the City of Redondo Beach was developed. The feasibility of converting a commercial strip to housing and relocating the commercial uses to developments at the ends of the corridor was studied. The strategy proved to be feasible subject to reduced parking requirements.

*Neighborhood Electric Vehicle (NEV) Demonstration Project (2009 – 2012)*

Previous studies discovered that the trips taken by South Bay households were relatively short on average. The question was the extent to which short-range electric vehicles could satisfy those short trips. A fleet of NEVs was acquired and loaned to 50 households for a two-month period each. Usage of all household vehicles including the NEVs was monitored with GPS technology. The demonstration found that households with an NEV used it for 19% of their trips and reduced their GHG emissions by 20%. The study created a rich database of household travel based on 6,100 round trips with more 20,000 trip-segments that were observed and quantified from those household trips.

*Battery Electric Vehicle (BEV) Demonstration Project (2013 – 2015)*

A fleet of full speed BEVs was acquired and loaned to South Bay households for a 2- month period. As in the NEV project, GPS was used to monitor all household vehicular travel. The demonstration found the average household reduced their GHG emissions by 40%. BEV usage replicated the driving patterns of the internal combustion engine vehicles. Like the NEV study, this study also created a rich database of household travel based on an observed total of 39,000 miles of BEV trips over the course of the study.

*Assessing the Multi-Unit Dwelling (MUD) Barrier to Plug-in Electric Vehicle in the South Bay (2016-2017)*

The purpose of the report was to explore the MUD electric infrastructure barrier to plug in electric vehicle adoption within the South Bay sub-region. The results confirm that the cost of Electric Vehicle Service Equipment (EVSE) installation in MUDs is variable from site to site and often high largely because of the 50-60-year age of the housing stock. Additionally, parking arrangements, distance to the electrical panel and the level of electric service to the building were important factors. Level 1 charging and group investments for EVSE installations may provide MUD residents access to home charging at lower costs. Upgrade to Level 2 charging infrastructure was determined to add a significant financial burden to building owners.

*Slow Speed Network Plan for the South Bay (2016 – 2017)*

Within the framework of Metro's "Complete Streets" strategies, this project developed a "Master Plan" for a "Slow-Speed" network across the South Bay – a network that would include all modes of vehicles whose maximum speed would be 25 mph or less (including NEVs). The slow speed infrastructure, if implemented, would facilitate the development of the LUV market – a significant element of the Sustainable South Bay Strategy.


Map: LA Metro Slow Speed Network Design


# Climate Action Plan Categories & Measures

The South Bay Cities' Climate Action Plans facilitated by the SBCCOG included five broad categories - Land Use and Transportation, Energy Efficiency, Solid Waste, Urban Greening, and Energy Generation/Storage. As part of the efforts under each category, the SBCCOG, working with consultants, identified a broad menu of feasible strategies for the South Bay sub-region. The menu was then presented to the cities to select specific measures that they would adopt for implementation. Based on the selections made by each city, estimated reductions in GHG emissions from each sector were calculated. These estimates were then totaled for the a sub-regional GHG reduction by source. The following chart summarizes, by category, the potential emission reductions based on the total selections of the cities.

As depicted in the Figure 7a, the categories included in the CAP, have the potential to avoid approximately 2,991,622 MT CO2e emissions by 2035 and accomplish the SBCCOG's reduction targets of 15% below 2005 by 2020 and 49% below 2005 by 2035.

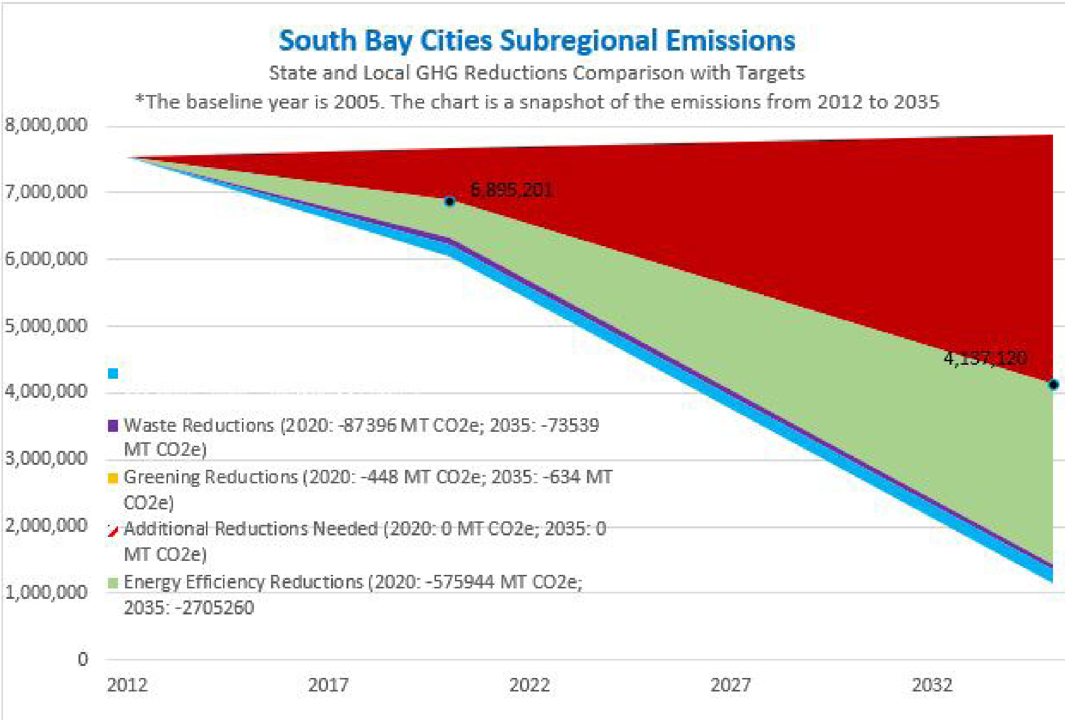
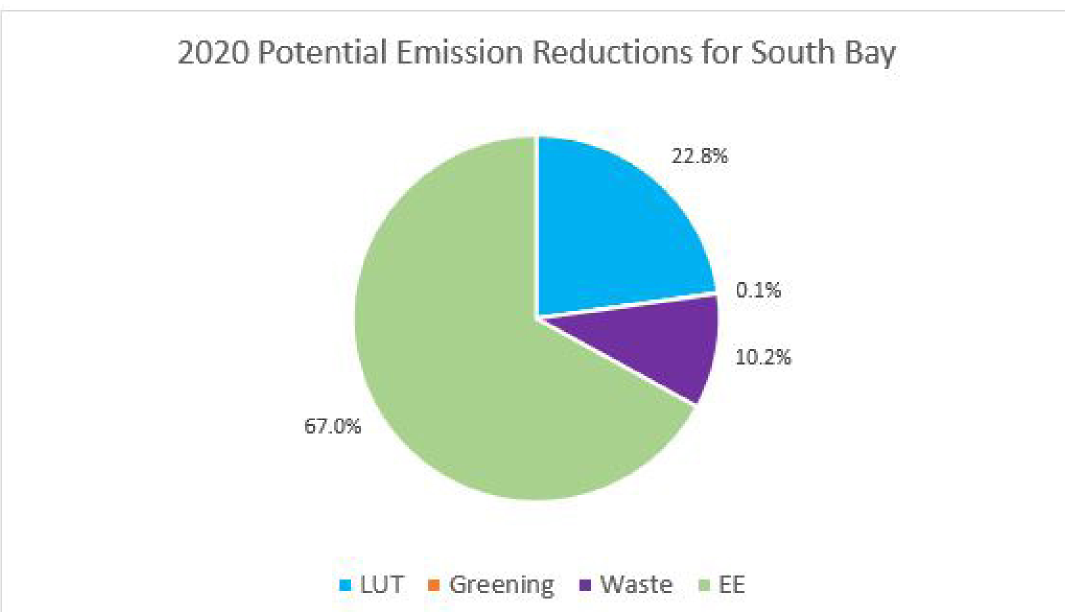



Figure 8: : South Bay Cities Sub-Region, State, and Local GHG Reductions Comparison with Targets 2012-2035 (The baseline year is 2005, the chart is a snapshot of the emissions from 2012 to 2035)



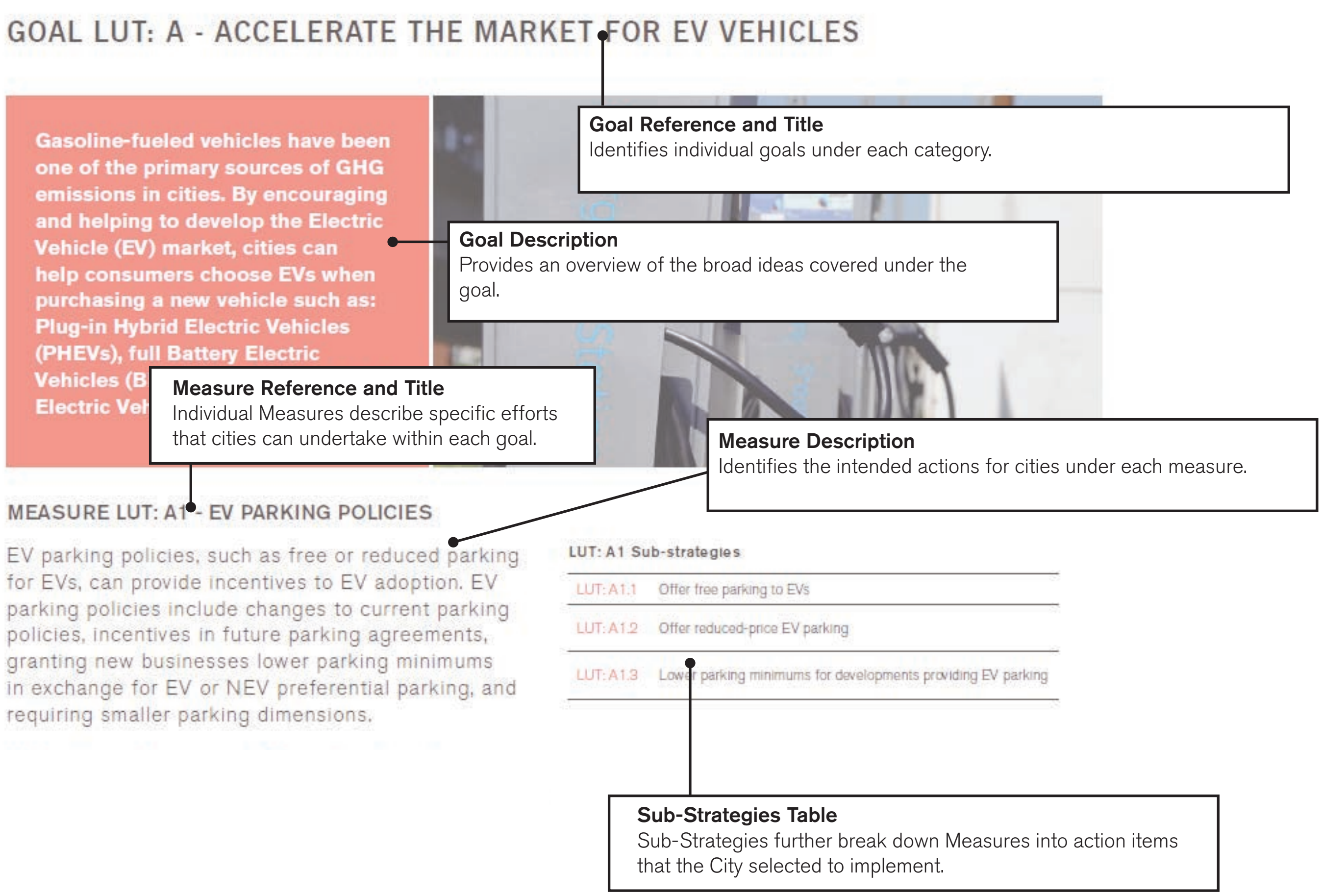

NOTE: All emission reduction calculations are based totals from city-selected strategies.

## Co-Benefits

Additionally, economic, social, and environmental benefits that can be realized with the implementation of these measures are listed as co-benefits. These include eight areas where gains may be accrued beyond reductions in GHG emissions:

- Adaptation Strategy Support
- Air Quality
- Economy + Jobs
- Energy Conservation
- Public Health
- Resource Conservation
- Safer Streets
- Transportation System Improvement

## How to Read the Document



# South Bay LUT Strategies

*Sustainable South Bay Neighborhoods*

## EXECUTIVE SUMMARY

The South Bay City Council of Governments (SBCCOG) promotes evidence-based local government strategies that will meet California's **greenhouse gas (GHG) emissions** reduction targets.[1] The SBCCOG has developed a suite of Land Use and Transportation strategies for built-out suburban communities, that can be adapted to many other communities in California.

> The South Bay Region Land Use and Transportation Chapter of the Climate Action Plan reveals transportation-related GHG reductions of **15% or more** in most neighborhoods.

Over **50%** of households in the South Bay region will see a reduction of 15% with implementation of the sub-regional Plan.

Using evidence gathered in the South Bay for over 10 years, this report shows that these strategies combined, not only have the potential to reduce transportation-related emissions in neighborhoods by 15% or more, but provide neighborhood services in an equitable fashion. For the South Bay region, the Land Use and Transportation (LUT) Chapter of the Climate Action Plan results in over 50% of South Bay households reducing their emissions by 15% upon full implementation.

Since transportation emissions can account for 50% or more of total emissions for a city or a region[2], achieving GHG emissions reduction targets will require significant changes to how people and goods travel. Climate action planning must address both the land use patterns that shape travel behavior as well as the availability of more efficient transportation modes. More efficient land use and parking strategies can offer the highest rewards in terms of GHG emission reductions because they reduce the need for travel for the entire community. Transportation strategies that affect mode choice are effective depending on the number of people they influence.

The SBCCOG has conducted extensive research over the last fifteen years to develop Land Use and Transportation (LUT) strategies that 1) are suited to the South Bay communities, 2) are cost-effective, and 3) provide the necessary emission reductions based on sound

1. Assembly Bill 32 (Chapter 488, Statutes of 2006)
2. For example, in the South Bay transportation emissions account for 57% of total emissions in Lawndale and on the lower end, 18% in Carson.

> The strategies presented in this report, known as the South Bay Sustainable Strategies (SSBS), can be more easily deployed at scale across a broader range of neighborhood types found in the South Bay and throughout California than the prevailing transit-oriented development approach.

**South Bay Trips**


88%


3%


7%

**Other** 2%

evidence.

The most popular planning paradigms of today are those of Smart Growth and Transit Oriented Development (TOD). These are based on the premise that the combination of rail/bus service and dense housing will decrease vehicle miles traveled (VMT). Planning that centers on transit and density effectively leaves out many communities in California, particularly the South Bay, for two main reasons. First, the system does not comprehensively cover the South Bay so that all areas are accessible and there is little frequent transit service for the existing system. Like most parts of California, trips are predominantly made with an auto. While some extensions of regional transit lines are planned in the South Bay in the coming decades, they will not provide a sufficient network for local and sub-regional travel. Short of diverting all available transportation funding in the sub-region, the cost to build and operate frequent transit service throughout the sub-region would be prohibitive. Second, most communities in the South Bay are mature suburbs with little vacant land for new construction and residential densities are already among the densest areas in Los Angeles County. Without essentially building a new transportation system, there is little opportunity to further increase density without also significantly increasing VMT, which will be contrary to the State's goals.

Fortunately, the South Bay has positioned itself to contribute to land use and transportation climate action planning in new and effective ways for neighborhoods that are left out of the current dialogue. The South Bay Cities Council of Governments (SBCCOG) has three main research studies that show GHG emissions can be reduced in suburban settings:

**1. Neighborhood Transportation Performance Study (2003-2008)**

This extensive study examined the relationship between commercial development and travel behavior in the South Bay. Findings revealed that density of businesses was a key attribute in determining if residents would visit and walk to nearby commercial centers. The study concluded that most trips in the South Bay were short. This study was funded by the Southern California Association of Governments (SCAG) and the Los Angeles Metropolitan Transportation Authority (LAMetro).

**2. Neighborhood Electric Vehicle (NEV) Demonstration Study (2009-1012)**

NEVs are short-range electric vehicles that have several advantages over full-battery vehicles. They are cheaper, smaller and can be charged more easily. The study sought to understand if the NEV could replace a household's 2nd or 3rd vehicle. GPS systems were placed in the NEV and all the other household vehicles. The study found that households with an NEV used it for 19% of their trips and reduced their GHG emissions by 20%. Also 70% of the household trips were 3 miles or less. The study created a rich database of household travel based on 20,000 observed trips and was funded by the South Coast Air

Quality Management District (SCAQMD).

**3. Battery Electric Vehicle (BEV) Demonstration Study (2013-2015)**

BEVs are longer-range electric vehicles (80-mile range). Again, GPS systems were placed in the BEVs and other vehicles in the household. When given a vehicle, the average household reduced their GHG emissions by 40%. Like the NEV study, this study also created a rich database of household travel based on 20,000 trips. The BEV study was funded by the South Coast Air Quality Management District (SCAQMD).

The GHG reduction methodology created in this report offers several benefits. Currently most transportation and land use funding programs in California require the project show demonstrated GHG reductions. Neighborhoods that fall out of the high-quality transit requirement, don't have GHG reduction methodology (particularly CARB approved methodology) available to them and therefore can't meet the application requirements and access funding. The methodology created here provides options for these neighborhoods and allows for more neighborhoods to be eligible for funding. GHG emissions modeling has historically centered on the use of the Transportation Analysis Zone (TAZ), a unit defined by an administrative or arbitrary boundary dependent on a census tract and not having to do with the actual travel behavior of households within. The neighborhood-oriented methodology shifts the unit of analysis to the household considering how households travel from their home into surrounding neighborhoods. Also, most Climate Action Planning relies on VMT modeling from outdated studies where the modeled data do not reflect the specific area under analysis. The work here uses direct assumptions from a rich local database comprised of three large-scale studies.

The tool created for the South Bay neighborhood-oriented methodology is flexible and transparent so that all assumptions can be easily identified, and all assumptions can be easily modified. It is a first-generation tool that illustrates how local robust data at a granularity greater than all household travel surveys and census data, can be used to calculate VMT and GHG emissions reductions. Further generations of this tool depend on critical feedback and new data.

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Palm Ave
536
109SB PV/VIA VALENCIA

## INTRODUCTION

Current emissions methodologies are insufficient for built-out suburban regions that need alternative approaches to traditional planning paradigms. The manual presented here introduces new greenhouse gas emissions (GHG) reduction methodologies behind the Sustainable South Bay Land Use and Transportation Strategies.

It builds upon existing methodologies to provide an improved manual for Climate Action Planning for Suburban Communities. The manual, serving as a part of the South Bay Transportation and Land Use Chapter of the Climate Action Plan, calculates emission reductions for 41 neighborhoods in the South Bay for a total regional reduction.

The purpose of Climate Action Plans (CAPs) is to demonstrate how a local government can reduce GHGs through the adoption of strategies. Steps within CAPs include calculating an inventory of existing GHG emissions, adopting reduction targets, selecting strategies to meet the targets and developing implementation and monitoring tools. Within California, CAP targets are benchmarked to levels set by Assembly Bill (AB) 32 which calls for emissions to be reduced to 1990 levels by 2020 and 80% below 1990 levels by 2050.

Greenhouse gas emissions vary by sector and thus CAPs are generally partitioned into the following divisions: Solid Waste, Energy Efficiency, Energy Storage, and Land Use and Transportation (LUT). Depending on the context, transportation can account for 50% or more of GHG emissions within a city or region and thus constitutes a pivotal role in climate action planning. Transportation and Land Use strategies within CAPs focus on reducing vehicle miles traveled (VMT) and/or reducing the carbon intensity of VMT (e.g. through electrification).

CAPs are methodological at heart. Because legislation calls for specific quantifiable reduction targets to be met, when a local government chooses to undertake climate action planning it must methodologically show how quantitative targets can be met. Most published CAPs demonstrate these reductions with methodologies based on a 2010 manual drafted by the California Air Pollution Control Officers Association (CAPCOA).[3] The document reviews traditional Land Use and Transportation (LUT) strategies and offers metrics based on evidence from available published studies. Prior to the CAPCOA document, standardized methods for quantifying LUT GHG emissions were not readily available. CAPCOA entered into a major effort, collecting available studies and evidence to formulate the methodologies and gathering them into a convenient source. At the time of this document, CAPCOA was the state of the art, however, new and updated methodologies are needed to present communities with new approaches based on the most recent data.

CAPCOA covers many transportation strategies including parking policy and pricing; commute trip reduction; transit

3. CAPCOA (2010). "Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Governments to Assess Emission Reductions from Greenhouse Gas Mitigation Measures."

system improvements; road pricing management; and electric vehicles. The Land Use Strategies offer some of the highest VMT reduction percentages.[4] They reflect the popular planning paradigms of today, namely those of Smart Growth and Transit Oriented Development (TOD). These planning concepts are based on the premise that the combination of rail or high-quality bus service and dense housing decreases VMT because more people will have more travel options beyond the auto for mobility. The two (transit and housing) will create a virtuous cycle, dense housing providing the ridership needed to make transportation sustainable and transit providing residents with alternatives to the private vehicle. Thus, land use and transportation strategies revolve around developing dense housing around existing rail or high-quality bus service (TOD) or adding transit to dense housing. Included are strategies that encourage the diversity of uses (mixed-use) beyond housing. For example, new developments might integrate a bottom floor of commercial and office space, theoretically providing residents and transit goers more access to goods and services at the TOD hubs.

The South Bay has been almost completely built-out since the 1960s, and has been slowly densifying as infill development replaces older, lower-density uses. Residential density is in fact higher than the City of Portland and almost on par with some of the densest areas in Los Angeles County, including Westwood and West Hollywood. Yet, the South Bay has poor performing transit and is auto-dominated. Over 86% of South Bay residents commute by auto and fewer than 6% by bus or rail.[5]

The South Bay Cities Council of Governments (SBCCOG) has developed alternative land use and transportation strategies that focus on enhancing mobility within neighborhoods without relying on building expensive transit infrastructure. Current light rail projects in Los Angeles have on average cost around $370 million per mile and heavy rail an average of $890 million per mile.[6] Concomitantly even if service were to be provided by bus rapid transit (BRT), capital costs remain high ranging from around $300,000 to $78 million per mile in 2017 dollars.[7] Addition of transit is not resulting in reduced GHG emissions. In Los Angeles, where transit is being added, transit ridership fell 16% from 2013 to 2016.[8]

The South Bay strategies reflect the realities of how South Bay residents' travel, observed through the extensive research the COG has undertaken over the last few decades. Over 88% of trips in the South Bay are made in a private auto and under 3% in public transit which means that South Bay residents prefer the point to point flexibility the auto provides.[9] Most trips in the South Bay are local: 70% of trips made in the South Bay are under three miles.[10] This means that most trips are within neighborhoods. Walking in the South Bay is incentivized by access to goods and services.[11] Together, the patterns call for strategies that are flexible and suited to neighborhoods, enhancing neighborhood goods and services and promoting walking. These strategies are called the Sustainable South Bay Strategies (SSBS).[12] Combined, they promote holistic planning at the neighborhood level, integrating land use and transportation in flexible ways so that the transportation needs of all residents are met regardless of the presence of transit infrastructure. The SBCCOG promotes a 'leave no neighborhood behind' approach.

4. CAPCOA (2010). "Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Governments to Assess Emission Reductions from Greenhouse Gas Mitigation Measures." Pgs. 65-67
5. US Census, ACS- three-year estimate 2012
6. Calculated from LA Metro
7. http://www.gao.gov/new.items/d01984.pdf
8. http://www.latimes.com/local/lanow/la-me-ln-bus-ridership-study-20170518-story.html7
9. California Household Travel Survey (CHTS) 2013
10. Metro 2014 SRTP and Siembab, W., Rhoads, M., and Baum, A. (2015). "Drive the Future: Battery Electric Vehicle Project." Prepared for the South Bay Cities Council of Governments
11. SBCCOG (2009). "A Sustainable South Bay: An Integrated Land Use and Transportation Strategy (SBSS)"
12. Ibid

The CAPCOA methodology does not lend itself to the SSBS neighborhood-oriented strategies for several reasons.

1. The unit of analysis for quantifying GHG emission reductions based on the CAPCOA methodology is a Transportation Analysis Zone (TAZ). TAZs are commonly used for VMT modeling. The zones tend to follow administrative boundaries outlined by census tracts and don't reflect actual travel behavior. Because the SSBS centers on neighborhoods as defined by a neighborhood center or other anchor point, a new unit of analysis needs to be created.

2. CAPCOA does not provide an adequate strategy or methodology for assessing business density and diversity, the key variables that incentivize walking within a neighborhood. Business density and diversity form the basis for the SSBS land use strategies. CAPCOA measures density as number of persons, employees, or dwellings per square mile. Accessibility is measured by proximity to a downtown and would effectively leave out most neighborhoods within the South Bay. Diversity is measured by mixes of broad categories: single/multifamily residential, commercial, industrial, institutional and park and does not sufficiently capture service and goods mix. The SSBS requires new measurements for accessibility and diversity.

Most importantly the extensive research conducted in the South Bay has resulted in a large database of local travel collected over 15 years. This database offers benefits that supersede household travel surveys such as the California Household Survey (CHTS) and National Household Travel Survey (NHTS), that capture few observations for one day of travel once a decade. CAPCOA VMT reductions are modeled from scant and outdated studies from areas that are often similar to the city or region under analysis. The rich local South Bay dataset allows for VMT reductions to be calculated from direct observation of how its residents travel.

The South Bay is poised to contribute to land use and transportation climate action planning in new and effective ways for neighborhoods that are left out of the current dialogue. This report introduces the VMT and resulting GHG reduction methodologies behind the SSBS land use and transportation strategies. It builds upon existing CAPCOA strategies to provide an improved manual for Climate Action Planning for Suburban Communities. In doing so, the South Bay heeds to CAPCOA's call for innovation:

"CAPCOA encourages local governments to be bold and creative as they approach the challenge of climate change, and does not intend (the) report to limit the scope of measures considered for mitigation.[13]"

The rest of the report will discuss the South Bay region, the SSBS land use and transportation concepts and strategies, the SSBS emissions methodologies and resulting calculations.

13. CAPCOA (2010). "Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Governments to Assess Emission Reductions from Greenhouse Gas Mitigation Measures." Pg. 3

## THE SOUTH BAY

The South Bay is a built-out, relatively dense sub-region of Los Angeles County. It is roughly the same physical size as Portland consisting of 15 cities (between LAX and the Port of Los Angeles), parts of the City of Los Angeles and unincorporated Los Angeles County. However, the South Bay is twice as dense as Portland.[14]

The 15 cities can be grouped into three areas: Beach, Inland and Peninsula. The inland cities include Carson, Gardena, Hawthorne, Inglewood, Lawndale, Lomita, and Torrance. These cities are characterized by wide arterial boulevards and flat terrain. The beach cities include El Segundo, Hermosa Beach, Manhattan Beach, and Redondo Beach and are characterized by a higher proportion of local, slow speed streets and open space access to the beach. The peninsula cities include Palos Verdes Estates, Rancho Palos Verdes, Rolling Hills Estates, and Rolling Hills, and are located on steeper terrain overlooking the other cities and the ocean.

The South Bay encompasses a wide variety of incomes and ethnicities. The South Bay houses around 1 million people, 384,183 households, and 430,000 employees.[15] The largest cities are Torrance and Inglewood and the smaller cities are the beach and peninsula cities. The wealthier communities are located in the beach and peninsula cities. Several of the communities in Carson, Gardena, Hawthorne, Inglewood, Lawndale and Lomita score as the top 10% most pollution-burdened census tracts in California, see Figure 13.[16]

The South Bay cities originally developed to accommodate single-family homes and their complement: the automobile. While the original housing stock has densified over time, activities are dispersed on arterial strips. As such, origins and destinations are separated by more than half a mile from most homes, a distance outside of walking range, leaving residents dependent on the auto. Not only have past development patterns led to auto dependence, there is virtually no rail and little frequent bus service to provide residents with an alternative. Figure 3 represents the Los Angeles Metro Rail and BRT system. The South Bay is outlined in red.

Only portions of the Green Line (rail) and Silver Line (bus), and under-construction Crenshaw/LAX rail line lie within the South Bay boundaries. A future extension of the Green Line to Torrance is funded but is not scheduled to open until 2030. With the Green Line and future Crenshaw/LAX line, only 5% of South Bay households are within ½ mile of rail. Figure 3 below plots households within a ½ mile walking distance of current and future rail stations.

Based on commute mode shares, South Bay residents overwhelmingly use private autos to commute (86.4%) while only 5.3% of residents use the bus. The auto is overwhelmingly used for all trips (88%).[17] Only 7% of total trips are made walking and transit accounts for a mere 3% of trips.[18]

Another characteristic of travel in the South Bay is that trips are short in length: most trips generated in the South Bay stay

14. Based on 2010 Census, Population and Size of 1. Portland City: 583,776; 145 sq. miles 2. South Bay Cities: 1,052,802; 140 sq. miles
15. Based on 2010 Census Data
16. CalEnviroScreen 2.0
17. Data calculated from 2013 Caltrans Household Travel Survey (CHTS)
18. Ibid

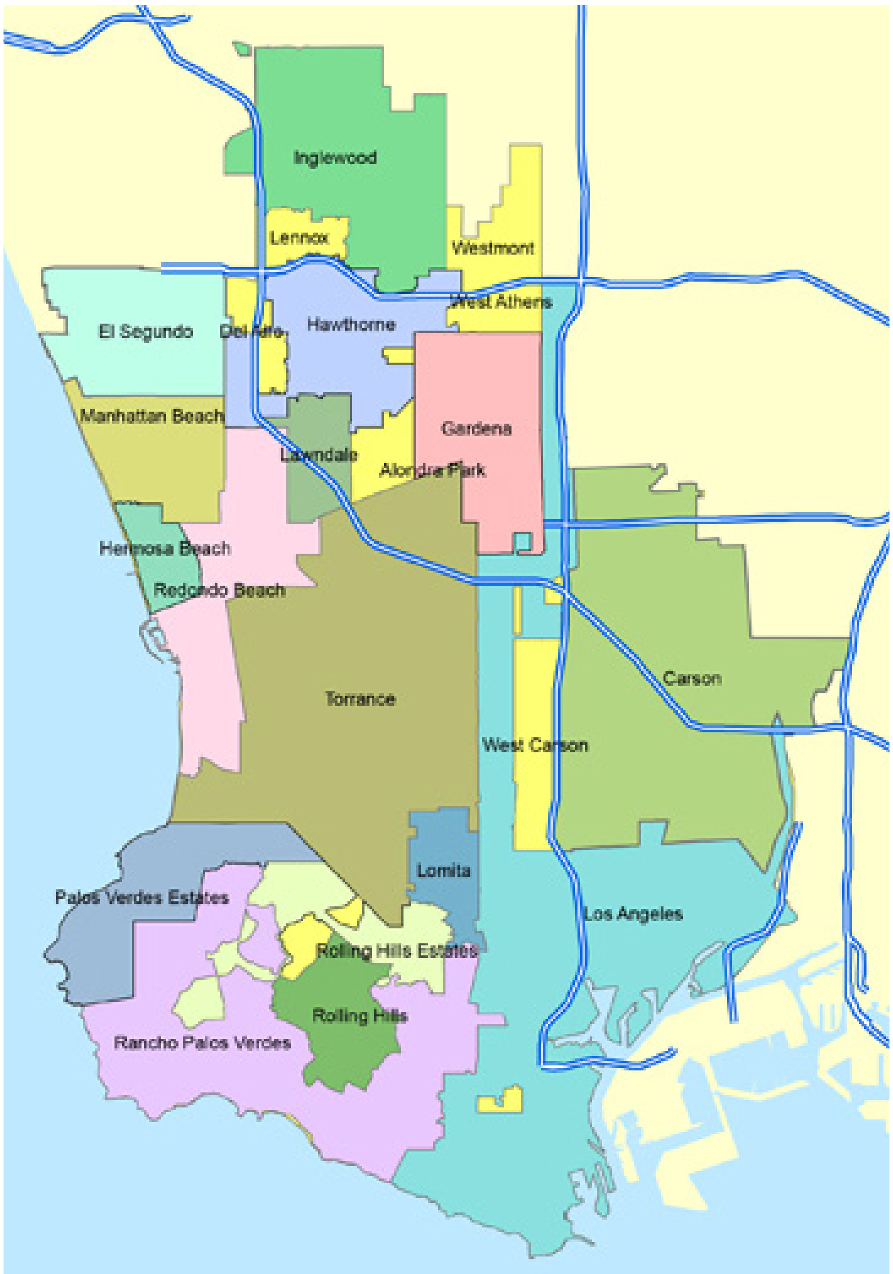



FIGURE 1 The South Bay Cities

| Commute Mode | South Bay Study Area | LA County Average |
|---|---|---|
| Drive Alone | 76.1% | 72.4% |
| Carpool | 10.3% | 10.5% |
| Bus | 5.3% | 6.5% |
| Rail Transit (Metro) | 0.1% | 0.7% |
| Railroad (Metrolink) | 0.1% | 0.2% |
| Bicycle | 0.7% | 0.9% |
| Walk | 1.9% | 2.9% |
| Work at Home | 4.1% | 5.0% |
| Other* | 1.3% | 0.01% |

*Motorcycle, taxi, ferry.

Source: U.S Census, ACS three-year estimate, 2012.

TABLE 1 South Bay Commute Mode Share

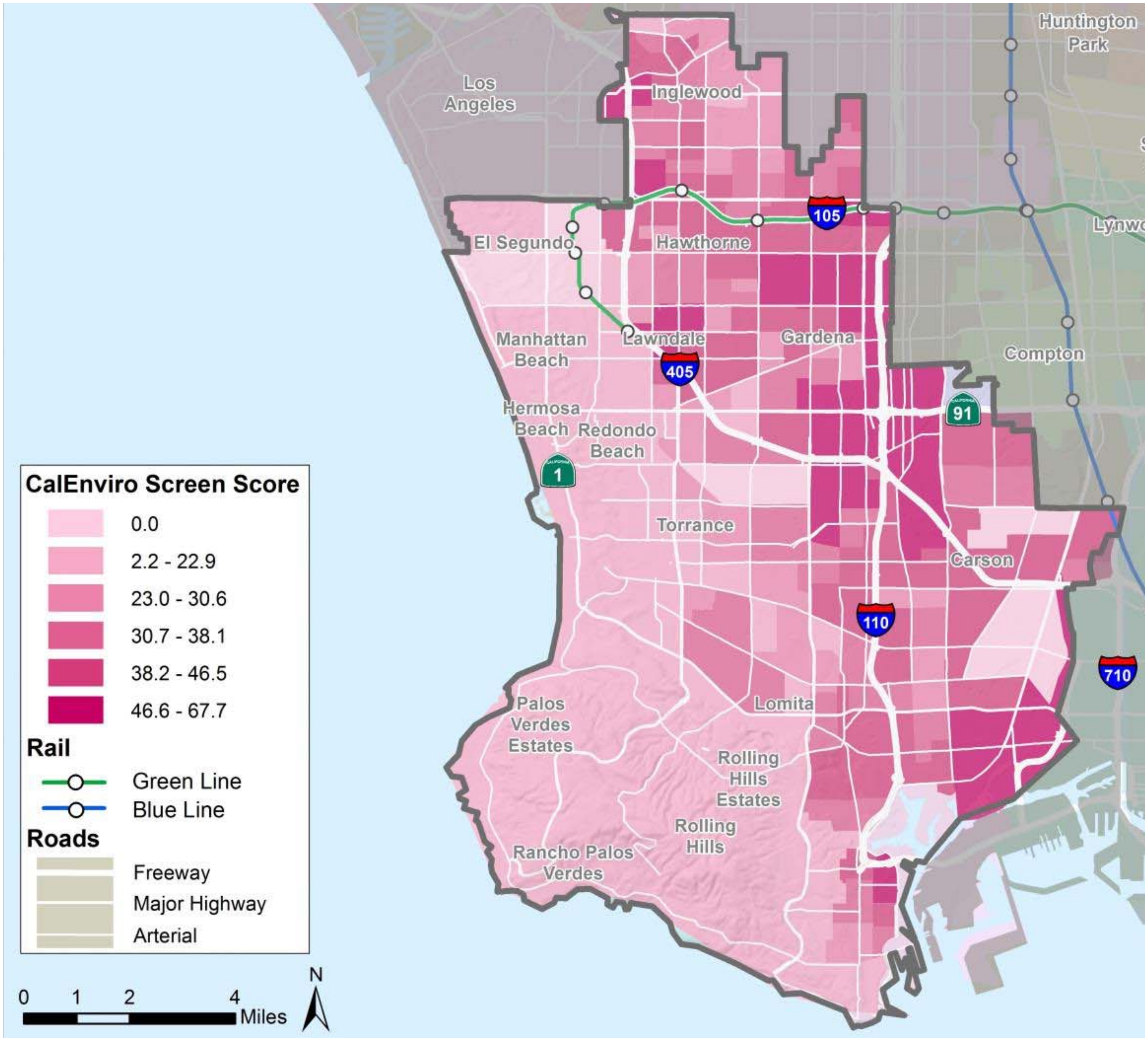



FIGURE 2 Cal EnviroScreen Results

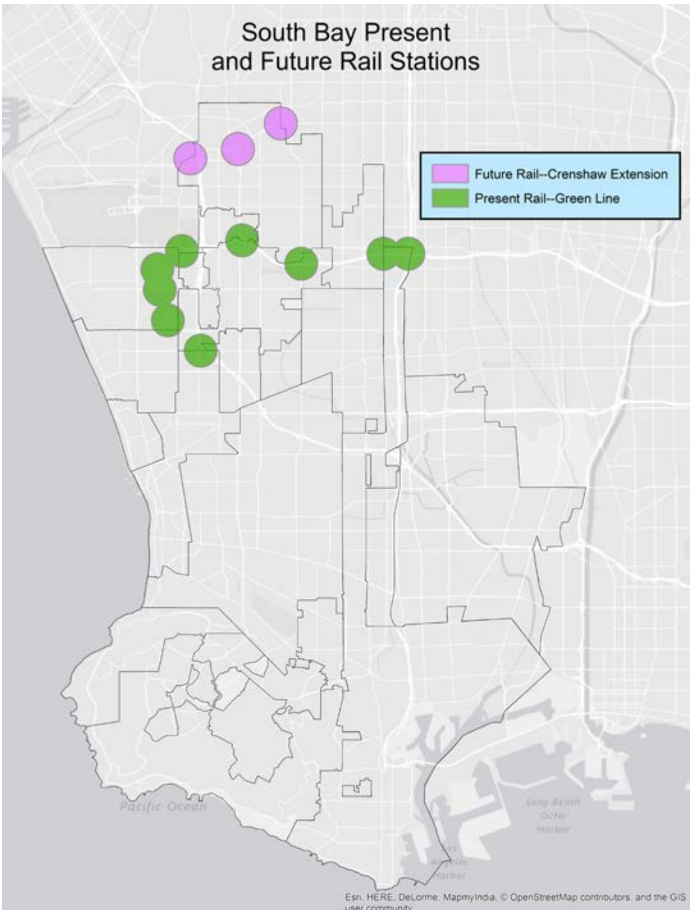



FIGURE 3 South Bay Rail Service

within the South Bay. Data from multiple studies reveal that 70% of trips originating in the South Bay are under 3 miles.[19]

In short, the auto-oriented development patterns of the South Bay, combined with the lack of a frequent transit network and an overall preference to travel via auto given the current system, makes GHG reduction strategies that are focused on transit and density ineffective for the mature suburbs of the South Bay.

The SSBS land use vision addresses GHG reduction in mature suburbs through strategies that shorten trips via the compression of origins and destinations thereby reducing VMT and increasing walking and the use of short-range mobility devices such as bicycles and neighborhood electric vehicles. The mobility component stresses the electrification of the fleet to flexibly meet the needs of residents beyond a walking range. Combined, these strategies reduce both VMT and GHG emissions in the South Bay.

19. The following studies show that trips in the South Bay are short: Metro 2014 SRTP and Siembab, W., Rhoads, M., and Baum, A. (2015). “Drive the Future: Battery Electric Vehicle Project.” Prepared for the South Bay Cities Council of Governments

## SUSTAINABLE SOUTH BAY STRATEGIES (SSBS): THE RESEARCH

# Three main studies provide the background evidence and data for the South Bay strategies and GHG emission reduction methodology.

**8 Neighborhood Transportation Performance Study (2003-2008)**
This study examined the relationship between commercial development and travel behavior in the South Bay. It sought to determine the characteristics of destination clusters that attract the highest percentage of trips from households within a ½-mile of the cluster, and that also have a high percentage of walking trips. In other words, the study assessed the performance of 8 horizontal mixed-use centers and neighborhoods in the South Bay. Four of the centers consisted of commercial strips on major arterials (see Hawthorne and Artesia for examples in the image to the right). The other four centers consisted of denser commercial contained in a traditional center format (see shapes of Riviera Village and El Segundo for examples).

Neighborhoods were drawn around the centers and the surrounding population was surveyed regarding their travel behaviors such as how often they visited the nearby commercial cluster and what modes were used for that travel. They were also surveyed as to general trip making by mode. 2,125 households completed surveys.

Findings revealed that density of businesses was a key attribute in determining if residents would visit the nearby commercial area and if they would walk to it. The study also concluded that most trips in every neighborhood were short.

Land use strategies cannot be created without a robust understanding of the relationship between destination clusters, housing, and travel behavior at the local level. This

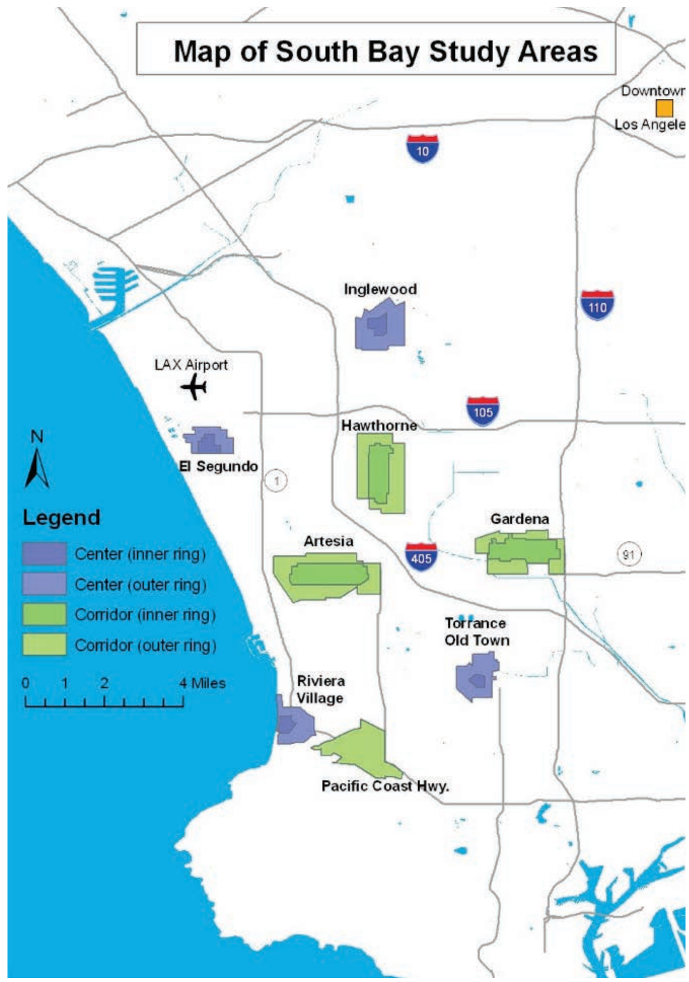



FIGURE 4 Map of South Bay Study Areas

study provides the essential basis for the SSBS.

**Neighborhood Electric Vehicle (NEV) Demonstration Study (2009-2012)**

Neighborhood Electric Vehicles (NEVs) are short-range slow speed (max. 25 mph on 35 mph streets) electric vehicles that have an advantage over full-battery electric vehicles because they are cheaper and smaller (can be parked and charged more easily). From the Transportation Performance Study, it was revealed that most trips of South Bay residents are under 3 miles. This study sought to understand if a NEV could replace a household's 2nd or 3rd vehicle since NEVs could accommodate these short trips.

The study placed NEVs in 50 households each for a period of 2 to 3 months. GPS units were installed in the NEVs and other household vehicles to capture the total household travel. Data captured were VMT, routes, destinations, and speeds. Over 20,000 trips were catalogued in a database.

Findings revealed that households successfully integrated NEVs into their regular travel. The GPS data showed that trips are short: for all household vehicles, 70% of the trips were less than 3 miles. When given a NEV, a household used it for 19% of their trips. The GHG emission reduction was 24% per household.

**Battery Electric Vehicle (BEV) Demonstration Study (2013-2015)**

Battery Electric Vehicles (BEVs) are longer-range electric vehicles (80-mile range before having to charge) that more closely resemble gas-powered vehicles in form and function. While an NEV can absorb a household's short-range travel, a longer-range vehicle is needed for the remainder of a household's trips. This study sought to understand if a BEV could function as a household's primary vehicle.

The study placed BEVs in 50 households each for a period of 2 months. GPS units were placed in the BEVs and other household vehicles to capture the total household travel. Data captured were VMT, routes, destinations and speeds. Over 20,000 trips were catalogued in a database. Findings revealed that trips taken in a BEV were equivalent to those taken in an Internal Combustion (ICE) vehicle. Very few trips in ICE vehicles were taken outside of the range of a BEV. When given a BEV, an average household used it for 40% of their trips and reduced their GHG emissions by 40%.

**Study Summary**

With no changes in the development pattern, the South Bay can dramatically reduce its carbon footprint when households drive zero emission personal vehicles that match their mobility needs. Most trips in the South Bay are too long to walk, too short for transit, and perfect for limited-range electric vehicles.

The two transportation SSBS strategies are:

1. Converting the existing fleet of ICE vehicles to some form of electric vehicle, and
2. Reducing the number of vehicles per household through growth of the mobility services market.

The land use vision in the SSBS consists of consolidating destinations so they are optimized for walking and short-range vehicles. Currently, destinations are inefficiently distributed in auto-oriented commercial strips rather than neighborhood-oriented centers. The following sections describe the land use reorganization needed in the South Bay to optimize transportation efficiency.

## EVOLUTION OF THE SUBURBAN MODEL

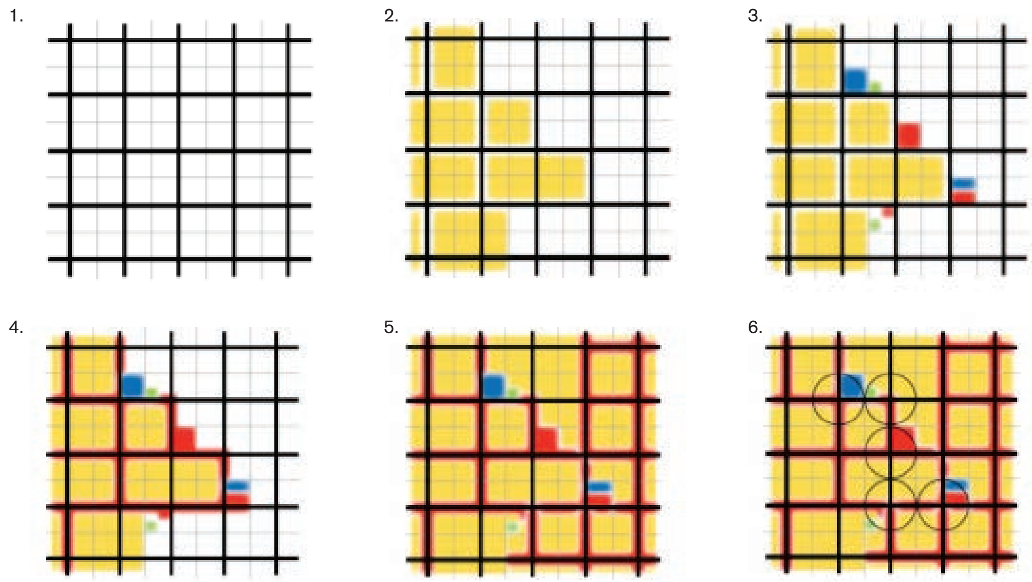



FIGURE 5 Evolution of the Suburban Grid

Figure 5 depicts the evolution of a generic suburban landscape. It shows how destinations become separated from their origins and why solutions oriented around rail leave out most neighborhoods. The first diagram pictures a basic street grid. Arterial street grids define the layout of most South Bay inland cities and portions of the beach cities. As the suburbs formed, single-family residential tracts developed inside of the major arterials at the edge of the grid, depicted in the second image. Civic, park and open space along with commercial centers then developed on the edge of the tract in response to the demands of the single-family residential. These uses occur along the periphery of residential spaces and at intersections. Because the edge of the single-family residential is separated from the activities, access to the activities necessitates an automobile, as most destinations are longer than a half mile in distance from the households.
In the 4th phase, auto-oriented commercial corridors developed along the major arterials. This type of commercial activity can be seen today along most South Bay arterials in the form of gas stations, auto repair shops, fast food restaurants and strip malls whose fronts feature parking lots. In phases 5 and 6, single-family residential tracts expand outward. As a result, residential is segregated from commercial land use and destinations are arrayed along a corridor instead of concentrated into centers, leaving destinations far apart and outside of walking distance. The circles in image 6 represent half-mile walking radii around intersection nodes within which there is no concentration of activities and no destinations within walking distance.

# SUSTAINABLE SOUTH BAY STRATEGIES: SUSTAINABLE SUBURB MODEL

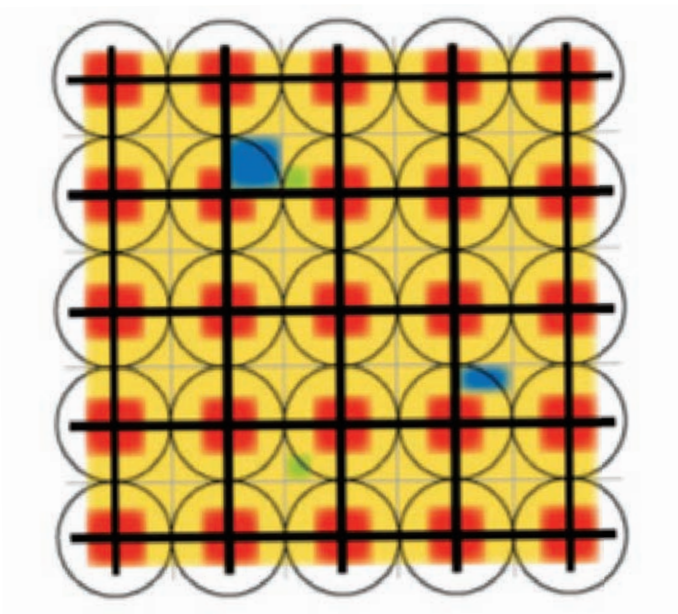


FIGURE 6 Smart Suburbs Grid

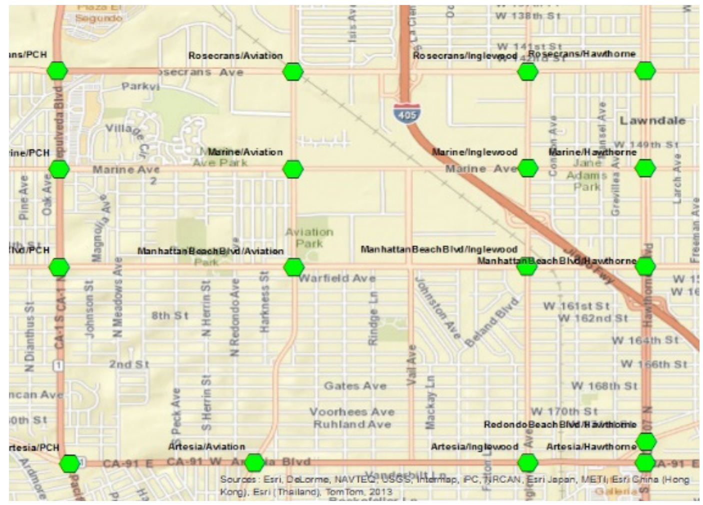


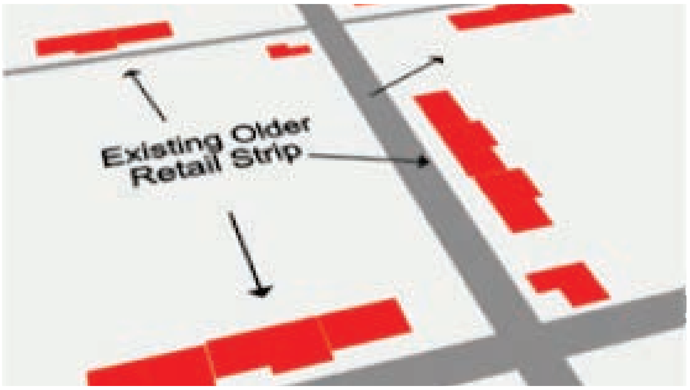

FIGURE 7 Major/Major Intersections in the South Bay

The Sustainable Suburb Model, or the "centers" strategy as promoted in the SSBS, considers all neighborhoods comprehensively. All intersections of two major streets are conceptualized as Neighborhood Centers with half-mile neighborhoods surrounding them. Within a 16-square mile grid, there is the potential to achieve 25 walkable neighborhoods. This land use pattern is not dependent on concentrated public investment in a single corridor project, as is often the case with TOD, allowing a more even distribution of destinations to more neighborhoods.

Intersection nodes become 'centers' or 'villages' that provide residents with dense access to goods, services, technology, and face to face social interaction. The 'centers' strategy, coined Neighborhood Oriented Development (NOD), retrofits the parcels on arterials with underperforming commercial into housing to further support the centers. The underperforming commercial retail along arterials is absorbed into the intersection nodes. The arterial commercial is then replaced with housing. Parking at the centers is managed to help incentivize walking, ride-sharing, ride-hailing, and the use of NEVs.

Figure 7 shows potential intersection centers within the South Bay. One major advantage of this concept is that it is equitable. More residents are treated to the same level of transportation and land use services.

Like Transit Oriented Development, NOD encourages a mix of land uses within close proximity. However, NOD recognizes that greater transportation efficiency can be achieved through the concentration of destinations in a walkable neighborhood center rather than arbitrarily adding individual commercial spaces to the ground floor of multifamily housing projects. The retrofit should increase walking mode share due to more destinations appearing within one-half mile from households and being co-located with each other. This system also



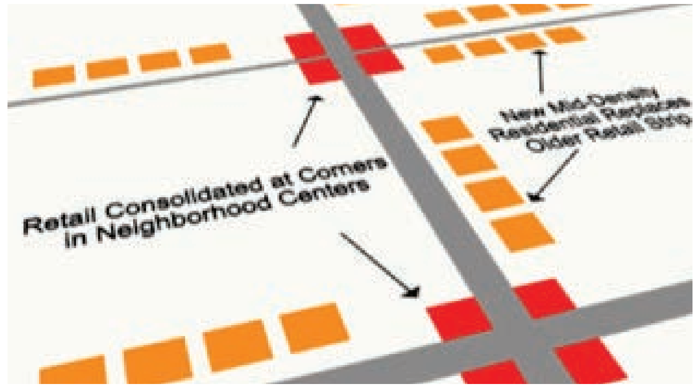




FIGURE 8 Conversion of Strip Arterial to Dense Commercial Nodes and Arterial Housing

FIGURE 9 Future Neighborhood Centers

supports a variety of electric slow-speed vehicles and other mobility strategies. The mode share of limited-range vehicles should also increase as destinations in adjacent neighborhood centers supplement a household's activities.

Along with offering a dense concentration of physical destinations, Neighborhood Centers are conceptualized to include a wide variety of transportation modes, physical services, and access to the virtual presence of services provided in electronic form such as distance education and digital medicine. Neighborhood centers enhance mobility by providing the convergence of car/bike/NEV sharing, public transit, ride-hailing and vanpool stations. Level 1 and 2 charging units should be available for electric vehicles. Outdoor spaces with amenities like lounge and fountain furniture provide outdoor public spaces that can be versatile. As digital technology is transforming commercial, retail and work activity, Neighborhood Centers should be equipped to support home-based workers, neighborhood businesses, office and meeting space and digital technology to offer services such as Telepresence and 3D printing.

Transition from Strip Arterial to Housing

Transition of Intersection to Village Center


FIGURE 10 Conversion of Strip Arterial to Housing and Creation of Neighborhood Centers

# SUSTAINABLE SOUTH BAY STRATEGIES: LAND USE AND TRANSPORTATION BY DISTANCE

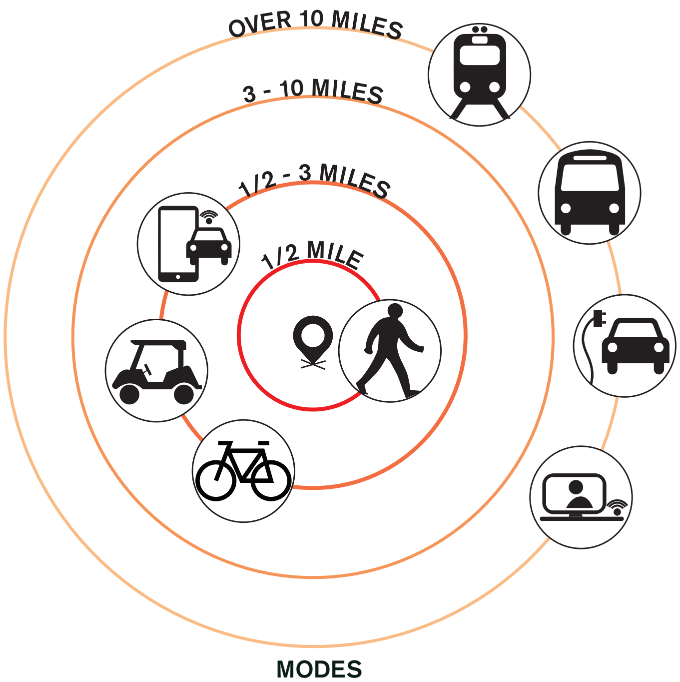



FIGURE 11 Mode by Distance

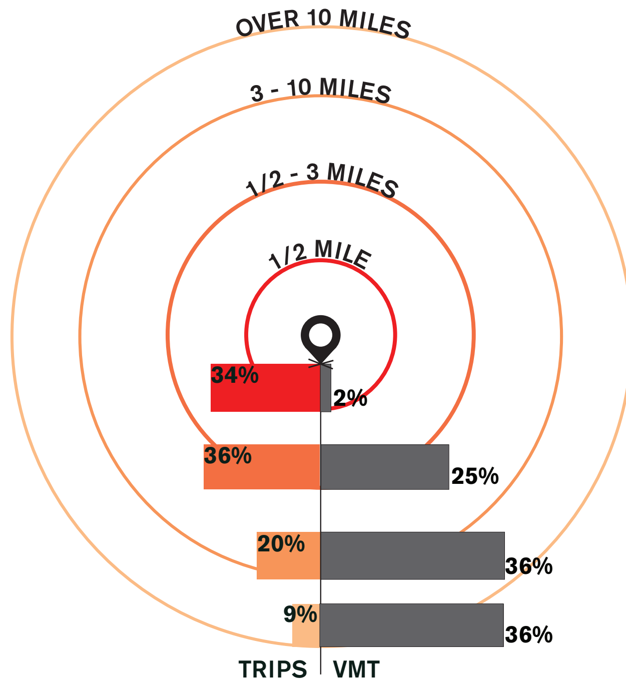



FIGURE 12 Trips and VMT by Distance

The land use strategies shorten trips by creating greater accessibility nearer to the household. This new proximity pulls in longer-distance trips and increases walking. The transportation component complements the land use vision through encouraging a suite of transportation options that reduce GHG emissions beyond and within a walkable radius from a household. These mobility options are appropriate to distance traveled. For example, to satisfy needs further than a half mile, the transportation vision promotes the use of NEVs. Short-range electric devices such as electric bicycles and Segways can also facilitate short-range travel. Hand-held personal electric devices such as scooters are portable and serve as a first and last-mile mode.

Other modes such as biking, ride-sharing, ride-hailing and neighborhood electric vehicles could serve a household's needs beyond a half mile and within a reasonable distance. Buses are often time-competitive within a 10-mile radius as well, if service is frequent. Longer-range vehicles, such as full battery electric vehicles (BEVs), and rail transit can accommodate trips needed outside a 10-mile radius. Flexible workplace options such as staggered work hours and telecommuting can eliminate a portion of trips needed for work. The image above depicts various distance rings or shells that serve as the boundaries of the various modes.

Table 2 lists the percent of trips and VMT an average South Bay household makes by distance. These data are summarized from both the SBCCOG NEV and BEV studies.[20] The numbers have been validated by other studies and

20. Siembab, W., Rhoads, M., and Baum, A. (2015). "Drive the Future: Battery Electric Vehicle Project." Prepared for the South Bay Cities Council of Governments; and Siembab, W., Magarian, D. (2013). "Zero emission local use vehicles: The neglected sustainable mode." Prepared for the South Bay Cities Council of Governments.

surveys such as the Caltrans 2010 household survey (CHTS). The NEV and BEV data are far more robust as combined they represent over 40,000 trips.

The NEV and BEV studies show that a substantial portion of trips are made within a half mile of the home (34%), however these trips represent a small portion of overall household VMT. 63% of a household's VMT occurs within 10 miles from the home. While the percentage of trips outside of a 10-mile radius from the home is small, this portion represents a significant amount of VMT (37%). Figure 12 illustrates the concept.

For the SSBS strategies to reduce GHG emissions, they must reduce or replace (e.g. gas for electric) a household's VMT. The SSBS land use strategies pull in more trips and VMT from outer rings into the inner ring thereby shortening trips and replacing them with walking or short-range electric vehicle trips. Trips made outside of a half-mile radius can be served with electric vehicles, shared mobility, non-motorized modes such as biking, and transit.

| **Average Percent of Household Trips and VMT by Distance** | |
|---|---|
| **Trips** | |
| Under .5 miles | 34% |
| Under 3 miles | 70% |
| Between 3 and 10 miles | 20% |
| Between 3 and 10 miles (work) | 4.6% |
| Over 10 miles | 9% |
| Over 10 miles (work) | 2.6% |
| **VMT** | |
| Under .5 miles | 2% |
| Under 3 miles | 27% |
| Between 3 and 10 miles | 36% |
| Between 3 and 10 miles (work) | 8.3% |
| Under 10 miles | 63% |
| Over 10 miles | 37% |
| Over 10 miles (work + chained) | 10.4% |
| **NEV (when available)** | |
| Percent of trips in a NEV | 19% |
| **BEV (when available)** | |
| Percent of trips in a BEV | 40% |

TABLE 2 South Bay Trips and VMT by Percentages[21]

21. Ibid.

# SUSTAINABLE SOUTH BAY STRATEGY: LAND USE STRATEGIES

The 8-neighborhood Transportation Performance Study, mentioned above, revealed that more households visited and walked to commercial areas that were denser and served neighborhood needs. As can be seen in Table 3, the center of Riviera Village captured 46% of the surrounding household's daily trips and 14% of these were made on foot. The worst performing area, Gardena, captured only 17% of the surrounding households' daily trips and 2% of these were made on foot. Table 3 also shows that the areas which captured the greatest share of nearby household trips and walking trips were areas that had more businesses per acre in general and especially more neighborhood-serving businesses. For data references, see the following report: South Bay Transportation Performance Study: Technical Report 2 by Marlon Boarnet.[22]

The land use strategies focus around providing the mix, density, and key trip capture destinations of the highest performing centers in the study and are categorized as neighborhood-oriented development strategies. Parking strategies at neighborhood centers can help to encourage walking and reduce VMT.

Parking is inextricably linked to congestion, VMT, and mode choice (Manville & Shoup, 2005; Shoup, 2006; Shoup, 2005). Parking takes up valuable space that can be devoted to open space, other uses, and a more vibrant street life. Availability of parking is linked to mode choice. In Manhattan, where parking is greatly limited and expensive, 78% of households don't own a car while in the rest of the region only 7% go carless (Manville & Shoup, 2005). Between 8% and 74% of traffic on arterials is due to cruising for parking spaces and one curb space can account for 1,825 vehicle miles traveled per year (Shoup, 2006). Parking prices are more important than the price of fuel or transit in mode choice (Shoup, 2005).

Therefore, SSBS land use measures must work in tandem with parking to facilitate alternative mode choices. Walking, Neighborhood Electric Vehicles (NEVs), and shared and autonomous vehicles will be greatly incentivized by parking measures.

| | | | Businesses per Acre | |
|---|---|---|---|---|
| | Trip Capture | Walking Trips | All | Neighborhood |
| **Center** | | | | |
| Riviera Village | 46% | 14% | 6.44 | 3.50 |
| Torrance | 47% | 11% | 6.26 | 2.50 |
| El Segundo | 30% | 8% | 2.62 | 1.05 |
| Inglewood | 33% | 6% | .53 | .22 |
| **Corridor** | | | | |
| Artesia | 30% | 5% | 1.05 | .38 |
| Gardena | 17% | 2% | 1.03 | .47 |
| Hawthorne | 31% | 1% | 1.39 | .66 |

TABLE 3 Center and Corridor Data

The following lists the combined Land Use and Parking SSBS Strategies. For a more detailed description of the strategies please see the Implementation Guide.

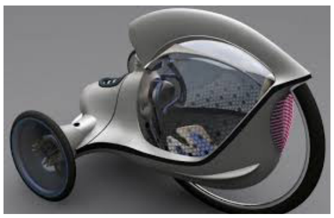
*Land Use and Parking Strategies:*

| **Integrate Neighborhood Oriented Development (NOD)** |
|---|
| Amend zoning code or general plan to encourage greater commercial building density and more businesses per acre and provide well-rounded services to residential communities |
| Develop a NOD plan. Establish NOD centers within ½ mile radii of a 3-mile community |
| Encourage higher "Business Establishment Density and Diversity" (Number of Businesses per Acre) within NOD centers. Discourage large format business establishments |
| **Integrate Reduced Parking** |
| Reduce or eliminate minimum parking requirements for NODs |
| Institute optimal parking pricing |
| Adopt a comprehensive parking policy to unbundle the true cost of parking |
| Encourage developers to create shared parking through lower in-lieu fees |
| Implement on-street parking pricing |

22. http://www.southbaycities.org/sites/default/files/documents/7.09_Technical_Report__2_-_final.pdf

## SUSTAINABLE SOUTH BAY STRATEGY: MOBILITY STRATEGIES

# The land use component of the SSBS framework addresses access to essential goods and services within walkable distances of every household.



When a NEV was introduced into a household, average GHG emissions were reduced by **19%**

When a BEV was introduced into a household, average GHG emissions were reduced by **40%**

The transportation vision complements land use by considering the mobility needed to supplement walking within a half-mile radius and to access destinations outside a half-mile radius.

Conversion to an electric fleet provides the most effective reduction of GHG emissions. The transportation vision also promotes a variety of other modes such as biking, ride-sharing, ride-hailing, shuttles, and transit, plus organizational practices which facilitate telecommuting and flexible work start times.

### ELECTRIC VEHICLE STRATEGIES

Slow-speed electric vehicles such as neighborhood-electric vehicles (NEVs) provide a viable alternative to full-size vehicles for short trips. The South Bay's suburban network of wide streets is ideal for the conversion to complete streets that facilitate walking and biking and slow-speed lanes for NEVs, Segways, scooters, skateboards, and a host of other personal electric mobility devices. NEVs are convenient because they are easy to charge (generally in a common electric 110 v outlet) and are smaller in scale than a gas-powered vehicle. NEVs are also more affordable as they range in price starting around $8,000 for a lower-end 4-wheel NEV.

NEVs are limited to streets with speed limits under 35 miles per hour. Other mobility devices have different regulatory restrictions that limit where they can travel. The lack of supportive infrastructure, plus the limitation on range (NEVs have a 10-mile charge range), constricts a household's ability to travel longer distances.

Full-battery electric vehicles (BEVs) don't have the same speed and route limitations as NEVs. The battery range of BEVs fluctuates with the price of the vehicle. For 2017 the lowest price car Mitsubishi-i-MiEV had a range of 63 miles while the Tesla S100D had a range of 360 miles.[23] The BEV study mentioned above demonstrated that households used BEVs identically to gas powered vehicles thereby providing a viable replacement. When a BEV was placed in a household, the household's GHG emissions were reduced by 40%. The

23. https://www.fleetcarma.com/2017-battery-electric-cars-reported-range-comparison/

adoption of electric mobility is constrained by many factors. Currently, households are unwilling to purchase an electric vehicle over a gas-powered vehicle because of the expense, the current lack of ubiquitous electric charging infrastructure (it is perceived as far easier to fill up a car with fuel), and the lack of knowledge about rebates and types of electric mobility. Family traditions and gas-fueled vehicle advertising are significant cultural factors also creating barriers to purchase. Many people live in multi-unit dwellings (MUDs) where parking garages either do not contain 110 v outlets or they are complicated to access making owning a plug-in electric vehicle prohibitive.

Local, regional, and state governments can facilitate EV purchases and adoption by offering more public charging in government facilities and parking lots, incentivizing the private sector to offer charging, conducting education campaigns, and adopting complete streets policies that consider a full range of mobility devices. The following lists the electric mobility strategies cities can enact. For an in-depth description of the strategies, please see the Implementation Guide.

*Accelerate the Market for Electric Vehicles*

| **EV Parking Policies** |
|---|
| Offer free or reduced-price parking to EVs in city lots and on-street |
| Grant new developments lower parking minimums if they provide EV parking |
| Adopt parking standards for residential, commercial, and industrial development |

| **EV Charging Strategies** |
|---|
| Install level 1 and 2 charging in city-owned parking lots and facilities |
| Provide on-street level 1 and 2 charging |
| Create policies that encourage facility owners to provide level 1 charging |
| Cooperate with regional agencies to expand charging networks |

| **EV Administrative Readiness** |
|---|
| Reduce costs of electric permits for service upgrades |
| Offer on-line permitting to streamline the application process |
| Minimize time to complete inspection (within 24 hours) |
| Streamline panel upgrade when it does not involve relocation |

| **Public Information Programs** |
|---|
| Commit to publicize EV programs through websites, social media, print media and front desk |

| **Multi-modal streets to support slow-speed mobility** |
|---|
| Plan and implement local "off-ramps" to connect the backbone to local activity centers |
| Promote slow-speed vehicles through signage, maps, and public information |
| Implement South Bay slow speed backbone network plan |

## SHARED MOBILITY STRATEGIES

To supplement household mobility, the SSBS transportation vision encourages the use of shuttles, ride-sharing, bike-sharing, car-sharing and ride-hailing services such as Uber and Lyft.

Shared mobility refers to the shared use of a vehicle, bicycle, or other low-speed travel mode that enables travelers short-term access to a mode on an as-needed basis as well as other shared modes. Shared mobility can include roundtrip travel (the mode is returned to its origin) and one-way travel (the mode is left at a different destination than its origin either at a station or anywhere within a geography).

Studies have documented that when users join a car sharing program a percentage of them sell one of their vehicles. Within the United States, surveys have revealed that 11 to 26 percent of carsharing participants sold a personal vehicle after entering a program (Lane, 2005; Martin, Shaheen, & Lidicker, 2010). Carsharing participants also increase walking as a mode to access goods and services (Cohen & Shaheen, 2016). Carsharing has the potential to decrease VMT because

it emphasizes cost per hour and/or mileage causing a driver to be more judicious about their travel and some studies have shown VMT reductions in the range of 7.6 to 80% (Cohen & Shaheen, 2016).

Bike-sharing has been shown to have similar effects on VMT, mobility and GHG reductions. Public bike-sharing can decrease driving and taxi trips (Cohen & Shaheen, 2016).

As technology further develops, ride-hailing among for-hire vehicle services such as Uber and Lyft will play an increasingly important role in mobility and VMT and GHG reductions. UberPool and LyftLine are the commonly used taxi ride-hailing applications in most cities around the world. New ride-hailing applications are appearing in New York. Via provides on-demand, integrated, and fixed-route travel. Cars drive a set of fixed routes and pick up passengers along the way. Bandwagon allows people to match and share rides in local, licensed taxis. A recent study showed that taxi sharing could reduce taxi trips by 40% with reductions in emissions (Santi, et al., 2014).

Local governments can have a direct relationship with ride-hailing, bike sharing and car sharing service providers. Shared mobility is influenced by and influences most aspects of planning such as transportation and circulation, zoning, land use and growth management, urban design, housing, economic development, and environmental policy, conservation, and climate change. Local governments can help facilitate shared mobility through various strategies.

For an in-depth review of shared mobility see the Shared Mobility Report.

| **Encourage Shared Mobility** |
|---|
| Build cross-sector alliances with businesses, educational institutions, community organizations, and other stakeholders to develop shared mobility services |
| Consider funding a bike-sharing transportation infrastructure network using development fees |
| Work with local bike coalitions and other stakeholders to establish or expand bike-sharing |
| Support the viability of mobility hubs |
| Develop ordinances that incorporate share modes with documented reductions in VMT |
| Ensure that development projects enhance multi-modal transportation options |
| Establish transportation surcharges for single-passenger for-hire vehicle services (ride-sourcing/TNC/taxi) with an origin, destination or passing through SBCCOG |
| Encourage a car-sharing program |
| Become a car-sharing customer |
| Advance a wide array of payment options to improve access to mobility options |
| Access, analyze, and monitor data from innovative mobility services to ensure positive environmental and emissions outcomes |

## ACTIVE TRANSPORTATION STRATEGIES

Strategies that facilitate walking and biking such as traffic calming measures, improving bike and pedestrian measures and the provision of pedestrian and bike infrastructure complement the land use and slow-speed vehicle strategies. The following lists complementary bicycle and pedestrian strategies.

| **Adopt Active Transportation Initiatives** |
| --- |
| Adopt a complete streets policy |
| Develop a bicycle and/or pedestrian master plan |
| Require short-term and long-term bicycle parking and shower facilities |
| Implement pedestrian infrastructure, such as curb extensions, high visibility crosswalks, etc. |
| Develop a network of protected bike lanes and bike paths |
| Implement traffic calming and complete streets improvements |

## ORGANIZATIONAL STRATEGIES

Organizational strategies refer to strategies that affect the workplace and thus commute trips. Work trips account for a significant portion of a household's VMT and when clustered around peak periods can exacerbate congestion and GHG emissions. As referenced in Table 2, VMT related to work (both work trips and trips chained to work like shopping) accounts for around 19% of a household's VMT.

Currently working from home is not a substantial commuting mode, under 4% of the workforce works from home.[24] However, flexible work (taking phone calls and writing e-mails outside of the workplace) accounts for a sizable portion of the daily activity and a larger transition to replacing the commute should occur. While only certain portions of the workforce can feasibly work from home, substantial portions from even traditional face-to-face labor industries has the capacity to do some work from home or off-site nearer to the home. This will increase as gigabyte networks become more ubiquitous allowing for telepresence and high-definition communication.

For a more detailed description of organization actions see the Implementation Guide.

In all, the SSBS strategies improve mobility and accessibility while reducing GHG emissions associated with transportation. The land use strategies shorten trips by enhancing neighborhood accessibility. The new proximity combined with parking strategies increases walking for trip making while the transportation strategies complement land use through encouraging a suite of transportation options that reduce or eliminate GHG emissions for both short and long-distance trips. The following section will describe the methodology for quantifying the GHG reductions for the SSBS strategies based on the background research.

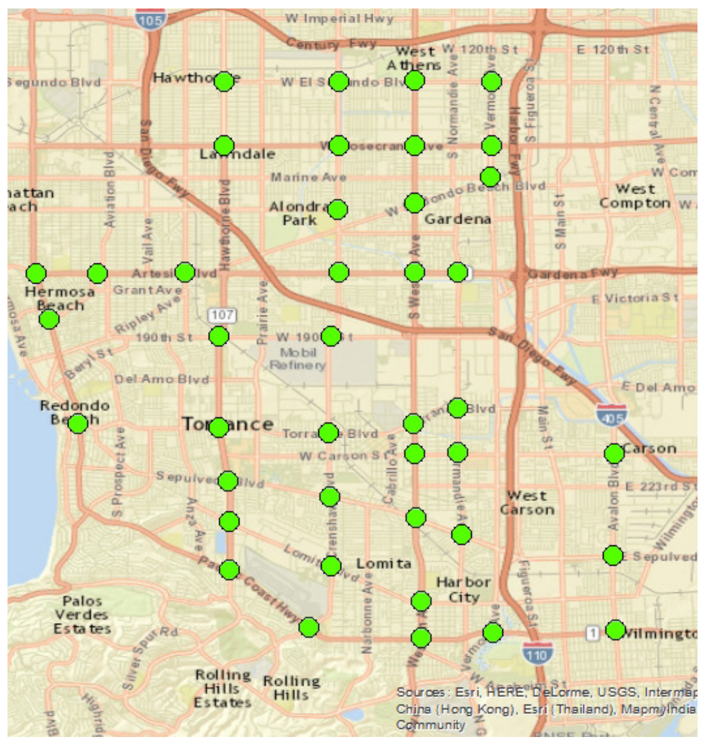
| **Organizational Strategies** |
| --- |
| Within the city, encourage telecommuting and alternative work schedules |
| Work with local employers to institute telecommuting and alternative work schedules |

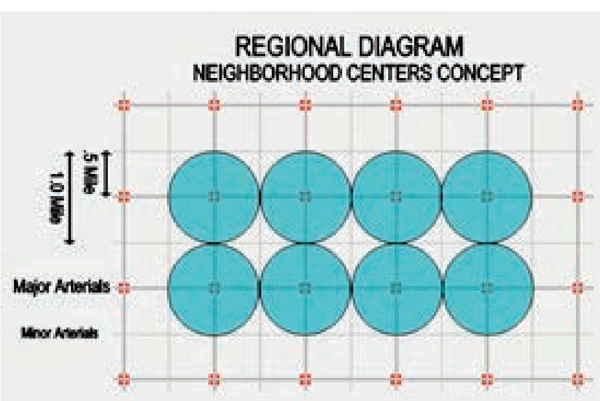
24. 2009 National Household Transportation Survey (NHTS)

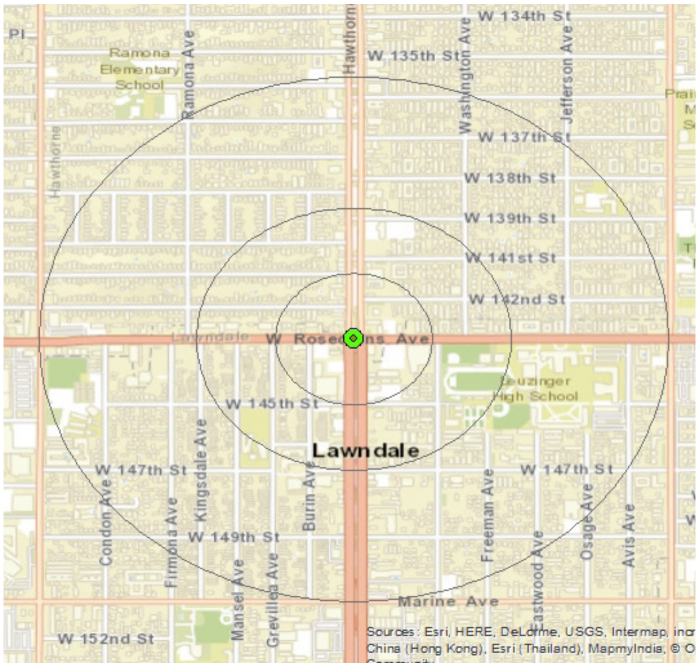
## SUSTAINABLE SOUTH BAY STRATEGY: QUANTIFYING GHG REDUCTIONS

The following section will calculate the GHG reduction for the South Bay region using the Sustainable South Bay Strategies (SSBS). The regional calculations are based on GHG reductions for 41 conceptual neighborhoods, listed below and shown on the map. The methodology is described in step by step detail in the appendix. Here a brief overview is provided.

| City | Count |
|---|---|
| Carson | 2 |
| Gardena | 9 |
| Harbor City, LA City | 2 |
| Hawthorne | 3 |
| Hermosa Beach | 2 |
| Lomita | 2 |
| Redondo Beach | 4 |
| Torrance | 16 |
| Wilmington, LA city | 1 |
| **Grand Total** | **41** |






## GHG REDUCTION METHODOLOGY OVERVIEW

Strategies Used

4 groups of strategies are calculated for each neighborhood in this order:

1. NEV and BEV strategies
2. The Neighborhood-Oriented Development (NOD) Strategy (Land Use)
3. Parking layered onto NOD
4. Workplace practices: Telecommuting and Workplace Parking Pricing

Neighborhood Geographies

Each of the strategies is assessed for different geographies within a neighborhood. A neighborhood is considered as households living within a ½ mile from the neighborhood center because this encompasses the walking radius from the center. 70% of South Bay trips are under three miles and bicycle trips tend to lie within 3 miles of a one-way distance. NEVs are generally not driven past a one-way distance of 10

| | Trip Generation (Trip Capture) | Walking Trips | VMT | Source |
|---|---|---|---|---|
| **½ Mile Radius** | | | | |
| Artesia/Hawthorne Corridors | 25% | 4% | 2% | Trip Capture: Land Use Study[25]<br>VMT: BEV/NEV Data [26] |
| El Segundo | 28% | 7% | 2% | Land Use Study and BEV/NEV Data |
| Riviera Village | 46% | | 2% | Land Use Study and BEV/NEV Data |
| **½ Mile to 3 Mile Radius** | | | | |
| Artesia/Hawthorne | 46% | | 25% | Land Use Study and BEV/NEV Data |
| El Segundo | 43% | | 25% | Land Use Study and BEV/NEV Data |
| Riviera Village | 24% | | 25% | Land Use Study and BEV/NEV Data |
| **3 to 10 Miles Work** | 4.6% | | 8.3% | BEV/NEV Data |
| **3 to 10 Miles Other** | 15.4% | | 28% | BEV/NEV Data |
| **Over 10 Miles Work** | 2.6% | | 10.4% | BEV/NEV Data |
| **Over 10 Miles Other** | 6.4% | | 26% | BEV/NEV Data |

TABLE 4 Baseline Trip Generation and VMT Data by Geography

25. http://www.southbaycities.org/programs/land-use/south-bay-sustainable-strategy-integrated-land-use-and-transportation-strategy
26. Siembab, W., Rhoads, M., and Baum, A. (2015). "Drive the Future: Battery Electric Vehicle Project." Prepared for the South Bay Cities Council of Governments; and Siembab, W., Magarian, D. (2013). "Zero emission local use vehicles: The neglected sustainable mode." Prepared for the South Bay Cities Council of Governments.

miles. Finally, trips outside of a 10-mile radius are considered. These 4 distance rings are determined by the South Bay data:

1. ½ mile from the neighborhood center
2. ½ to 3 miles
3. 3 to 10 miles
4. Over 10 miles

Baseline Data

Average South Bay Household Trip Capture and VMT are presented for the distance categories in Table 4. Trip Generation or Trip Capture is defined as the percentage of total trips that a household makes in the geography. For example, an average household living within a ½ mile radius of the Artesia and Hawthorne Corridors, makes 25% of their trips to the corridor and these trips account for 2% of the household's total VMT.

Assumptions

There are several key assumptions made in the methodology (detailed in appendix):

a. Impact of Neighborhood Electric Vehicles (NEVs) before land use – if a household uses an NEV, they will reduce their VMT by 19% (from NEV study).
b. Impact of full Battery Electric Vehicles (BEVs) before land use – If a household uses a BEV, they will reduce their VMT by 40% (from BEV study).
c. NEV/BEV trips are assumed to be zero emissions and replace Internal Combustion Engine (ICE) trips at a one-to-one scale. This slightly overestimates GHG reduction, as electric power generation is associated with emissions. However, the cleaner the fuel source, as is the case in Southern California, the closer emissions get to zero. Also, electric vehicles eliminate cold starts which further bring emissions related to electricity generation down. The California Energy Commission reports that as of 2016, California's large investor owned utilities contracted between 28% and 43% of their electricity for renewable portfolio standard (RPS) sources.[27] The Energy Commission anticipates that the three larger investor owned utilities (PG&E, SCE, and SDG&E) will contract about half their electricity from RPS-eligible sources by 2020. California's fuel mix has a high renewable component, but the zero emission NEV/BEV assumption also assumes the electricity generation is zero emission.
d. The methodology assumes that household trip frequencies are fixed, so that if a household takes more trips within a half-mile, they reduce trips by the same amount beyond a half-mile. This may overestimate GHG reductions, since providing opportunities for more short trips may induce households to make more trips overall.
e. The methodology has been incorporated into a tool where all assumptions made are transparent, and flexible and can be changed. The tool is a scenario planning tool that in future work can be adjusted to incorporate different assumptions as policy makers see necessary or as more information and data are acquired.

Land Use Strategy: Neighborhood Oriented Development (NOD)

The land use study showed that households walk and visit nearby centers when there is a higher mix and density of destinations. Of the 8 centers and corridors studied, Riviera Village received the most visits and walking trips of nearby households. Therefore, the land use strategy emphasizes the densification of commercial activity and services at key areas.

27. California Public Utilities Commission (2017) "Renewables Portfolio Standard Annual Report." Pg. 10 California Public Utilities Commission Renewable Portfolio Standards

For the 41 centers (intersections), the current retail density is calculated and then matched to one of the three study centers or corridors:

1. Artesia/Hawthorne (Artesia and Hawthorne are two different corridors but with similar statistics and so are combined)
2. El Segundo
3. Riviera Village

The intersection/conceptual center is given the baseline trip capture rates of the matching center and the methodology calculates the increase in trip capture and walking rates when commercial activity densification reaches that of Riviera Village. If the intersection/center has the same commercial

Effect Size: Total GHG Emissions

Average household VMT reductions are calculated for each of the strategies at each of the distance categories. To determine the total neighborhood VMT reductions and therefore GHG reductions, the average household reductions are multiplied by the number of households affected by each strategy. The assumptions for effect size are flexible and can be easily changed to test scenarios. These are the effect size assumptions made for the Regional Climate Action Plan (CAP):

1. 1% of households adopt an NEV
2. 1% of households adopt a BEV
3. For all households
   a. 25% telecommute one day a week
   b. 25% are affected by workplace parking engendering the following rates:
      i. 34% take transit
      ii. 21% carpool
      iii. 45% drive alone
4. All households are affected by land use and parking

The above methodology was applied to 41 potential neighborhood centers in the South Bay. The following runs through an example intersection/center: Rosecrans and Hawthorne and then applies these calculations to the 41 centers for a Regional Reduction.

**EXAMPLE INTERSECTION: HAWTHORNE AND ROSECRANS**

Hawthorne and Rosecrans, located on the lower edge of Hawthorne, is used as an illustration. The images below display the location of Hawthorne and Rosecrans within the South Bay and the radii around Hawthorne and Rosecrans for 1/8th mile and 1/2th miles. There are 7,449 households living within a ½ mile radius of the intersection. The 1/8th mile radius is drawn to calculate the business density. There are 2.06 businesses per acre within a 1/8th mile radius amounting to roughly 64 existing business (2.06*31acres). The land use strategy encourages the business density to equal that of Riviera Village. Number of businesses would need to increase to approximately 125 to reach the same density as Riviera Village (4.02*31). Business quantity would need to double.

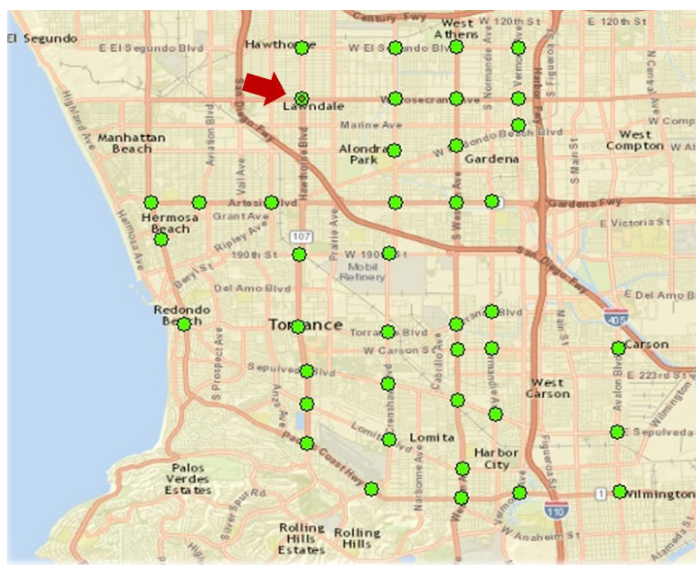
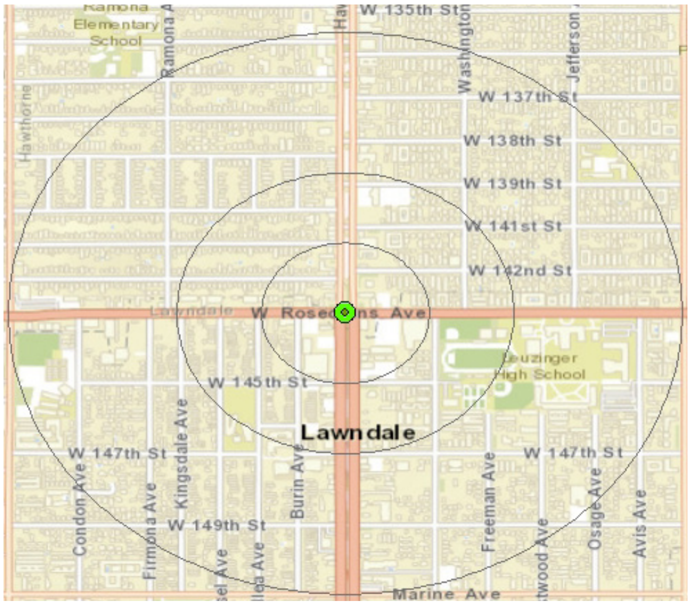
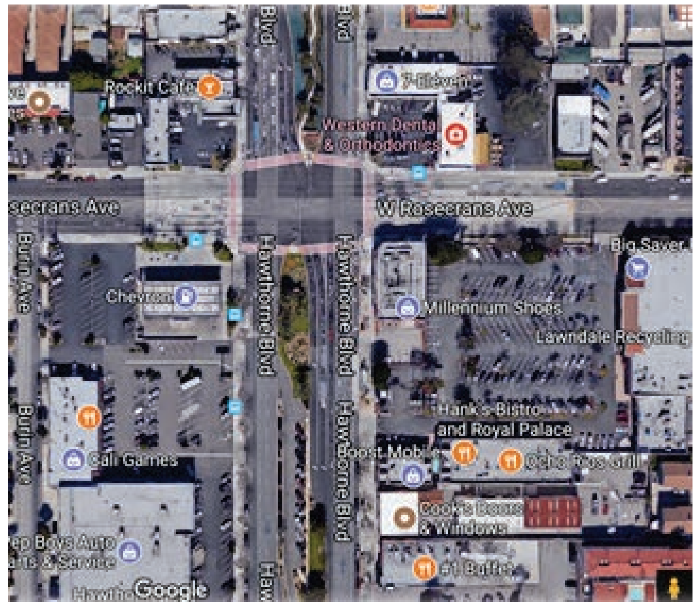



FIGURE 13: Hawthorne and Rosecrans Intersection Images and Data



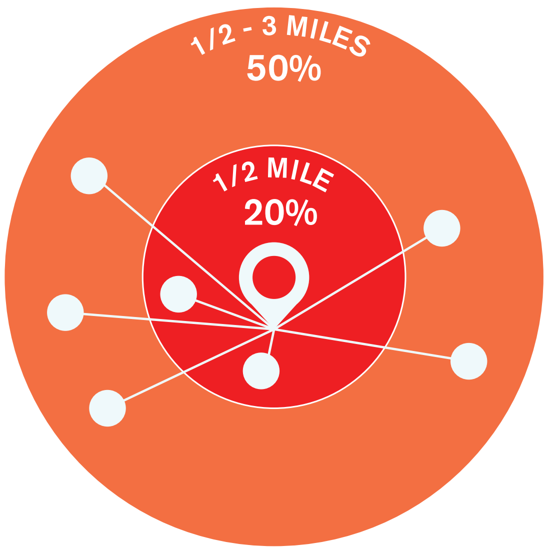

## Trip Capture

Trip Capture, a very simple concept, is the percentage of trips made in an area. For a household trip capture within ½ mile would be the percentage of trips the household makes within a ½ mile of their residence.

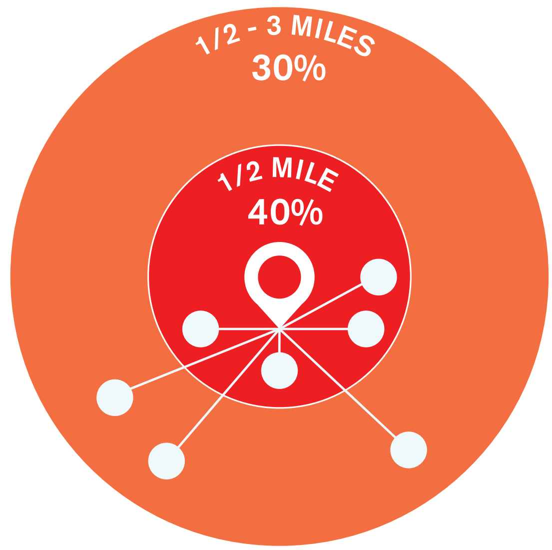
| | 1/2 Mile |
|---|---|
| Population | 22,126 |
| Households | 7,449 |
| Total Businesses | 64 (1/8th Mile Radius) |
| Businesses per acre | 2.06 (1/8th Mile Radius) |

The following are the strategies used to calculate VMT reduction:

1. Impact of Neighborhood Electric Vehicles (NEVs) and Full Battery Electric Vehicles (BEVs) before land use for all distance rings
2. Land Use strategies for the ½-mile and ½ to 3-mile rings
3. Parking with Land Use for the ½-mile and ½ to 3-mile rings
4. Impact of NEVs after Land Use for the ½-mile and ½ to 3-mile rings
5. Impact of BEVs after Land Use for the ½-mile and ½ to 3-mile rings
6. Telecommuting, carpooling and transit for commuting for the 3 to 10-mile and over 10-mile rings




**TRIPS PRE-LAND USE**




**TRIPS POST-LAND USE**

FIGURE 14: Sample Schematic of Trip Changes between shells or circles

The land use and parking strategies will have the largest impact on VMT because they affect all nearby households, increasing walking and reducing the distance traveled by internal combustion engines (ICE). However, it will take time to fully implement land use strategies, especially when compared to electric vehicle strategies, therefore the reduction in GHGs that NEVs and BEVs will realize independent of land use strategies is calculated first. Workplace strategies such as parking and telecommuting can also be implemented quickly and are part of the pre-land use GHG emissions configuration for the distance rings further out.

NEV and BEV strategies should be implemented as soon as possible. The results, which are explained in the next few pages, show that significant GHG reductions can be made with NEVs and BEVs before land use. The land use strategies are considered next in the VMT calculations and then the parking and mobility strategies are layered on top of the change.

The SSBS land use strategy focuses on densifying activities within a 1/8th mile radius around a major/major intersection creating a neighborhood center so that residents within a ½ mile radius can access an array of goods and services by walking or other modes. This shorten trips (trips that are commonly accessed outside of the neighborhood are now pulled into the neighborhood). Take the following schematic as an example. It illustrates the change in trip capture after land use implementation. Say that a household makes 10 trips a day. Before land use changes, the household makes 20% of their trips within a ½ mile of their home (trip capture) amounting to 2 trips. They make 50% of their trips within ½ to 3 miles. Thirty percent are made outside of the 3-mile shell. After land-use changes, this household now makes more trips to their neighborhood center and thus more trips within a ½ mile radius. These trips are pulled in from the outer shell. The new trip capture rates are 40% or 4 trips for the ½ mile radius. This is an increase of 2 trips from the pre-land use scenario. Fewer trips are now made in the ½ to 3-mile ring, a reduction of 2 trips. The number of trips outside the 3-mile shell remains the same at 30%. The effect of the land use

Hawthorne and Rosecrans Matching Center

Using Hawthorne and Rosecrans as an example, the first step is to identify what center or corridor is most like the intersection in terms of business density. Three prototypes are constructed from the land use study. The densities are not the same as the densities in Table 3, in the beginning of this report because they are adjusted to reflect similar radii. Because the corridors of Artesia and Hawthorne performed similarly, their data have been averaged.NEV and BEV strategies

1. (Lowest Density): Artesia/Hawthorne corridor: business density of 1.05 business per acre.
2. (Medium Density): El Segundo center: business density of 2.76 businesses per acre.
3. (High Density): Riviera Village center with a business density of 4.02 businesses per acre.

The intersection of Hawthorne and Rosecrans has a business density of 2.06 which is most like El Segundo's and so is given El Segundo's walking and trip capture rates as a baseline. The VMT reductions are calculated for Hawthorne and Rosecrans assuming the intersection achieves a business density of Riviera Village's through land use measures. In other words, the business density will double from 2 business per acre to 4. Figure 15 illustrates this process.

Hawthorne and Rosecrans Average Household VMT Reductions: ½ mile ring

The baseline trip capture for the Hawthorne and Rosecrans neighborhood center is the El Segundo center of 28%. As was explained in the text box above, trip capture is the percentage of trips made in a given area as a percentage of total trips made. With the introduction of land use, emissions related to trips within a ½ mile radius will increase because more trips are pulled in from trips that were previously taken outside of a ½ mile radius. VMT reductions for a ½ mile are under 1 percentage points for NEV and BEV strategies (.4% and .8%) before the land use strategies are realized, shown in Table 5. When given an NEV, an average household will replace Internal Combustion Engine (ICE) VMT with electric VMT by .4 percentage points and this is assumed to be a .4 percentage point reduction in GHG emissions. When given a BEV, an average household will replace ICE VMT with electric VMT by .8 percentage points and this is assumed to be a .8 percentage point reduction in GHG emissions. VMT increases with the land use strategies because more trips are pulled into the ½ mile ring (46% versus 28%) and so there is an increase in VMT by 1 percentage point. Parking strategies reduce VMT by 1.4 percentage points. These trips are assumed to be replaced with walking trips. After land use, NEV and BEV VMT capture are slightly higher than before land use because more trips occur within the ½ miler ring.

Hawthorne and Rosecrans Average Household VMT Reductions: ½ to 3-mile radius

Because more trips are pulled into the ½ mile ring after the land use strategy, fewer trips are made in the ½ to 3-mile radius. Here the baseline trip capture rate is 42% while the post land use scenario is 24%. Relatively large VMT emissions reductions occur for the ½ to 3-mile ring of 10.7 percentage points relative to the baseline. Here it is assumed that parking strategies shift trips to transit (or shared mobility etc.)

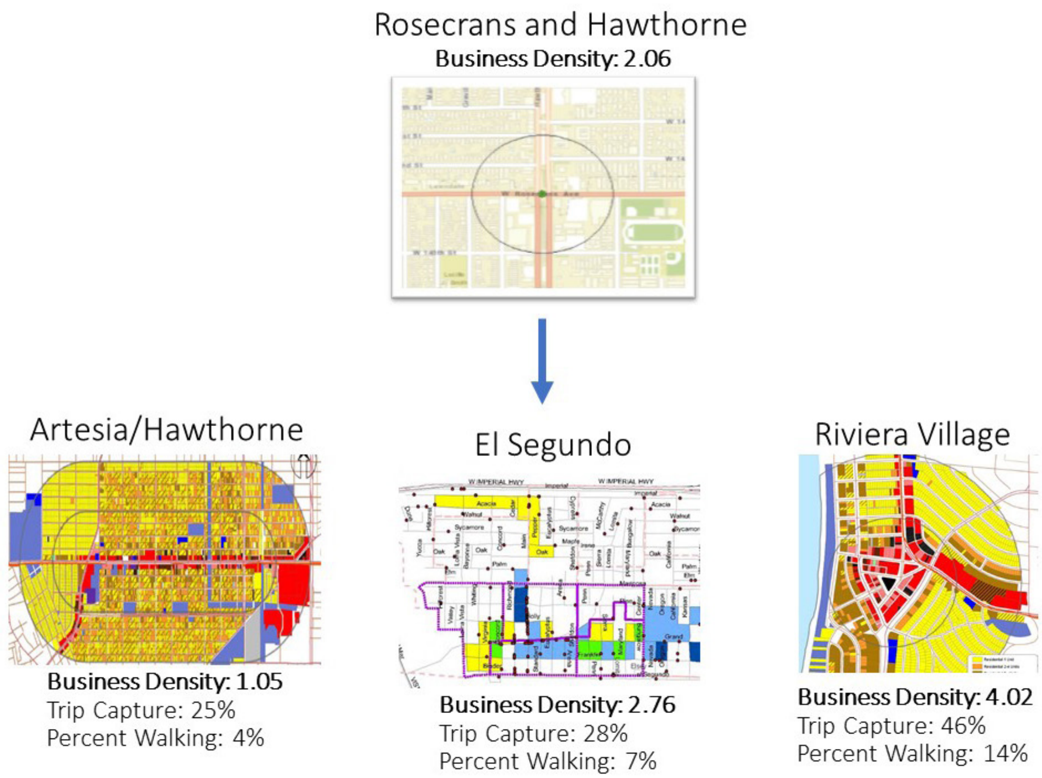



FIGURE 15: Schematic for assigning the El Segundo Center to the Hawthorne and Rosecrans Intersection

reducing VMT by 1.4 percentage points (fifth column). NEV and BEV strategies are smaller for this ring after land use than before land use, because they are replacing fewer trips.

The trip network effect of all centers was not calculated in the emissions methodology. Figure 16 shows some of the 41 concept centers and the 3-mile radius of centers around the Rosecrans and Hawthorne intersection. It is evident that within a 3-mile range, households surrounding the intersection, have an array of other centers nearby, increasing their overall access to a variety of goods and services if all centers were developed. Different centers have the potential to specialize in key goods and services.

Zero-emission vehicles including NEVs, BEVs and Bikes, provide clean access to nearby centers along with shuttles and ride-hailing/ride-sharing services.

Because the impact and interaction with other neighborhood centers (intersections) has not been quantified, the GHG reductions have been underestimated.

Hawthorne and Rosecrans Average Household VMT Reductions: 3-10 miles and Over 10 miles

The SSBS concept emphasizes work-related strategies namely in the form of increased telecommuting and flexible work schedules, so work trips have been separated from other trips outside of a 3-mile range.

The BEV and NEV data (from the BEV and NEV studies) indicate that the average household makes 4.6% of total trips to work within 3 to 10 miles and 15% of total trips for other

| | | W/ out Land Use | NEV W/ out Land Use | BEV W/ out Land Use | Land Use (RV Inner) | Parking w/ LU | NEV w/ LU | BEV w/ LU |
|---|---|---|---|---|---|---|---|---|
| | | | | | **Hawthorne Rosecrans** | | | |
| **1/2 Miles** | Capture | 28% | 28% | 28% | 46% | 46% | 46% | 46% |
| | Transit | 7.0% | 7.0% | 7.0% | 14.0% | 17.0% | 17% | 17% |
| | ICE Trips | 21.0% | 17.0% | 12.6% | 32% | 29% | 23% | 17% |
| | ICE VMT | **2.0%** | **1.6%** | **1.2%** | **3.0%** | **1.6%** | **2.2%** | **1.7%** |
| | **Reduction** | | **0.4%** | **0.8%** | **-1.0%** | **1.4%** | **0.8%** | **1.4%** |
| *Percent Indicates Percentage Point Reduction from Baseline* | | | | | | | | |

TABLE 5 1/2-mile Household VMT Reductions for Hawthorne and Rosecrans

| | | W/ out Land Use | NEV W/ out Land Use | BEV W/ out Land Use | Land Use (RV Inner) | Parking w/ LU | NEV w/ LU | BEV w/ LU |
|---|---|---|---|---|---|---|---|---|
| | | | | | **Hawthorne Rosecrans** | | | |
| **1/2 to 3 Miles** | Capture | 42% | 42% | 42% | 24% | 24% | 24% | 24% |
| | Transit | | | | | 2% | | |
| | ICE Trips | 42% | 34% | 25% | 24% | 22% | 19% | 14% |
| | ICE VMT | **25%** | **20%** | **15%** | **14%** | **13%** | **12%** | **9%** |
| | **Reduction** | | **4.8%** | **10.0%** | **10.7%** | **1.4%** | **2.7%** | **5.7%** |
| *Percent Indicates Percentage Point Reduction from Baseline* | | | | | | | | |

TABLE 6: Household Daily VMT Reductions for Hawthorne and Rosecrans 1/2 to 3 miles

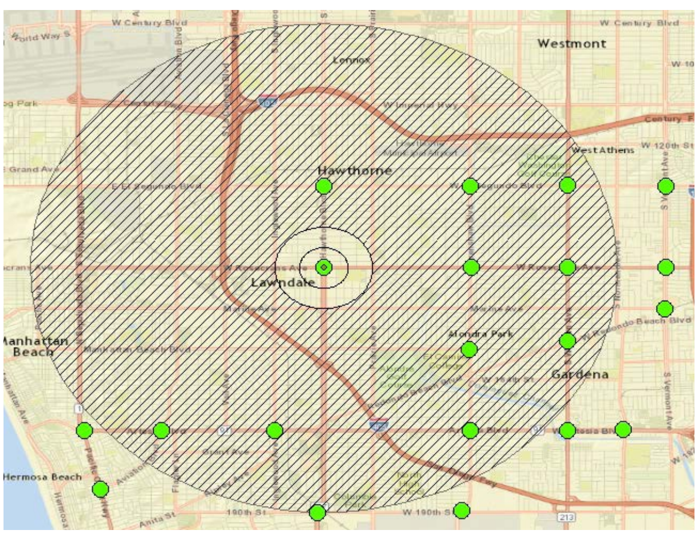



FIGURE 16: 3-mile radius superimposed on Intersection Network

activities within 3 to 10 miles. These numbers serve as the baseline when no strategies are incorporated.

From 3 to 10 miles, 4.6% of household trips are made to work and 15.4% to non-work activities. While percentages of trips captured in the outer rings begin to fall, the percentage of VMT devoted to longer distance travel increases. 27% of average VMT occurs under 3 miles, 36% of within the 3 to 10-mile range and another 36% over 10 miles. So, while 70% of trips are made under a 3-mile range, a little over 70% of VMT occurs outside of a 3-mile range. Addressing VMT within this range is critical to reducing GHG emissions.

SSBS Land use strategies, apart from the network effect, cease to affect trips outside of a 3-mile range. The Hawthorne and Rosecrans intersection along with the other centers will see the same rate of GHG reductions for over 3 miles as the baseline is the same for all households outside a 3-mile range.

| | | W/ out mobility strategies | Parking (Carpooling) | Parking (Transit) | NEV | BEV | Telecommuting |
|---|---|---|---|---|---|---|---|
| | | | **Hawthorne Rosecrans** | | | | |
| **3 to 10 miles (work)** | Capture | 4.6% | 4.6% | 4.6% | 4.6% | 4.6% | 4.6% |
| | Transit Trips | 0.2% | | | | | |
| | Mobility | | 2.3% | | | | |
| | ICE Trips | 4.4% | 2.3% | 0.0% | 3.5% | 2.6% | 0% |
| | ICE VMT | **8.3%** | **4.4%** | **0.0%** | **6.7%** | **5.0%** | **0.0%** |
| | **Reduction** | | **3.9%** | **8.3%** | **1.6%** | **3.3%** | **8.3%** |
| | | | | | | | |
| **3 to 10 miles (Other)** | Capture | 15% | | | 15% | 15% | |
| | Transit Trips | 0.8% | | | | | |
| | Mobility | | | | | | |
| | ICE Trips | 14.6% | | | 12.5% | 9.2% | |
| | ICE VMT | 27.7% | | | 23.6% | 17.5% | |
| | **Reduction** | | | | **4.1%** | **10.2%** | |
| | | | | | | | |
| **Over 10 miles (work)** | Capture | 2.6% | 2.6% | 2.6% | | 2.6% | 2.6% |
| | Transit | 0.2% | | 2.6% | | | |
| | Shared | | 1.3% | | | | |
| | ICE Trips | 2.5% | 1.3% | 0.0% | | 1.6% | |
| | ICE VMT | 10.4% | 5.5% | 0.0% | | 6.6% | 0.0% |
| | **Reduction** | | **4.9%** | **10.4%** | | **3.8%** | **10.4%** |
| | | | | | | | |
| **Over 10 Miles (Other)** | Capture | 6% | | | | 6% | |
| | Transit | 0.4% | | | | | |
| | Shared | | | | | | |
| | ICE Trios | 6% | | | | 4% | |
| | ICE VMT | 26% | | | | 17% | |
| | **Reduction** | | | | | **9.5%** | |

*Percent Indicates Percentage Point Reduction from Baseline*

TABLE 7: Household Daily VMT Reductions for Hawthorne and Rosecrans 1/2 to 3 miles

Over 10-mile trips constitute 36.4% of an average household's VMT. The average South Bay household makes 2.6% of trips for work over 10 miles and 6% of other trips over 10 miles.

Reductions are calculated for strategies related to work: telecommuting which assumes a 100% replacement of ICE VMT related to work and parking strategies which promote carpooling (50% reduction of work-related ICE VMT) and transit (100% of work-related ICE VMT) as well as electric vehicles. Only BEVs are considered over 10 miles. Percentage of households telecommuting, and number of days worked as well as percentage of households affected by workplace strategies are taken into consideration when computing the

| **Without Land Use** | **1/2 mile** | **1/2 to 3 miles** | **3 to 10 miles** | **Over 10 miles** | **Total** |
|---|---|---|---|---|---|
| **NEV w/ out Land Use** | 0.4% | 5.0% | 5.5% | | **10.9%** |
| **BEV w/ out Land Use** | 0.8% | 10.3% | 7.6% | 13.3% | **31.9%** |
| **Parking (Carpooling)** | | | 3.9% | 4.9% | **8.8%** |
| **Parking (Transit)** | | | 8.3% | 10.4% | **18.7%** |
| **Telecommuting** | | | 8.3% | 10.4% | **18.7%** |

| **With Land Use** | **1/2 mile** | **1/2 to 3 miles** | **3 to 10 miles** | **Over 10 miles** | **Total** |
|---|---|---|---|---|---|
| **Land Use (RV Inner)** | -1.0% | 10.7% | | | **9.7%** |
| **Parking w/ LU** | 1.4% | 1.4% | | | **2.9%** |
| **NEV W/ LU** | 0.8% | 2.7% | 5.5% | | **9.0%** |
| **BEV W/ LU** | 1.4% | 5.7% | 7.6% | 13.3% | **28.0%** |
| **Parking (Carpooling)** | | | 3.9% | 4.9% | **8.8%** |
| **Parking (Transit)** | | | 8.3% | 10.4% | **18.7%** |
| **Telecommuting** | | | 8.3% | 10.4% | **18.7%** |

*Percent Indicates Percentage Point Reduction from Baseline*

TABLE 8: Hawthorne and Rosecrans Average Household Percentage Point VMT Reduction Summary

**Neighborhood Households: 7,449**

| **Without Land Use** | **Total Daily Emissions** | **Percent of HH** | **Total HH Affected** |
|---|---|---|---|
| **NEV w/ out Land Use** | 11% | 1% | 74 |
| **BEV w/ out Land Use** | 32% | 1% | 74 |
| **Parking (Carpooling)** | 9% | 5% | 391 |
| **Parking (Transit)** | 19% | 9% | 633 |
| **Telecommuting** | 19% | 25% | 1,862 |
| **With Land Use** | | | |
| **Land Use (RV Inner)** | 10% | 100% | 7,449 |
| **Parking w/ LU** | 3% | 100% | 7,449 |
| **NEV w/ LU** | 9% | 1% | 74 |
| **BEV w/ LU** | 28% | 1% | 74 |
| **Parking (Carpooling)** | 9% | 5% | 372 |
| **Parking (Transit)** | 19% | 9% | 670 |
| **Telecommuting** | 19% | 25% | 1,862 |

*Percent Indicates Percentage Point Reduction from Baseline*

TABLE 9: Strategy Effect Sizes for Hawthorne and Rosecrans

total neighborhood GHG reductions. Here total possible daily reductions are considered.

Hawthorne and Rosecrans Average Household VMT Reduction Summary

Table 8 summarizes the average per-household daily VMT reductions for Hawthorne and Rosecrans. The strategies with the largest effect are the BEV strategies, 31.9 percentage points without land use and 28 percentage points after land use. The percentage points fall slightly after land use because overall trips are shortened when land use strategies are implemented. If a household adopts telecommuting, it is assumed that VMT related to work is eliminated for that day, accounting for a 18.7 percentage point reduction. If a household takes transit to work the same percentage point reduction in VMT is realized. If the household carpools to work, half this reduction is realized. Upon implementation of land use, it is calculated that an average household will reduce their VMT by 9.7 percentage (land use) points and the 2.9% (parking).

The totals do not indicate that if all policies are adopted a household would realize the sum of the reduction. For example, the total reductions for the without land use scenario equals to 89, but impossible for a household to realize under these scenarios. A household could drive both an NEV and a BEV for a total reduction of 42.8 percentage points, but a household would have to telecommute every day in order to see the full 18.7 percentage point reduction and the carpooling and transit reductions would not apply. Conversely, if a household were to carpool, they would not see the transit or telecommuting reduction. Only one of the workplace strategies can be applied to the household or a combination. These distinctions are applied to the total neighborhood reductions in the following section. In the following section assumptions about the total number of households affected by each strategy is applied. For example, a number of households are assumed to be affected by NEV strategies and these are separated from the households that are assumed to be affected by BEV strategies.

Hawthorne and Rosecrans Total Neighborhood GHG Reductions

The next step in the GHG reductions calculations is to apply the individual household reductions above to the number of households in the neighborhood affected by each strategy. All assumptions can be easily modified in the model and the model can be run on a variety of scenarios. The following assumptions are made:

1. The land use and parking strategies affect all households within a ½ mile. For Hawthorne and Rosecrans this amounts to 7,449 households.
2. A NEV and BEV penetration rate (adoption rate) is set at 1% of total population, so within a 1/2-mile ring, 74 households will own a NEV and BEV. This assumption was arbitrarily made and is conservative. It was based on the low adoption rates of EVs seen today and can be readily adjusted upon new information and new trends as well as successfully strategy implementation.
3. In terms of telecommuting, many flexible assumptions are made. The first assumption is that 25% of households are able to telecommute which is a conservative estimate given than most jobs have some sort of digital task that can be completed at home.[28]
   However, getting 25% of the workforce to telecommute is a much more challenging objective, therefore VMT reductions are calculated for this population working only one day a week from home so that the average trip and resulting GHG emissions reduction is low.
4. 25% of households will be affected by workplace parking strategies. Studies reveal that when workplace parking is implemented, 21% of workers carpool, 34% take transit and the rest drive alone.[29]

Table 9 shows the number of households affected by each strategy. The reason the Land Use and Parking strategies are so powerful is that they potentially affect all residents within walking distance. In the case of Hawthorne and Rosecrans this would be 7,449 residents whereas the NEV and BEV strategies only affect 1% of the population (based on the arbitrary assumption) for a total of around 74 households. NEV and BEV strategies can be powerful the more households they affect, especially in conjunction with land use and parking strategies.

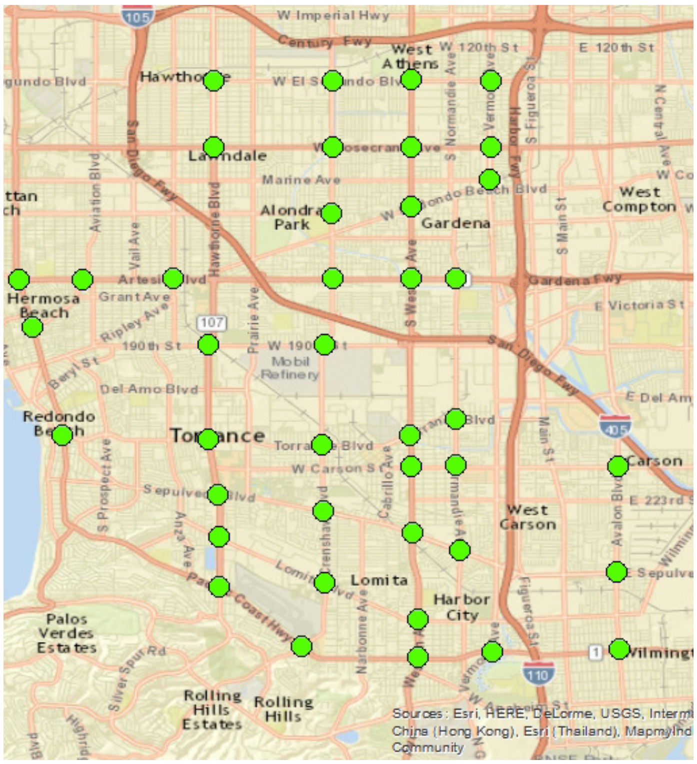
The total emissions reductions for the Hawthorne and Rosecrans neighborhood are 3.4% (transportation-related emissions) before land use strategies and 15.8% after land use. These totals are calculated by taking the total population of 7,449 households and multiplying it times an daily average household VMT (assuming ICE VMT which is gasoline fueled VMT) to produce neighborhood VMT. VMT reductions are calculated for each strategy by the number of households affected. The reduction is then summed and subtracted from the total neighborhood VMT to determine the percent reduction. Telecommuting reductions are calculated as a fraction of a day. Some strategies eliminate the trip while others shift the fuel source of the trip and is considered as eliminated VMT, but both are considered to reduce GHG emissions equally. An example neighborhood reduction calculation is provided in the Appendix.

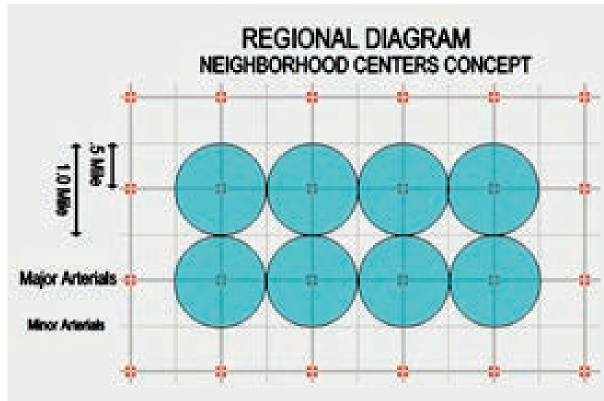
## SOUTH BAY REGION CALCULATIONS

Identification of Potential 41 Neighborhood Centers

41 major/major intersections (the intersection of 2 major arterials) were selected in the South Bay to serve as potential neighborhood centers. For this Regional Climate Action Plan (CAP), 41 sites have been selected as ideal because major buildings, businesses, highways, or open space do not obstruct the four corners of the major/major intersections. While some of the concept centers are in Redondo Beach and Hermosa Beach, much of the arterial networks of the beach cities and the peninsula cities are curvilinear and sloped requiring a slightly different neighborhood center approach which will be discussed in the Implementation Guide. Of the 41 sites, 16 are in Torrance, 9 in Gardena, 4 in Redondo Beach, 3 in Hawthorne, 2 in Carson, Harbor City, Hermosa Beach, and Lomita and 1 in Wilmington.

28. https://www.bls.gov/opub/btn/archive/where-people-worked-2003-to-2007.pdf
29. Shoup, D. (2005). Parking Cash Out. American Planning Association, Chicago.




| City | Count |
|---|---|
| Carson | 2 |
| Gardena | 9 |
| Harbor City, LA City | 2 |
| Hawthorne | 3 |
| Hermosa Beach | 2 |
| Lomita | 2 |
| Redondo Beach | 4 |
| Torrance | 16 |
| Wilmington, LA city | 1 |
| **Grand Total** | **41** |

The 41 Neighborhoods for the South Bay
Table 10 lists the 41 centers, their intersections, and city. For each potential center, 2 statistics are considered:

1. Business Density as calculated by total number of businesses within a 1/8th mile radius of the midpoint of the intersection divided by 31 acres (acres within a ¼ mile radius).
2. Number of households within a ½ mile radius of the intersection.

As can be seen, the centers range in numbers of businesses and households. Hawthorne/Torrance has a high number of businesses per acre at 8.42. On the lower range are the intersections in Harbor City, LA with only 1 or 2 businesses. The average business density for all intersections is around 2. An average of 4,794 households live within 1/2 mile.

In Table 11, each of the 41 intersections is given its corresponding study area as a baseline. Twenty-two of the intersections match with the business densities of the Artesia/Hawthorne corridors, 16 of the intersections match with El Segundo's, and 3 match with Riviera Village.

| Intersection | City | Businesses 1/8th Mile Total | Businesses 1/8th Mile Density/Acre | Households 1/2 mile |
|---|---|---|---|---|
| Artesia and Aviation | Redondo Beach | 66 | 2.13 | 6,263 |
| Artesia and Inglewood | Redondo Beach | 57 | 1.84 | 5,312 |
| Avalon and Carson | Carson | 30 | 0.97 | 2,759 |
| Avalon and PCH | Wilmington, LA City | 48 | 1.55 | 3,705 |
| Avalon and Sepulveda | Carson | 20 | 0.65 | 3,552 |
| Crenshaw and 190th | Torrance | 24 | 0.77 | 1,034 |
| Crenshaw and Artesia | Torrance | 65 | 2.10 | 3,977 |
| Crenshaw and El Segundo | Hawthorne | 35 | 1.13 | 1,450 |
| Crenshaw and Lomita | Lomita | 59 | 1.90 | 2,996 |
| Crenshaw and Manhattan B.B. | Gardena | 8 | 0.26 | 3,286 |
| Crenshaw and Sepulveda | Torrance | 112 | 3.61 | 4,205 |
| Crenshaw and Torrance | Torrance | 81 | 2.61 | 3,990 |
| Crenshaw Rosecrans | Gardena | 33 | 1.06 | 7,410 |
| Hawthorne and 190th | Redondo Beach | 64 | 2.06 | 7,031 |
| Hawthorne and El Segundo | Hawthorne | 71 | 2.29 | 6,578 |
| Hawthorne and Lomita | Torrance | 91 | 2.94 | 6,518 |
| Hawthorne and Rosecrans | Hawthorne | 64 | 2.06 | 7,449 |
| Hawthorne and Sepulveda | Torrance | 108 | 3.48 | 4,210 |
| Hawthorne and Torrance | Torrance | 261 | 8.42 | 5,350 |
| Normandie and Artesia | Gardena | 36 | 1.16 | 3,766 |
| Normandie and Carson | Torrance | 22 | 0.71 | 6,406 |
| Normandie and Sepulveda | Torrance | 44 | 1.42 | 5,039 |
| Normandie and Torrance | Torrance | 12 | 0.39 | 5,237 |
| PCH and Artesia | Hermosa Beach | 98 | 3.16 | 5,747 |
| PCH and Aviation | Hermosa Beach | 86 | 2.77 | 8,399 |
| PCH and Crenshaw | Torrance | 53 | 1.71 | 3,107 |
| PCH and Hawthorne | Torrance | 71 | 2.29 | 4,678 |
| PCH and Torrance | Redondo Beach | 79 | 2.55 | 6,862 |
| PCH and Vermont | Harbor City, LA City | 7 | 0.23 | 3,547 |
| PCH and Western | Harbor City, LA City | 2 | 0.06 | 7,183 |
| Vermont and El Segundo | Gardena | 2 | 0.06 | 3,451 |
| Vermont and Marine | Gardena | 22 | 0.71 | 5,701 |
| Vermont and Rosecrans | Gardena | 32 | 1.03 | 4,744 |
| Western and Artesia | Torrance | 43 | 1.39 | 3,884 |
| Western and Carson | Torrance | 59 | 1.90 | 5,646 |
| Western and El Segundo | Gardena | 5 | 0.16 | 1,907 |
| Western and Lomita | Lomita | 5 | 0.16 | 6,046 |
| Western and Redondo B.B. | Gardena | 56 | 1.81 | 4,256 |
| Western and Rosecrans | Gardena | 38 | 1.23 | 3,353 |
| Western and Sepulveda | Torrance | 17 | 0.55 | 5,566 |
| Western and Torrance | Torrance | 56 | 1.81 | 4,952 |

TABLE 10: Demographic and Business Data for the 41 intersections

| Intersection | City | Total | Density/Acre | Similar Study Center |
|---|---|---|---|---|
| Artesia and Aviation | Redondo Beach | 66 | 2.13 | El Segundo |
| Artesia and Inglewood | Redondo Beach | 57 | 1.84 | El Segundo |
| Avalon and Carson | Carson | 30 | 0.97 | Artesia/Hawthorne |
| Avalon and PCH | Wilmington, LA City | 48 | 1.55 | Artesia/Hawthorne |
| Avalon and Sepulveda | Carson | 20 | 0.65 | Artesia/Hawthorne |
| Crenshaw and 190th | Torrance | 24 | 0.77 | Artesia/Hawthorne |
| Crenshaw and Artesia | Torrance | 65 | 2.10 | El Segundo |
| Crenshaw and El Segundo | Hawthorne | 35 | 1.13 | Artesia/Hawthorne |
| Crenshaw and Lomita | Lomita | 59 | 1.90 | El Segundo |
| Crenshaw and Manhattan B.B. | Gardena | 8 | 0.26 | Artesia/Hawthorne |
| Crenshaw and Sepulveda | Torrance | 112 | 3.61 | Riviera Village |
| Crenshaw and Torrance | Torrance | 81 | 2.61 | El Segundo |
| Crenshaw Rosecrans | Gardena | 33 | 1.06 | Artesia/Hawthorne |
| Hawthorne and 190th | Redondo Beach | 64 | 2.06 | El Segundo |
| Hawthorne and El Segundo | Hawthorne | 71 | 2.29 | El Segundo |
| Hawthorne and Lomita | Torrance | 91 | 2.94 | El Segundo |
| Hawthorne and Rosecrans | Hawthorne | 64 | 2.06 | El Segundo |
| Hawthorne and Sepulveda | Torrance | 108 | 3.48 | Riviera Village |
| Hawthorne and Torrance | Torrance | 261 | 8.42 | Riviera Village |
| Normandie and Artesia | Gardena | 36 | 1.16 | Artesia/Hawthorne |
| Normandie and Carson | Torrance | 22 | 0.71 | Artesia/Hawthorne |
| Normandie and Sepulveda | Torrance | 44 | 1.42 | Artesia/Hawthorne |
| Normandie and Torrance | Torrance | 12 | 0.39 | Artesia/Hawthorne |
| PCH and Artesia | Hermosa Beach | 98 | 3.16 | El Segundo |
| PCH and Aviation | Hermosa Beach | 86 | 2.77 | El Segundo |
| PCH and Crenshaw | Torrance | 53 | 1.71 | Artesia/Hawthorne |
| PCH and Hawthorne | Torrance | 71 | 2.29 | El Segundo |
| PCH and Torrance | Redondo Beach | 79 | 2.55 | El Segundo |
| PCH and Vermont | Harbor City, LA City | 7 | 0.23 | Artesia/Hawthorne |
| PCH and Western | Harbor City, LA City | 2 | 0.06 | Artesia/Hawthorne |
| Vermont and El Segundo | Gardena | 2 | 0.06 | Artesia/Hawthorne |
| Vermont and Marine | Gardena | 22 | 0.71 | Artesia/Hawthorne |
| Vermont and Rosecrans | Gardena | 32 | 1.03 | Artesia/Hawthorne |
| Western and Artesia | Torrance | 43 | 1.39 | Artesia/Hawthorne |
| Western and Carson | Torrance | 59 | 1.90 | El Segundo |
| Western and El Segundo | Gardena | 5 | 0.16 | Artesia/Hawthorne |
| Western and Lomita | Lomita | 5 | 0.16 | Artesia/Hawthorne |
| Western and Redondo B.B. | Gardena | 56 | 1.81 | El Segundo |
| Western and Rosecrans | Gardena | 38 | 1.23 | Artesia/Hawthorne |
| Western and Sepulveda | Torrance | 17 | 0.55 | Artesia/Hawthorne |
| Western and Torrance | Torrance | 56 | 1.81 | El Segundo |

TABLE 11: The Assignment of Centers and Corridors to the 41 Intersections

| | | Land Use Strategy | | Emissions Reductions | | |
|---|---|---|---|---|---|---|
| | | | | No Actions | With Actions | |
| **Intersection** | **City** | **Baseline** | **Change** | **Baseline** | **Pre LU** | **Post LU** |
| Artesia and Aviation | Redondo Beach | El Segundo | Riviera Village | 0% | 3.40% | 15.80% |
| Artesia and Inglewood | Redondo Beach | El Segundo | Riviera Village | 0% | 3.40% | 15.80% |
| Avalon and Carson | Carson | Artesia/Hawthorne | Riviera Village | 0% | 3.40% | 16.80% |
| Avalon and PCH | Wilmington | Artesia/Hawthorne | Riviera Village | 0% | 3.40% | 16.80% |
| Avalon and Sepulveda | Carson | Artesia/Hawthorne | Riviera Village | 0% | 3.40% | 16.80% |
| Crenshaw and 190th | Torrance | Artesia/Hawthorne | Riviera Village | 0% | 3.40% | 16.80% |
| Crenshaw and Artesia | Torrance | El Segundo | Riviera Village | 0% | 3.40% | 15.80% |
| Crenshaw and El Segundo | Hawthorne | Artesia/Hawthorne | Riviera Village | 0% | 3.40% | 16.80% |
| Crenshaw and Lomita | Lomita | El Segundo | Riviera Village | 0% | 3.40% | 15.80% |
| Crenshaw and Manhattan BB | Gardena | Artesia/Hawthorne | Riviera Village | 0% | 3.40% | 16.80% |
| Crenshaw and Sepulveda | Torrance | Riviera Village | Same | 0% | 3.40% | |
| Crenshaw and Torrance | Torrance | El Segundo | Riviera Village | 0% | 3.40% | 15.80% |
| Crenshaw Rosecrans | Gardena | Artesia/Hawthorne | Riviera Village | 0% | 3.40% | 16.80% |
| Hawthorne and 190th | Redondo Beach | El Segundo | Riviera Village | 0% | 3.40% | 15.80% |
| Hawthorne and El Segundo | Hawthorne | El Segundo | Riviera Village | 0% | 3.40% | 15.80% |
| Hawthorne and Lomita | Torrance | El Segundo | Riviera Village | 0% | 3.40% | 15.80% |
| Hawthorne and Rosecrans | Hawthorne | El Segundo | Riviera Village | 0% | 3.40% | 15.80% |
| Hawthorne and Sepulveda | Torrance | Riviera Village | Same | 0% | 3.40% | |
| Hawthorne and Torrance | Torrance | Riviera Village | Same | 0% | 3.40% | |
| Normandie and Artesia | Gardena | Artesia/Hawthorne | Riviera Village | 0% | 3.40% | 16.80% |
| Normandie and Carson | Torrance | Artesia/Hawthorne | Riviera Village | 0% | 3.40% | 16.80% |
| Normandie and Sepulveda | Torrance | Artesia/Hawthorne | Riviera Village | 0% | 3.40% | 16.80% |
| Normandie and Torrance | Torrance | Artesia/Hawthorne | Riviera Village | 0% | 3.40% | 16.80% |
| PCH and Artesia | Hermosa Beach | El Segundo | Riviera Village | 0% | 3.40% | 15.80% |
| PCH and Aviation | Hermosa Beach | El Segundo | Riviera Village | 0% | 3.40% | 15.80% |
| PCH and Crenshaw | Torrance | Artesia/Hawthorne | Riviera Village | 0% | 3.40% | 16.80% |
| PCH and Hawthorne | Torrance | El Segundo | Riviera Village | 0% | 3.40% | 15.80% |
| PCH and Torrance | Redondo Beach | El Segundo | Riviera Village | 0% | 3.40% | 15.80% |
| PCH and Vermont | Harbor City | Artesia/Hawthorne | Riviera Village | 0% | 3.40% | 16.80% |
| PCH and Western | Harbor City | Artesia/Hawthorne | Riviera Village | 0% | 3.40% | 16.80% |
| Vermont and El Segundo | Gardena | Artesia/Hawthorne | Riviera Village | 0% | 3.40% | 16.80% |
| Vermont and Marine | Gardena | Artesia/Hawthorne | Riviera Village | 0% | 3.40% | 16.80% |
| Vermont and Rosecrans | Gardena | Artesia/Hawthorne | Riviera Village | 0% | 3.40% | 16.80% |
| Western and Artesia | Torrance | Artesia/Hawthorne | Riviera Village | 0% | 3.40% | 16.80% |
| Western and Carson | Torrance | El Segundo | Riviera Village | 0% | 3.40% | 15.80% |
| Western and El Segundo | Gardena | Artesia/Hawthorne | Riviera Village | 0% | 3.40% | 16.80% |
| Western and Lomita | Lomita | Artesia/Hawthorne | Riviera Village | 0% | 3.40% | 16.80% |
| Western and Redondo BB | Gardena | El Segundo | Riviera Village | 0% | 3.40% | 15.80% |
| Western and Rosecrans | Gardena | Artesia/Hawthorne | Riviera Village | 0% | 3.40% | 16.80% |
| Western and Sepulveda | Torrance | Artesia/Hawthorne | Riviera Village | 0% | 3.40% | 16.80% |
| Western and Torrance | Torrance | El Segundo | Riviera Village | 0% | 3.40% | 15.80% |

TABLE 12: Emissions Reductions for 41 Neighborhood Centers

The average business densities of the intersections are at 2 business per acre, which means around 62 businesses within a 1/8th mile radius (30 acres). Many of the intersections have very low densities and practically no businesses to offer their surrounding residents. These intersections would particularly benefit from the land use strategies in enhancing accessibility and walkability for the nearby residents. If an intersection has a density near Riviera Village, the land use strategy walking and capture rates are not applied. Only 3 of the 41 intersections have high business densities: Crenshaw/ Sepulveda (3.61); Hawthorne/Sepulveda (3.48); and Hawthorne/Torrance (8.42).

Total GHG Emission Reductions for the 41 centers Table In order to meet the reductions for each of the strategies, cities and the COG must take actions to realize emissions gains. For example, cities and the COG can take actions to incentivize the purchase of EVs and to incentivize greater business density and the creation of neighborhood centers. These are discussed in depth in the Implementation Guide.

Table 12 lists the emissions reductions for the 41 intersections including the baseline (zero reductions when no actions are taken by cities or the COG); pre land-use (before land use changes take effect, only considering electric vehicle actions and workplace actions); and post land-use (when land use changes take effect and including electric vehicle and workplace actions). For all intersections the pre-land use reduction is 3.4% because the reductions are applied the same across all households as the baseline is the same (zero actions). Intersections that have lower business densities, where Artesia is the baseline, see higher overall reductions of 16.8%, one percentage point above El Segundo's baseline. For intersections where the business densities match Riviera Village's, they do not see a land-use reduction.

In terms of the region, 202,684 households live within the catchment area of the 41 intersections accounting for over 50% of South Bay households (384,183). 92,133 households see GHG reductions of 16.8%; 90,654 see reductions of 15.8%; and 19,897 see reductions of 3.4%. This results in the 202,684 households seeing an average GHG emissions reduction of 15%. Because only 41 intersections have been explored, larger GHG reductions can be met when the methodology is applied to more areas throughout the South Bay.

The final table, Table 13, lists the reduction potential for different scenarios of NEV, BEV and telecommuting penetrations/ ownership rates. Shaded areas represent the assumptions made for the regional calculations. More aggressive EV strategies, that increase EV ownership, can further decrease emissions. For example, if 30% of households own an NEV and BEV, emissions decrease by an additional 7%. These reductions would increase even more if households began to acquire more than one electric vehicle. Emissions related to telecommuting can also increase if a larger percentage of workers (more than 25%) can telecommute one or more days which seems to be the case as from workplace data from the bureau of labor statistics.[30] The table demonstrates the potential of the tool to test various assumptions.

| | Percent of Neighborhood | Additional | Total |
|---|---|---|---|
| NEV/BEV | 1% | 0.4% | 16.8% |
| | 10% | 2.1% | 18.9% |
| | 20% | 4.6% | 21.4% |
| | 30% | 7.0% | 23.8% |
| | 40% | 9.5% | 26.3% |
| | 50% | 11.9% | 28.7% |
| Telecommuting | 25% 1 day | 0.8% | 16.8% |
| | 25% 2 day | 0.7% | 17.5% |
| | 25% 5 day | 5.7% | 22.5% |
| | 50% 1 day | 0.9% | 17.7% |
| | 50% 2 day | 1.6% | 18.4% |
| | 50% 5 day | 10.3% | 27.1% |

TABLE 13: Neighborhood Emissions Scenarios

30. https://www.bls.gov/opub/btn/archive/where-people-worked-2003-to-2007.pdf

## CONCLUSION

The work presented here is a movement towards providing evidence-based, emissions reductions methodologies for new, flexible transportation and land use strategies that can be applied for any neighborhood across California. This report has presented a new paradigm for planning in built-out suburbs to increase mobility, provide enhanced neighborhood services, and decrease emissions.

The Sustainable South Bay Strategies (SSBS) incorporate land use strategies that bring goods and services closer to households, equitably throughout cities. This shifts household trips from driving to walking and ma¬kes overall household trips shorter. The shift in goods and services from underperforming auto-oriented arterials to compact centers opens up land to housing. These strategies equitably distribute resources throughout neighborhoods and communities rather than the corridor-specific investments that occur through constricted transit strategies. The land use strategies are complemented with mobility strategies in the form of electric vehicles, NEVs and BEVs, and workplace strategies such as telecommuting and parking.

The innovative emissions methodology presented here has demonstrated that neighborhoods can decrease their emissions by 15% or more when implementing the SSBS, this applies to over 50% of the households in the South Bay with full implementation of the neighborhood-oriented strategies. This is in large part because land use and parking regulations affect greater amounts of people (potentially all residents within given zone of influence). The more robust the entire network of neighborhood centers (major/major intersections), the larger the emission reductions because households will have even greater access to goods and services within shorter distances. This potential networking between neighborhoods was not assessed in the methodology and future work will attempt to factor in the network effect. Land use strategies are important because they affect the entire neighborhood population and strengthen access and placemaking.

The methodology is unique in that it considers how trips are made from the point of view of the household, using a nearby neighborhood center as the land use component. The robust South Bay dataset, collected over 15 years, reveals how trips and vehicle miles traveled (VMT) are made at the various modal boundaries. 70% of South Bay household trips are under 3 miles. This accounts for under 30% of household VMT. The reverse is true for distances over 3 miles. Over 70% of South Bay household VMT occurs over 3 miles, representing under 30% of household trips.

Addressing short trips is as necessary as addressing long ones. The neighborhood-oriented strategies focus on bringing more trips closer to the household through the creation of neighborhood centers and parking regulations. This makes trips shorter and increases walking which is the cleanest and healthiest mode available. Workplace practices such as telecommuting also draw in long distance trips closer to the home. Other long-distance trips are addressed through electric vehicles, bicycles, shared mobility, shuttles and transit.

The methodology has shown that electric vehicles are more effective the more households adopt them, which is intuitive. The modest assumption of a 1% household adoption rate is probably conservative, but reflects real-world realities: few households today own EVs relative to fuel-powered vehicles. Strategies to increase EV ownership can have substantial GHG impacts, and policy focus should be prioritized around making EVs affordable. Electric vehicle and workplace strategies are especially important when considering trips made over 3 miles as these trips comprise the bulk of a household's VMT (70%) and therefore GHG emissions. Electric vehicle and workplace strategies can reduce, eliminate, or change the fuel source of this VMT and be enhanced by the networking effect of neighborhood centers. Emissions begin to decrease even more substantially when households begin to own more than one electric vehicle. Policies that are oriented around decreasing the cost of EV ownership and increasing EV infrastructure, can have guaranteed effects of decreasing GHG emissions at a lower opportunity cost and increasing mobility if households begin to purchase electric vehicles at increasing rates. The average reductions were proven in the South Bay NEV and BEV studies.

Apart from demonstrating the GHG reduction effectiveness of the SSBS strategies, based on 15 years of local data, the methodology presented here holds value in several ways. The unit of analysis is the neighborhood from the perspective of a household. This approach provides an alternative to the commonly used Transportation Analysis Zone (TAZs) for GHG modeling, a unit which is often defined by an administrative or arbitrary boundary (usually dependent on census tracts) and not having to do with the actual travel behavior of the households within. The unit of analysis featured in the SSBS methodology and the radial shells surrounding the household show where and what type of travel is being made. For example, this level of organization allows household trips and VMT to be segregated by distance and trip type allowing for targeted strategies.

The data populating the SSBS model comes directly from household travel behavior within the South Bay based on over 40,000 local observed trips forming a rich database. Thus far, this is the most robust dataset used for GHG emissions Climate Action Plan modeling. Much emissions modelling relies on a few observations from transportation surveys conducted every decade or on studies conducted in areas that don't resemble the South Bay. The model itself is flexible as all assumptions (mode split and penetration rates) can be modified and adjusted with new information. The model is highly transparent and easy to follow which is often not the case with current travel behavior and emissions tools. It presents a real setting to evaluate the performance of plans and strategies to make sure areas are reaching the emission goals and targets they set.

Lastly, the innovative emissions methodology presented here provides an opportunity for increased flexibility in applications for State resources. For 2016, the California Climate Investments (CCI) & Greenhouse Gas Reduction Fund (GGRF) channeled $3.1 billion from California CAP and Trade funds to applicants throughout California. These applications were fundamentally contingent upon the ability to demonstrate reduced greenhouse gas emissions through 'California Air Resources Board (CARB) approved Quantification Methodologies'. Only projects that adopt traditional planning approaches were awarded funding as these are the only emissions methodologies approved and provided. The requirement effectively leaves out all projects that are not about increased density around rail or high-quality bus service, which excludes most projects in suburban neighborhoods. This is in large part due to the fact that there are no new CARB approved methodologies to meet other types of strategies and there has been a lack of continued research on transportation and land use strategies and resulting emissions reductions methodologies. It is important we develop methodologies that are cost-effective, result in emission reductions based on sound information, and are equitable.

This report presents the methodology for a first-generation tool. It is hoped that future generations of this tool will be developed with continued feedback and new data.

# RESEARCH AGENDA

The concepts and methodologies presented here need to be continually revised and updated with new data in order to project emissions reductions with the most accuracy. Future research should harness the advances in data and storage, particularly utilizing data from mobile devices (e.g. cell phones and activity trackers), sensors (arterial and freeway sensors; video cameras), GPS units placed in vehicles, and surveys both traditional and innovative (smart phone applications). The following lists some of the directions future research/grants can take:

1. Land Use
    a. Comprehensive study of the 41 intersections, their current goods and service composition and the travel around the intersections by mode. This travel would incorporate the surrounding households and visitors.
    b. Re-study of the 8 centers and corridors with the addition of new centers and corridors in the South Bay. This would update the study conducted from 2006 to 2009 and include the identification of new centers and corridors.
    c. Before and after studies of retail densification. The project would implement the SSBS strategies and conduct a before and after analysis of the effects on travel and modes.

2. Mobility
    a. Conduct additional NEV and BEV studies that combine the use of NEVs and BEVs. Provide households with access to one or more BEVs and or NEVs or a combination of the two. This would give the household a wider range of mobility options and assess how GHG emissions would be further reduced.
    b. Conduct walking and biking studies. Assess the current mode usage of walking and biking in the South Bay (e.g. how much is done, who does it and why?), but using the SSBS paradigm focusing on the access of goods and services complimented by infrastructure. Assess the current obstacles to both modes.

3. Flexible workplace options
    a. Asses the status of flexible workplace options within the South Bay. This would include a large-scale survey of South Bay residents and Employers within the South Bay. Assessment of the current limitations and obstacles to remote work. Assessment of the feasibility of work portals in Neighborhood Centers.

4. Modeling
    a. Creation of a tool that cities and other entities can work with in scenario planning
    b. Apply the methodology to city and regional scales
    c. Incorporate socioeconomic factors
    d. Incorporate network effects of neighborhood centers

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# APPENDIX C

## NEIGHBORHOOD-ORIENTED METHODOLOGY

The neighborhood-oriented emissions methodology centers on four sets of strategies:

1. NEV and BEV strategies
2. Land-use strategies (neighborhood-oriented design NOD)
3. Parking layered onto land use
4. Workplace strategies: Telecommuting, Parking (Carpooling and Transit)

These strategies are applied to the following geographies:

1. A ½-mile distance ring
2. A ½ to 3-mile distance ring
3. A 3 to 10-mile distance ring

4v. An over 10-mile distance ring

The NEV/BEV strategies are applied to all the distance categories. The land/use and layered parking strategies are applied to the 1/2 -mile and ½ to 3-mile distance rings only because the land use strategies affect walking and walking does not generally occur outside a ½-mile ring. It is assumed the land use strategies pull in trips into the 1/2 -mile ring from the ½ to 3-mile ring. Workplace practices are applied to the 3 to 10-mile and over 10-mile rings.

## BASELINE DATA

Eight centers/corridors were studied in the COGs Land Use study. As will be described, the retail density was the largest influencing factor in determined how many walking trips were made. 41 major/major intersections (the intersections of two major arterials) were identified in the South Bay to serve as potential neighborhood centers for the Climate Action Plan. These sites were selected because major buildings, businesses, highways, or open spaces do not obstruct the four corners of the intersections. They were matched with the one of the following 3 study centers based on their density per acre, Table 1: 1) low density (Artesia/Hawthorne – the average of the two study centers), 2) average density (El Segundo), and 3) high density (Rivera Village). Only three of the 41 centers have a density near or above Rivera Village. In these cases, the land use strategy is not applied.
Average South Bay Household Trip Capture and VMT are presented for the distance categories in Table 4. Trip Generation or Trip Capture is defined as the percentage

| | Trip Generation (Trip Capture) | Walking Trips | VMT | Source |
|---|---|---|---|---|
| **½ Mile Radius** | | | | |
| Artesia/Hawthorne Corridors | 25% | 4% | 2% | Trip Capture: Land Use Study[31] VMT: BEV/NEV Data[32] |
| El Segundo | 28% | 7% | 2% | Land Use Study and BEV/NEV Data |
| Riviera Village | 46% | | 2% | Land Use Study and BEV/NEV Data |
| **½ Mile to 3 Mile Radius** | | | | |
| Artesia/Hawthorne | 46% | | 25% | Land Use Data and BEV/NEV Data |
| El Segundo | 43% | | 25% | Land Use Study and BEV/NEV Data |
| Riviera Village | 24% | | 25% | Land Use Study and BEV/NEV Data |
| **3 to 10 Miles Work** | 4.6% | | 8.3% | BEV/NEV Data |
| **3 to 10 Miles Other** | 15.4% | | 28% | BEV/NEV Data |
| **Over 10 Miles Work** | 2.6% | | 10.4% | BEV/NEV Data |
| **Over 10 Miles Other** | 6.4% | | 26% | BEV/NEV Data |

TABLE 14: Baseline Trip Generation and VMT Data by Geography

31. http://www.southbaycities.org/programs/land-use/south-bay-sustainable-strategy-integrated-land-use-and-transportation-strategy
32. Siembab, W., Rhoads, M., and Baum, A. (2015). “Drive the Future: Battery Electric Vehicle Project.” Prepared for the South Bay Cities Council of Governments; and Siembab, W., Magarian, D. (2013). “Zero emission local use vehicles: The neglected sustainable mode.” Prepared for the South Bay Cities Council of Governments.

of total trips that a household makes in the geography. For example, an average household living within a ½ mile radius of the Artesia and Hawthorne Corridors, makes 25% of their trips to the corridor and these trips account for 2% of the household's total VMT.

### ASSUMPTIONS

There are several key assumptions made in the methodology (detailed in appendix):

a. Impact of Neighborhood Electric Vehicles (NEVs) before land use – if a household uses an NEV, they will reduce their VMT by 19% (from NEV study).
b. Impact of full Battery Electric Vehicles (BEVs) before land use – If a household uses a BEV, they will reduce their VMT by 40% (from BEV study).
c. NEV/BEV trips are assumed to be zero emissions and replace Internal Combustion Engine (ICE) trips at a one-to-one scale. This slightly overestimates GHG reduction, as electric power generation is associated with emissions. However, the cleaner the fuel source, as is the case in Southern California, the closer emissions get to zero. Also, electric vehicles eliminate cold starts which further bring emissions related to electricity generation down. The California Energy Commission reports that as of 2016 California's large investor owned ¬¬utilities contracted for between 28% and 43% of their electricity for renewable portfolio standard (RPS) sources.[33] The Energy Commission anticipates that the three larger investor owned utilities (PG&E, SCE, and SDG&E) will contract for about half their electricity from RPS-eligible sources by 2020. California's fuel mix has a high renewable component, but the zero emission NEV/BEV assumption is the same as assuming the electricity generation is zero emission.
d. The methodology assumes that household trip frequencies are fixed, so that if a household takes more trips within a half-mile, they reduce trips by the same amount beyond a half-mile. This may overestimate GHG reductions, since providing opportunities for more short trips may induce households to make more trips overall.
e. The methodology has been incorporated into a tool where all assumptions made are transparent, and flexible and can be changed. The tool is a scenario planning tool that in future work can be adjusted to incorporate different assumptions as policy makers see necessary or as more information and data are acquired.

### LAND USE STRATEGY: NEIGHBORHOOD ORIENTED DEVELOPMENT (NOD)

The land use study showed that households walk and visit nearby centers when there is a higher mix and density of destinations. Of the 8 centers and corridors studied, Riviera Village received the most visits and walking trips of nearby households. Therefore, the land use strategy emphasizes the densification of commercial activity and services at key areas. For the 41 centers (intersections), the current retail density is calculated and then matched to one of the three study centers or corridors:

1. Artesia/Hawthorne (Artesia and Hawthorne are two different corridors but with similar statistics and so are combined)
2. El Segundo
3. Riviera Village

The intersection/conceptual center is given the baseline trip capture rates of the matching center and the methodology calculates the increase in trip capture and walking rates when commercial activity densification reaches that of Riviera Village. If the intersection/center has the same commercial density as Riviera Village then no land use changes are calculated, and the intersection/center is given the same walking and trip capture rates as Riviera Village.
The methodology is flexible enough to apply to any area not just an intersection. Any point of interest or anchor point (e.g. mall, work hub etc.) and the neighborhood around the area

33. California Public Utilities Commission (2017) "Renewables Portfolio Standard Annual Report." Pg. 10 California Public Utilities Commission Renewable Portfolio Standards

can be analyzed.

### EFFECT SIZE: TOTAL GHG EMISSIONS

Average household VMT reductions are calculated for each of the strategies at each of the distance categories. To determine the total neighborhood VMT reductions and therefore GHG reductions, the average household reductions are multiplied by the number of households affected by each strategy. The assumptions for effect size are flexible and can be easily changed to test scenarios. These are the effect size assumptions made for the Regional CAP:

1. 1% of households adopt an NEV
2. 1% of households adopt a BEV
3. For all households
    a. 25% telecommute one day a week
    b. 25% are affected by workplace parking engendering the following rates:
        i. 34% take transit
        ii. 21% carpool
        iii. 45% drive alone
4. All households are affected by land use and parking

### ½ MILE ANALYSIS

Table 2 captures the process of VMT reduction for strategies within a ½-ring for an average household living within a ½ mile from a neighborhood center. The first column represents the baseline status for the household. It uses an average trip capture rate of 35% of the 8 centers and corridors from the South Bay Land Use study. This means that an average household will make 35% of their trips within a ½ mile from the home before any land use strategies are implemented. Of these 35%, 7% will be walking trips and 28% of the trips will be made in an internal combustion engine (ICE). This represents 2% of a household's VMT according to the NEV/BEV data from the SBCCOG NEV/BEV studies.

Columns 2 through 7 calculate the reductions in ICE VMT through the strategies. Because land use strategies take time to implement and manifest, NEV and BEV strategies are calculated before land use and after land use. The NEV study shows that when a household is given an NEV that household will replace 19% of their ICE trips with electric trips (this assumes a 1 to 1 ratio discussed above in the assumptions). Since trip capture is 28% for the ICE trips within the ½-mile ring, a 19% reduction of 28% is rounded to 5% (.19*28% = 5.32%) as is shown in column 3 of the table. This reduces ICE trips to 23% (rounding of (28%-5.32%)=22.68) and ICE VMT to 1.62% (2% -(.19*.02%)=1.62%). The reduction in ICE VMT is assumed to directly scale with the shift in trips from ICE to NEV vehicles - hence the 2% baseline value for ICE VMT (at baseline, 2% of household VMT is in ICE vehicles in trips strictly within a ½ mile distance from home) is reduced by a factor of (28% - 5.32%)/28% (=0.8101) to 1.62% (2% multiplied by .8101). Assuming NEV VMT is zero emission implies that the same reduction from 2% to 1.62%, or a reduction of 0.38 percentage points (19%) applies to household transport GHG. The same is applied to the BEV column (column 4) but using a 40% trip reduction (from BEV/NEV study data) which results in ICE vehicle trip reduction of 28% to 17% (11% BEV VMT = .40*.28). The reduction in ICE VMT scales in proportion to the shift of vehicle trips to BEV trips, and so the baseline of 2% ICE household VMT within a ½ mile of the residence becomes (column 3) 1.2% (a 40% reduction to account for the shift of 40% of trips to BEV). Again, assuming this is a GHG reduction implies that electric power generation is zero emissions.

Columns 4 and 5 show the VMT reductions for the land use and parking strategies. The land use strategy results in the densification of destinations at a neighborhood center (conceptualized at a major/major intersection) that equal Riviera Village. Here, the trip capture rate observed within a ½ mile of Riviera Village is used: 46% from the land use study.

| Within 1/2 Mile | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Baseline (without Land Use) | NEV W/out Land Use | BEV W/out Land Use | With Land Use Strategy | Parking with Land Use | NEV with Land Use | BEV with Land Use |
| Trip Capture | 35% | 35% | 35% | 46% | 46% | 46% | 46% |
| Walking Trips | 7% | 7% | 7% | 14% | 17% | 17% | 17% |
| NEV + | | 5% | | | | 5% | |
| BEV | | | 11% | | | | 11% |
| ICE Trips | 28% | 23% | 17% | 32% | 29% | 24% | 18% |
| ICE VMT | 2% | 1.62% | 1.20% | 2.24% | 2.01% | 1.65% | 1.23% |
| Reduction in ICE VMT | | 0.38% | 0.80% | -0.24% | 0.22% | 0.59% | 1.01% |

*Percent Indicates Percentage Point Reduction from Baseline*

TABLE 15: Estimated Average Household VMT Reduction for 1/2 mile

In other words, after land use strategies are implemented an average household will make more trips within a ½ mile of their home: from 35% to 46%. Their walking trips, as the land use data show, will also increase from 7% to 14%. The net effect within the ½ mile radius will be an increase in ICE trips and VMT, 28% to 32% ICE trips from the baseline and a proportionate increase in ICE VMT from 2% to 2.24%: 32%/28% (=1.12) multiplied by the baseline 2% of household VMT in this category. Although more walking trips are made, more trips in an ICE vehicle are also made (this has the benefit of pulling in trips from outer rings, decreasing VMT overall) and more ICE VMT since it goes up from 2% to 2.24% (shown as a -0.24 percentage-point reduction).

Parking strategies are applied to the neighborhood center and utilize assumptions from CAPCOA of 10% reduction in trips.[34] The "with land use" fraction of household ICE trips of 32% is multiplied by 10% for a total of 3% reduction. The trips are assumed to shift to walking trips and thus added to the walking trips 14% plus 3% for a total of 17%. ICE trips for parking are calculated as the subtraction of trip capture 46% minus the walking trips of 17% to equal 29%. Because the new baseline trip capture rate becomes 46% and the data contained in column 4, "with land use," VMT is reduced by a factor of 29%/32% (=0.906) to 2.029% (2.24% multiplied by .906) for a reduction of .22 percentage points.

Columns 6 and 7 represent the NEV and BEV strategies using the "with land use and parking" ICE trip rate of 29%. For the NEV strategy, 29% is multiplied by 19% NEV trip absorption rate and similarly in column 7, the "with land use and parking" ICE trip rate of 29% is multiplied by 40% (5% and 11% respectively. The reduction in household VMT and hence transport GHG emissions is calculated similar to earlier columns, but using the new baseline of column 4, "with land use". This has the effect of slightly reversing the increase in trips and VMT within the ½ mile ring after land use is introduced.

### ½ TO 3 MILES

Calculations for the ½ to 3-mile radius are the same as for under ½ mile. Here baseline trip rates are calculated as follows: 70% of trips are under 3-miles. The baseline trip capture rate under ½ mile is 35% and 70% subtracted from 35% equals a 35% trip capture rate for ½ to 3-miles. In the baseline, column 1, transit trips are added as 1% of the 35%

34. CAPCOA (2010). "Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Governments to Assess Emission Reductions from Greenhouse Gas Mitigation Measures."

| 1/2 Mile to 3 Miles | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Baseline (without Land Use) | NEV W/out Land Use | BEV W/out Land Use | With Land Use Strategy | Parking with Land Use | NEV with Land Use | BEV with Land Use |
| Trip Capture | 35% | 35% | 35% | 24% | 24% | 24% | 24% |
| Walking Trips | | | | | | | |
| NEV + | | 7% | | | | 4% | |
| BEV | | | 14% | | | | 9% |
| Transit | 0.35% | 0.3% | 0.3% | 0.2% | 2.6% | 2.6% | 2.6% |
| ICE Trips | 34.5% | 28% | 20% | 24% | 21% | 17% | 13% |
| ICE VMT | 25% | 20% | 15% | 17% | 16% | 13% | 9% |
| Reduction in ICE VMT | | 5.0% | 10.3% | 7.8% | 1.7% | 4.7% | 7.9% |
| *Percent Indicates Percentage Point Reduction from Baseline* | | | | | | | |

TABLE 16: Estimated Average Household VMT Reduction for 1/2 to 3 miles

baseline: .01*.35 = .35%. These data come from the 2013 California Household Travel Survey (CHTS). Baseline ICE trips are then assumed to be the baseline trip capture rate of 35% minus the transit trips of .35% = 34.5%. Baseline ICE VMT is 25% from the NEV/BEV data. Columns 2 and 3 function the same as columns 2 and 3 from Table 2. NEV and BEV adoption rates of 19% and 40% are applied to the baseline rates and reductions in ICE trips and scaled reductions in VMT. Here VMT reductions are larger because the trip capture within ½ to 3 miles is larger.

Columns 4 through 7 use a trip capture rate based on the land use strategies. Because the trip capture rate is larger under ½ miles due to the land use strategy, the resulting effect is that trip capture rate will be smaller within the ½ to 3-mile ring. The trip capture rate under ½ miles, after the land use strategy is 46%, and 70% minus 46% equals 24%. This reduction of 11 percentage points from the baseline (35% - 24%) results in a decrease in ICE trips of 10.5 percentage points (34.5% - 24%) resulting in a decrease of ICE VMT of 7.8 percentage points (25*24/34.5). Here larger VMT reductions are seen because more trips are being pulled into the inner ring shortening trips overall. Transit trips are reduced from .3% to .2% because the trip capture has been reduced.

In column 5, it is assumed that trips eliminated by parking strategies applied to the neighborhood center are shifted to transit trips (they can be shifted to shared mobility or bike trips equally). The parking assumption of 10% from under ½ miles is applied here: .24*.10 equals 2.4% plus .2% for a total of 2.6% transit trips. These are subtracted from the trip capture rate of 24% to equal total ICE trips of 21%. Because the new baseline trip capture rate becomes 24% and the data contained in column 4, "with land use," VMT is reduced by a factor of 17%*21%/24% = 16% or a VMT reduction of 1.7 percentage points.

Columns 6 and 7 represent the NEV and BEV strategies using the "with land use and parking" ICE trip rate of 21%. The NEV strategy absorbs 4% of ICE trips and the BEV strategy absorbs 9% for an ICE VMT percentage point reduction of 4.7 and 7.9 percentage points respectively. The reduction in household VMT and hence transport GHG emissions is calculated like earlier columns.

| 3 to 10 Miles (Work Related) | | | | | | |
|---|---|---|---|---|---|---|
| | Baseline | With Parking (Carpooling) | With Parking (Transit) | With NEV | With BEV | With Telecommuting |
| Trip Capture | 4.6% | 4.6% | 4.6% | 4.6% | 4.6% | 4.6% |
| Walking Trips | | | | | | |
| NEV + | | | | 0.87% | | |
| BEV | | | | | 1.8% | |
| Telecommuting | | | | | | 4.6% |
| Shared Mobility | | 2.3% | | | | |
| Transit | 0.2% | | 4.6% | | | |
| ICE Trips | 4.4% | 2.3% | 0.0% | 3.7% | 2.8% | 0.0% |
| ICE VMT | 8.3% | 4.4% | 0.0% | 7.1% | 5.0% | 0.0% |
| **Reduction in ICE VMT** | | **3.9%** | **8.3%** | **1.2%** | **3.3%** | **8.3%** |
| *Percent Indicates Percentage Point Reduction from Baseline* | | | | | | |

TABLE 17: Estimated VMT Reductions for 3 to 10-miles (Work Related)

## ½ TO 3 MILES

For calculations over 3 miles, trips are separated into work related a non-work related for the purposes of the telecommuting strategy. Here, the NEV/BEV data show that 4.6% of total trips are work related from the 3 to 10-mile range from home and this serves as the baseline trip capture rate. The Caltrans data show that 5% of trips within this distance are made in transit, and so a rate of .2% is applied (4.6% * 5%). ICE trips in the first column are the baseline trip capture of 4.6% minus transit trips of .2% for a total of 4.4%. ICE VMT of 8.3% come from the NEV/BEV data.

Assumptions for workplace parking strategies are applied to columns 2 and 3. Studies have shown that if pricing is applied to workplace parking, 34% of commuters will take transit and 21% will carpool, the rest will drive alone.[35] Column 2 calculates the reduction for carpooling assuming that 2 persons per car will reduce trips by 50%. So, 4.6% of ICE trips are multiplied by 50% to equal 2.3%. Reduction in ICE VMT is scaled from trips (8.3*2.3/4.4) to equal a 3.9 percentage point reduction. For the portion of trips that are applied to transit, all trips are assumed to replace ICE trips.

Columns 4 and 5 calculate the VMT reduction for drive alone trips made in an NEV and BEV. Absorption rates of 19% and 40% reduce baseline rates of 4.6% by .87% and 1.8% respectively reducing VMT by 1.2 and 3.3 percentage points. Telecommuting is assumed to absorb all work-related trips as the trips are eliminated or brought closer to the home. These rates will be scaled later when GHG reductions are calculated for number of days worked and household effect size is considered.

15.4% of trips are not related to work within 3 to 10 miles from the home according to the NEV/BEV data (Table 18). 5% of these trips are assumed to be taken in transit, resulting in an ICE trip baseline of 14.6%. 28% of household VMT is related to non-work trips within a 3 to 10-mile radius from the home according to the NEV/BEV data. Columns 2 and

35. Shoup, D. (2005). Parking Cash Out. American Planning Association, Chicago.

| 3 to 10 Miles (Other) | | | |
|---|---|---|---|
| | **Baseline** | **With NEV** | **With BEV** |
| Trip Capture | **15.4%** | **15.4%** | **15.4%** |
| Walking Trips | | | |
| NEV + | | 2.93% | |
| BEV | | | 6.16% |
| Telecommuting | | | |
| Shared Mobility | | | |
| Transit | 0.8% | 0.8% | 0.8% |
| ICE Trips | 14.6% | 11.7% | 8.5% |
| ICE VMT | 28% | 22.18% | 16.05% |
| **Reduction in ICE VMT** | | **5.5%** | **11.67%** |
| *Percent Indicates Percentage Point Reduction from Baseline* | | | |

TABLE 18: Estimated VMT reductions for 3 to 10-miles (Other)

3 calculate the reduction in ICE trips and VMT with the NEV and BEV strategies. For NEV, a 19% reduction is applied to the 15.4% of ICE trips resulting in a trip replacement of 2.93% and an ICE VMT reduction of 5.5% for nonwork-related trips 3 to 10 miles from the home. For BEV, a 40% reduction is applied to the 15.4% of ICE trips resulting in a trip replacement of 6.16% and an ICE VMT reduction of 11.67%.

## OVER 10-MILES

For calculations over 10 miles, the NEV/BEV data show that 2.6% of trips are work-related over 10 miles. The Caltrans data show that 6% of trips within this distance are made in transit, and so a rate of .2% is applied (2.6% * 6%). ICE trips in the first column are the baseline trip capture of 2.6% minus transit trips of .2% for a total of 2.5%. Baseline ICE VMT of 10.4% come from the NEV/BEV data.

Column 2 calculates the reduction for carpooling assuming 2 persons per car will reduce VMT by 50%. 2.6% of ICE trips are multiplied by 50% to equal 1.3%. Reduction in ICE VMT is scaled from trips (10.4*1.3/2.5) to equal a 4.9 percentage point reduction. For the portion of trips that are applied to transit, all trips are assumed to replace ICE VMT. Column 4 calculates drive alone trips made in a BEV. Absorption rates of 40% reduce baseline rates of 2.6% by 1.0% reducing VMT 3.8 percentage points. NEVs are not considered outside a 10-mile range. Telecommuting is assumed to absorb all work-related trips. These rates will be scaled later when GHG reductions are calculated for number of days worked.

6.4% of trips are not related to work over 10 miles from the home according to the NEV/BEV data. 5% of these are transit trips resulting in an ICE trip baseline of 6.0%. 26% of household VMT is related to non-work trips over 10 miles from the home according to the NEV/BEV data. Column 2 calculates the reduction in ICE trips and VMT with the BEV strategies. For BEV, a 40% reduction is applied to the 6.4% of ICE trips resulting in a trip replacement of 2.55% and an ICE VMT reduction of 9.55 percentage points.

## TOTAL NEIGHBORHOOD GHG CALCULATIONS

The above calculations are for average household VMT reductions for the SSBS strategies at the various distance rings. To calculate total GHG reductions for the neighborhood, each reduction needs to be applied to the number of households affected by the strategy. In other words, all households will be affected by land use strategies but only some strategies will be affected by electric vehicle strategies (not all households will purchase and or use an electric vehicle, but all households would live next to a center).

The assumptions about effect size can be easily modified within the tool. This example uses following assumptions as an illustration, they also form the basis for the Regional Calculations:

1. 1% of households adopt an NEV
2. 1% of households adopt a BEVRiviera Village

| Over 10 Miles (Work Related) | Baseline | With Parking (Carppoling) | With Parking (Transit) | With BEV | With Telecommuting |
|---|---|---|---|---|---|
| Trip Capture | 2.6% | 2.6% | 2.6% | 2.6% | 2.6% |
| Walking Trips | | | | | |
| NEV + | | | | | |
| BEV | | | | 1.0% | |
| Telecommuting | | | | | 2.6% |
| Shared Mobility | | 1.3% | | | |
| Transit | 0.2% | | 2.6% | | |
| ICE Trips | 2.5% | 1.3% | 0.0% | 1.6% | 0.0% |
| ICE VMT | 10.4% | 5.5% | 0.0% | 6.6% | 0.0% |
| **Reduction in ICE VMT** | | **4.9%** | **10.4%** | **3.8%** | **10.4%** |
| *Percent Indicates Percentage Point Reduction from Baseline* | | | | | |

TABLE 19: Estimated VMT reductions for Over 10-miles (work)

| Over 10 Miles (Other) | Baseline | With BEV |
|---|---|---|
| Trip Capture | 6.4% | 6.4% |
| Walking Trips | | |
| NEV + | | |
| BEV | | 2.55% |
| Telecommuting | | |
| Shared Mobility | | |
| Transit | 0.4% | |
| ICE Trips | 6.0% | 3.8% |
| ICE VMT | 26% | 16.84% |
| **Reduction in ICE VMT** | | **9.55%** |
| *Percent Indicates Percentage Point Reduction from Baseline* | | |

TABLE 20: Estimated VMT reductions for over 10-miles (Other)

| Without Land Use | 1/2 mile | 1/2 to 3 miles | 3 to 10 miles | Over 10 miles | Total |
|---|---|---|---|---|---|
| NEV W/out Land Use | 0.4% | 5.0% | 5.5% | | 10.9% |
| BEV W/out Land Use | 0.8% | 10.3% | 7.6% | 13.3% | 31.9% |
| Parking (Carpooling) | | | 3.9% | 4.9% | 8.8% |
| Parking (Transit) | | | 8.3% | 10.4% | 18.7% |
| Telecommuting | | | 8.3% | 10.4% | 18.7% |
| **With Land Use** | **1/2 mile** | **1/2 to 3 miles** | **3 to 10 miles** | **Over 10 miles** | **Total** |
| Land Use (RV Inner) | -1.0% | 10.7% | | | 9.7% |
| Parking w/LU | 1.4% | 1.4% | | | 2.9% |
| NEV w/LU | 0.8% | 2.7% | 5.5% | | 9.0% |
| BEV w/LU | 1.4% | 5.7% | 7.6% | 13.3% | 28.0% |
| Parking (Carpooling) | | | 3.9% | 4.9% | 8.8% |
| Parking (Transit) | | | 8.3% | 10.4% | 18.7% |
| Telecommuting | | | 8.3% | 10.4% | 18.7% |
| *Percent Indicates Percentage Point Reduction from Baseline* | | | | | |

TABLE 21: Estimated VMT Reduction Summary

| Without Land Use | | | | |
|---|---|---|---|---|
| Total Households | | 5,000 | | |
| Average HH Daily VMT | | 43.40 | | |
| **Strategy** | **VMT Reduction** | **Daily VMT Reduced** | **Households Affected** | **Total VMT Reduction** |
| NEV | 10.9% | 4.73 | 50 | 236.53 |
| BEV | 31.9% | 13.84 | 50 | 692.23 |
| Telecommuting | 3.7% | 1.62 | 1250 | 2028.95 |
| Parking Carpooling | 8.80% | 3.82 | 262.5 | 1002.54 |
| Parking Transit | 18.70% | 8.12 | 562.5 | 4565.138 |
| **Reduction** | | | | |
| Total Neighborhood VMT | | | 217,000 | |
| Total Neighborhood Reduced Neighborhood VMT | | | 8,525 | |
| Proportion VMT Reduced | | | 3.9% | |

TABLE 22: Simple Pre-Land Use Total Neighborhood VMT Reduction

3. For all households
    a. 25% telecommute one day a week
    b. 25% are affected by workplace parking which results in:
        i. 34% take transit
        ii. 21% carpool
        iii. 45% drive alone
4. All households are affected by land use and parking

The following will walk through an example of a 5,000-household neighborhood using the VMT Reduction Average Totals in Table 21 above.

Without Land Use:

1. NEV: 50 households see a VMT reduction of 10.9%
2. BEV: 50 households see a VMT reduction of 31.9%
3. Telecommuting: 1,250 households see a VMT reduction of 3.7% (Daily Reduction for one day: 18.7/5)
4. Transit due to parking: 563 households see a VMT reduction of 18.7%
5. Carpooling due to parking: 263 households see a VMT reduction of 8.8%

With Land Use

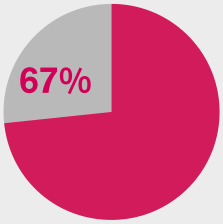
1. Land Use: 5,000 households see a VMT reduction of 7.5%
2. Parking: 5,000 households see a VMT reduction of 1.9%
3. NEV: 50 households see a VMT reduction of 10.7%
4. BEV: 50 household see a VMT reduction of 29.8%
5. Telecommuting: 1,250 households see a VMT reduction of 3.7 (Daily Reduction for one day: 18.7/5)
6. Transit due to parking: 563 households see a VMT reduction of 18.7%
7. Carpooling due to parking: 263 households see a VMT reduction of 8.8%

To calculate total neighborhood reductions total neighborhood VMT is determined and then subtracted by the sum of the reduced VMT. A simple 'without land use' illustration is calculated in Table 22 below. The total neighborhood population of 5,000 households are given an average daily VMT of 43.4 (derived from the BEV data). The percentage point VMT reduction for each strategy is multiplied by the daily VMT for a daily VMT reduction per strategy. Then the number of households affected is multiplied by the VMT reduction for a total neighborhood reduction per strategy. For example, considering NEV strategies before land use: 10.9% is multiplied by the daily average of 43.4 to equal 4.73. This is the average daily VMT reduced with an NEV. This is then multiplied by 50 households to get the total VMT reduction for the neighborhood of 236.53. Total daily neighborhood VMT is 217,000 (5,000*43.4). The sum of reduced VMT is 8,525. The proportion of VMT reduced is 3.9%.


# Energy Efficiency (EE)

**2020 GHG Reduction Potential**

ENERGY EFFICIENCY




**Reduction of 579,944 MT CO2 e/yr**

100% equals all CAP GHG emission reductions from all CAP strategies. EE represents 67+% reduction outlined in Sub-Region EE CAP.

**Co-benefits**

- Adaptation Strategy Support
- Air Quality
- Economy + Jobs
- Energy Conservation
- Public Health
- Resource Conservation
- Safer Streets
- Transportation System Improvement

## Due to increasing electricity and natural gas demands, the built environment is a significant contributor to GHG emissions. Improving energy efficiency (EE) of the new and existing buildings and infrastructure at the residential, commercial, and municipal level will result in significant GHG reductions.

The 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. The SBCCOG, with its member cities, is undertaking various programs to enhance energy efficiency at the community and municipal levels. These are, respectively described for both the SBCCOG and the cities, in the respective sub-strategies that include:  EE is defined as achieving the same services with less energy. Implementing EE strategies helps ensure a reliable, affordable, and sustainable energy system for the future.

EE through water efficiency and decrease energy demand through reducing the urban heat island effect. The SBCCOG, through its partnership with the cities, will obtain educational content, energy audit services, and assistance identifying potential funding sources to help implement strategies.

A full list of EE Strategies along with references is available in Appendix A- "Sub-Region Energy Efficiency CAP" including Methodology, Inventory & Forecast. The SBCCOG selected the following EE Strategies which were approved by the SBCCOG in 2015 along with GHG reduction targets for 2020 and 2035 (in support of the State of California 2050 GHG reduction goal).

## GOAL EE: A - INCREASE ENERGY EFFICIENCY IN EXISTING RESIDENTIAL UNITS

**Residential sector carbon dioxide emissions originate primarily from the direct fuel consumption (principally, natural gas) for heating and cooking, and electricity for cooling/heating, appliances, lighting, and increasingly for televisions, computers, and other household electronic devices. Improving EE at the residential level, reduces overall energy demand, which leads to a decrease in power plant emissions. It has other socio- economic benefits for the communities as well such as improved health and safety and lower utility costs.**

### MEASURE EE: A1 - EE TRAINING, EDUCATION, AND RECOGNITION

Opportunities for residents to improve EE 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.

EE: A1 SBCCOG Sub-Strategies

| | |
|---|---|
| EE: A1.1 | Provide cities with updated links and pamphlets. |
| EE: A1.2 | Collaborate with cities for e-newsletter and provide information and content. |
| EE: A1.3 | Attend EE fairs (e.g. Earth Day). |
| EE: A1.4 | Act as a resource center. |
| EE: A1.5 | Partner with Utilities to provide educational content to cities. |

EE: A1 Cities Sub-strategies

| | |
|---|---|
| EE: A1.1 | Post links on website/social media and provide materials at Public Events. |
| EE: A1.2 | Email list for email blasts of new information or trainings. |
| EE: A1.3 | Establish an annual EE Fair. |
| EE: A1.4 | Create a resource center. |
| EE: A1.5 | Hire/Designate Energy Advocate. |
| EE: A1.6 | Partner with South Bay Cities Council of Governments and Utilities to obtain educational content. |

### MEASURE EE: A2 - INCREASE PARTICIPATION IN EXISTING EE PROGRAMS

As part of the South Bay Energy Efficiency Partnership (SB 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.

EE: A2 Cities Sub-strategies

| | |
|---|---|
| EE: A2.1 | Partner with SBCCOG and Utilities for outreach events. |
| EE: A2.2 | Staff outreach to home owner associations (HOAs) and other housing groups. |

EE: A2 SBCCOG Sub-strategies

| | |
|---|---|
| EE: A2.1 | Partner with Cities and Utilities and participate in outreach programs. |
| EE: A2.2 | Develop a program list with resources and provide support to city staff conducting outreach. |

### MEASURE EE: A3 - ESTABLISH, PROMOTE OR REQUIRE HOME ENERGY EVALUATIONS

Home energy evaluations are necessary to identify cost-effective opportunities for energy saving and for residents to take practical actions to achieve EE.

EE: A3 Cities Sub-strategies

| | |
|---|---|
| EE: A3.1 | Require third-party inspector to verify Title 24 or greater compliance to home upgrades (Alternative: Enhanced enforcement of Title 24 compliance). |
| EE:A3.2 | Promote home energy audits through programs such as Energy Upgrade California or other State programs. |
| EE: A3.3 | Establish free "Energy Checkup" program with the assistance of the SBCCOG if funding can be obtained. |

EE: A3 SBCCOG Sub-strategies

| | |
|---|---|
| EE: A3.1 | Coordinate and administer energy audits. |
| EE: 3..2 | Administer and provide resources for "check-up" programs. |

**MEASURE EE: A4 - PROMOTE, INCENTIVIZE OR REQUIRE RESIDENTIAL HOME ENERGY RENOVATIONS**

## 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.

EE: A4 Cities Sub-strategies

| | |
|---|---|
| EE: A4.1 | Promote existing incentivized programs such as Energy Upgrade California. |
| EE: A4.2 | Develop or promote a green building program. |
| EE: A4.3 | Promote Financing Programs such as PACE (Properly Assessed Clean Energy). |
| EE: A4.4 | Waive or reduce permit fees to facilitate permit processing. |
| EE:A4.5 | Establish online permitting to facilitate permit processing. |
| EE: A4.6 | Develop city-based revolving loan fund. |
| EE: A4.7 | Develop a Point-of-Sale Energy Rating ordinance. |
| EE: A4.8 | Develop a Residential Energy Conservation Ordinance (RECO). |

EE: A4 SBCCOG Sub-strategies

| | |
|---|---|
| EE: A4.1 | Promote programs and provide online resources. |
| EE: A4.2 | Promote green building programs, recognize achievements, and provide city staff/firm training. |
| EE: A4.3 | Promote financing programs (e.g. HERO). |
| EE:A4.4 | Look into funding from SCE to help cities establish online permitting. |

## GOAL EE: B - INCREASE ENERGY EFFICIENCY IN NEW RESIDENTIAL DEVELOPMENTS

EE standards that are set beyond title 24, are far more stringent and effective in reducing GHG emissions. Cities that develop resources for implementing these standards for new residential development will help conserve electricity and natural gas.

### MEASURE EE: B1 - ENCOURAGE OR REQUIRE EE STANDARDS EXCEEDING TITLE 24

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. It is also important that Title 24 Standards are updated so that the full GHG reduction benefit of the title can be realized. City staff that are well-informed can implement updates quickly and effectively.

EE: B1 Cities Sub-strategies

| | |
|---|---|
| EE: B1.1 | Educate city staff, developers, etc., on future Title 24 updates and the additional energy efficiency opportunities for new residential development. |
| EE: B1.2 | Promote Tier 1, Tier 2, Green Building Ratings such as LEED, Build It Green/Green Point Rating System, or Energy Star certified buildings. |
| EE: B1.3 | Waive or reduce permit fees to facilitate permit processing. |
| EE: B1.4 | Establish online permitting to facilitate permit processing. |
| EE:B1.5 | Create an Energy award program for net-zero-net energy homes. |
| EE: B1.6 | Adopt a local ordinance to exceed Title 24 (2013) |

EE: B1 SBCCOG Sub-strategies

| | |
|---|---|
| EE: B1.1 | Provide recognition of achievements for net-zero-net energy homes. |

## GOAL EE: C - INCREASE ENERGY EFFICIENCY IN EXISTING COMMERCIAL UNITS

Educating the community about the benefits of EE and equipping them with strategies and technologies to do so is the key for enhancing energy efficiency. Different tools such as social, digital, and print media can be used to educate stakeholders.

### MEASURE EE: C1 - EE TRAINING AND EDUCATION

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.

EE: C1 Cities Sub-strategies

| | |
|---|---|
| EE: C1.1 | Post links on websites/ social media and provide materials at public events. |
| EE: C1.2 | Email list for e-mail blasts of new information or trainings. |
| EE: C1.3 | Establish an annual EE Fair. |
| EE: C1.4 | Create a resource center. |
| EE: C1.5 | Hire/ Designate Energy Advocate. |
| EE: C1.6 | Partner with SBCCOG and Utilities to obtain education content. |

EE: C1 SBCCOG Sub-strategies

| | |
|---|---|
| EE: C1.1 | Provide cities with updated links and pamphlets. |
| EE: C1.2 | Collaborate with cities for e-newsletter and provide information and content. |
| EE: C1.3 | Attend EE fairs (e.g. Earth Day). |
| EE: C1.4 | Act as a resource center. |
| EE: C1.5 | Partner with Utilities to provide educational content to cities. |

### MEASURE EE: C2 - INCREASE PARTICIPATION IN EXISTING EE PROGRAMS

As part of the South Bay Partnership with SCE and SCG, the cities can conduct outreach efforts to promote energy awareness, existing programs, and incentives that are offered for EE. 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.

EE: C2 Cities Sub-strategies

| | |
|---|---|
| EE: C2.1 | Partner with SBCCOG and Utilities for outreach events. |
| EE: C2.2 | Staff outreach to business groups. |

EE: C2 SBCCOG Sub-strategies

| | |
|---|---|
| EE: C2.1 | Partner with Cities and Utilities and participate in outreach programs |
| EE: C2.2 | Develop a program list with resources and provide support to city staff conducting outreach. |

### MEASURE EE: C3 - INCENTIVIZE OR REQUIRE NON-RESIDENTIAL ENERGY AUDITS

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. These audits can be established or promoted through various existing programs.

EE: C3 Cities Sub-strategies

| | |
|---|---|
| EE: C3.1 | Require third-party inspector to verify Title 24 or greater compliance to upgrades. |
| EE:C3.2 | Promote energy audits such as through Energy Upgrade California or other state programs. |
| EE:C3.3 | Require early adoption of AB 1103 for small buildings (5,000-10,000 square feet) |

EE: C3 SBCCOG Sub-strategies

| | |
|---|---|
| EE: C3.1 | Coordinate and administer energy audits. |


**MEASURE EE: C4 - PROMOTE OR REQUIRE COMMERCIAL ENERGY RETROFITS**

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.

EE: C4 Cities Sub-strategies

| | |
|---|---|
| EE: C4.1 | Promote existing incentivized programs such as Energy Upgrade California. |
| EE: C4.2 | Develop or promote a green building program. |
| EE: C4.3 | Promote Financing Programs such as PACE (Properly Assessed Clean Energy). |
| EE: C4.4 | Waive or reduce permit fees to facilitate permit processing. |
| EE: C4.5 | Establish online permitting to facilitate permit processing. |
| EE: C4.6 | Develop city-based revolving loan fund. |
| EE:C 4.7 | Develop a Commercial Energy Conservation Ordinance (CECO). |

EE: C4 SBCCOG Sub-strategies

| | |
|---|---|
| EE: C4.1 | Promote programs and provide online resources. |
| EE: C4.2 | Promote green building programs, recognize achievements, and provide city staff/firm training. |
| EE: C4.3 | Promote financing programs (e.g. HERO). |
| EE: C4.4 | Look into funding from SCE to help cities establish online permitting. |

## GOAL EE: D - INCREASE ENERGY EFFICIENCY IN NEW COMMERCIAL DEVELOPMENTS

City planners are uniquely positioned to inform developers of new EE standards / technologies. Building capacity at City staff level to execute these strategies is essential for cities to leverage the benefits of increased energy efficiency in commercial development

### MEASURE EE: D1 - ENCOURAGE OR REQUIRE EE STANDARDS EXCEEDING TITLE 24

This measure will develop City staff to be resources in encouraging and implementing energy efficiency beyond that are required by current Title 24 Standards for commercial development. In addition, this measure helps ensure that Title 24 Standards are updated.

EE: D1 Cities Sub-strategies

| | |
|---|---|
| EE: D1.1 | Educate City staff, developers, etc., on future Title 24 updates and the additional energy efficiency opportunities for new commercial development. |
| EE: D1.2 | Promote Tier 1, Tier 2, Green Building Ratings such as LEED, Build It Green/Green Point Rating System, or Energy Star certified buildings. |
| EE: D1.3 | Waive or reduce permit fees to facilitate permit processing. |
| EE: D1.4 | Establish online permitting to facilitate permit processing. |
| EE: D1.5 | Create and energy award program from net-zero-net-energy businesses. |
| EE: D1.6 | Adopt a local ordinance to exceed Title 24 (2013). |

EE: D1 SBCCOG Sub-strategies

| | |
|---|---|
| EE: D1.1 | Provide recognition of achievements for net-zero-net energy businesses. |

## GOAL EE: E - INCREASE ENERGY EFFICIENCY THROUGH INCREASED WATER EFFICIENCY (WE)

Providing safe drinking water and wastewater disposal is an energy-intensive process. Reducing water consumption saves energy because less water needs to be treated and pumped to end users. Moreover, when energy use is reduced, water is saved because less is needed in the operation of power plants. Through water efficiency measures, cities can help to protect dry areas from drought, lower consumers' utility bills, and reduce GHG Emissions.

### MEASURE EE: E1 - PROMOTE OR REQUIRE WATER EFFICIENCY THROUGH SB X7-7

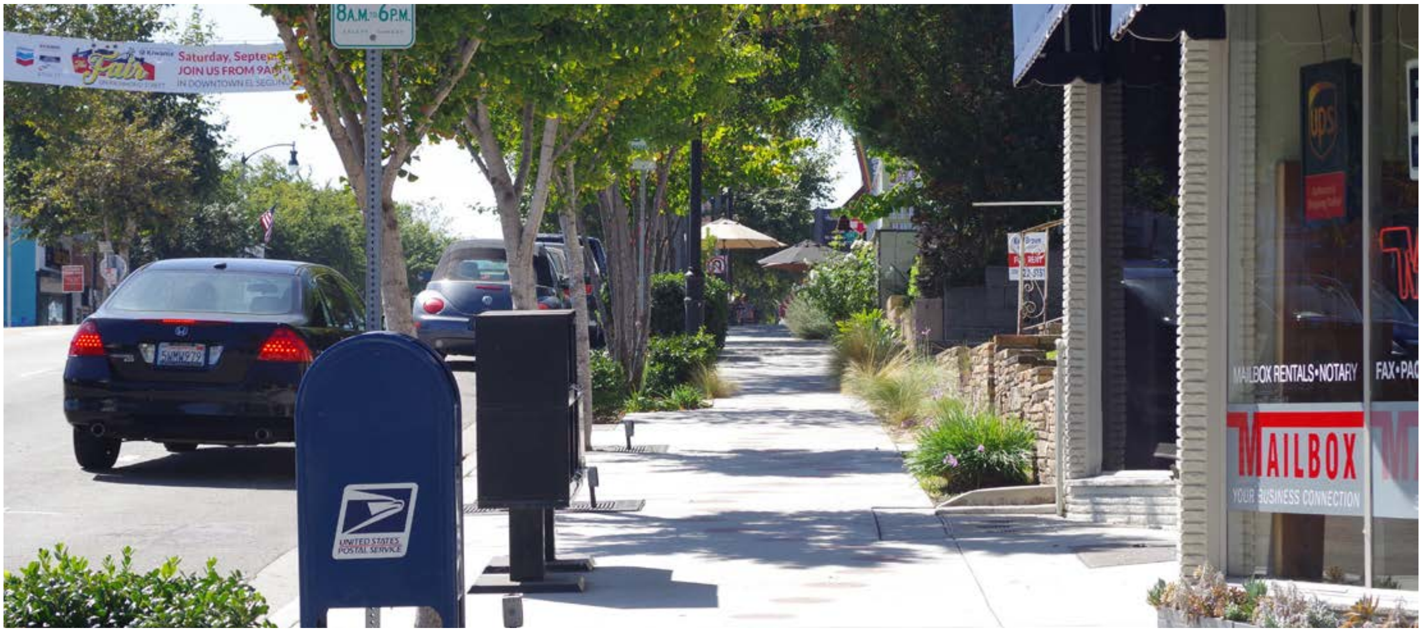
The Water Conservation Act of 2009 (SB X7-7), requires all water suppliers to increase water use efficiency. The legislation set an overall goal of reducing per capita urban water consumption by 20 percent from a baseline level by 2020. The goal of Water Conservation Act can be met by taking a variety 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 (WBMWD).

EE: E1 Cities Sub-strategies

| | |
|---|---|
| EE: E1.1 | Post links on website/social media and provide materials at public events. |
| EE: E1.2 | Email list for e-mail blasts of new information or trainings. |
| EE: E1.3 | Require low-irrigation landscaping. |
| EE: E1.4 | Partner with SBCCOG and WBMWD to obtain educational content. |
| EE: E1.5 | Partner with SBCCOG and WBMWD for outreach events. |

EE: E1 SBCCOG Sub-strategies

| | |
|---|---|
| EE: E1.1 | Provide cities with updated links and pamphlets. |
| EE: E1.2 | Collaborate with cities for e-newsletter and provide information and content. |
| EE: E1.3 | Partner with Water District to provide educational content and outreach assistance to cities. |




**MEASURE EE: E2 - PROMOTING WATER EFFICIENCY STANDARDS EXCEEDING SB X7-7**

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/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.

EE: E2 Cities Sub-strategies

| | |
|---|---|
| EE: E2.1 | Staff time dedicated to work with HOAs, businesses, and other groups for outreach. |
| EE: E2.2 | Allow recycled or grey water uses for non-municipal uses. |
| EE: E2.3 | Work with Water District to increase recycled water potential. |
| EE: E2.4 | Promote rainwater rebates and demonstrations. |

## GOAL EE: F - DECREASE ENERGY DEMAND THROUGH REDUCING URBAN HEAT ISLAND EFFECT

Shade trees and smaller plants such as shrubs, vines, grasses, and ground cover, help cool the urban environment. Yet, many communities have lost trees and green space as they have grown. This change is not inevitable. Many communities can take advantage of existing space, such as grassy or barren areas, to increase their vegetative cover and reap multiple benefits; such as reduced GHG emissions through reduced energy demands, carbon sequestration, improved human health etc.

### MEASURE EE: F1 - PROMOTE TREE PLANTING FOR SHADING AND EE

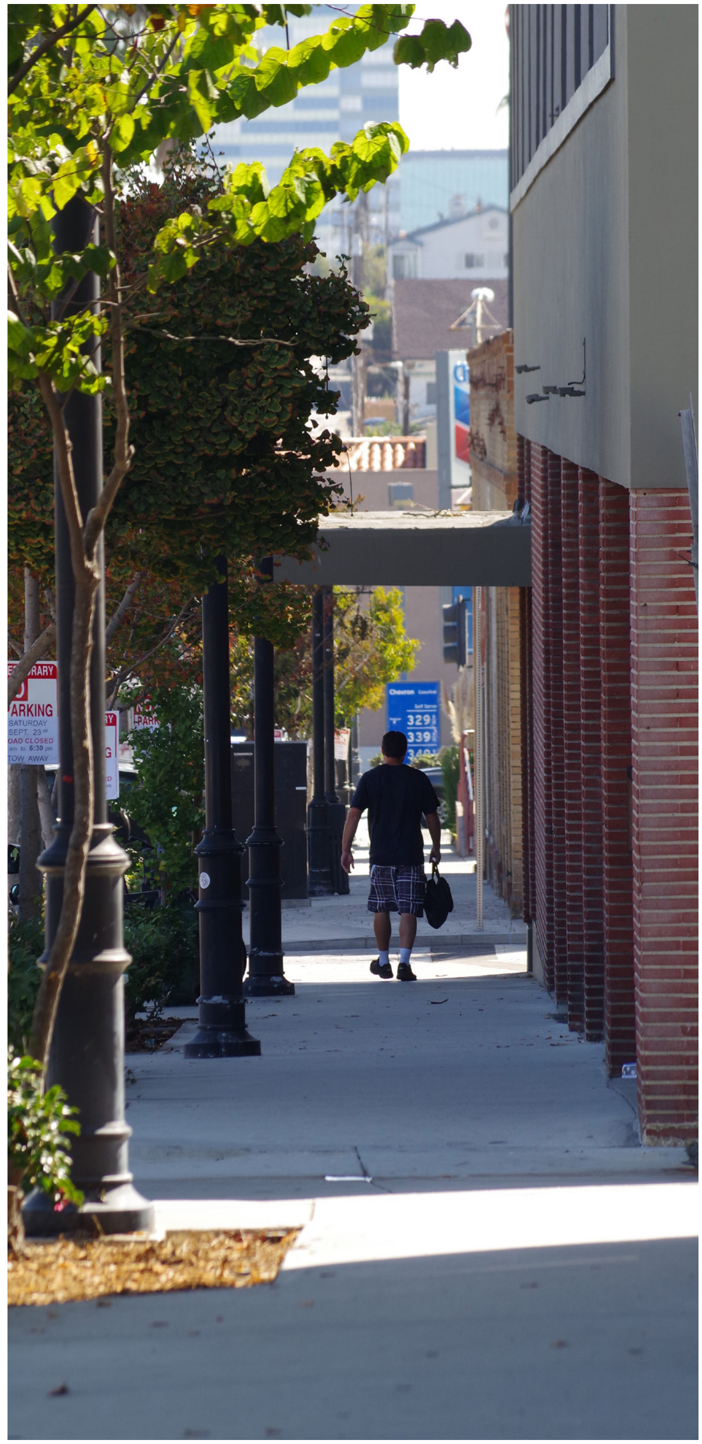
Trees and plants naturally help cool an environment by providing shade and evapotranspiration (the movement of water from the soil and plants to the air), making vegetation a simple and effective way to reduce urban heat islands. Urban heat islands are urban areas that are significantly warmer than their surrounding rural areas due to human activities.  Shaded surfaces may be 20–45°F 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. Furthermore, trees and plants that directly shade buildings can reduce energy use by decreasing demand for air conditioning.

EE: F1 Cities Sub-strategies

| | |
|---|---|
| EE: F1.1 | Encourage tree planting at plan check. |
| EE: F1.2 | Work with community to develop a tree-planting group. |
| EE: F1.3 | Develop a city tree planting program. |

### MEASURE EE: F2 - INCENTIVIZE OR REQUIRE LIGHT REFLECTING SURFACES

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 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.



EE: F2 Cities Sub-strategies

| | |
|---|---|
| EE: F2.1 | Pass an ordinance requiring or incentivizing cool roofs. |
| EE: F2.2 | Pass an ordinance requiring or incentivizing cool pavements. |

EE: F2 SBCCOG Sub-strategies

| | |
|---|---|
| EE: F2.1 | Provide cities with further information on cool roofs and cool pavements through handouts or presentations. |

## GOAL EE: G - PARTICIPATE IN EDUCATION, OUTREACH AND PLANNING FOR ENERGY EFFICIENCY

Educating stakeholders about the EE programs and providing technical assistance for implementing those strategies is crucial for achieving increased energy savings. Southern California Edison's (SCE) Energy Leadership Partnership (ELP) Program, provides a robust framework for cities to implement EE strategies.

### MEASURE EE: G1 - INCREASE ENERGY SAVINGS THROUGH THE SCE ENERGY LEADER PARTNERSHIP

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, reduces peak-time electricity demand, and plans 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.

## GOAL EE: H - INCREASE ENERGY EFFICIENCY IN MUNICIPAL BUILDINGS

Energy management for municipal buildings provides a quick "win" for cities and builds long-term capacity to develop EE projects and helps monitor and control energy use. The first crucial step towards energy management in municipal buildings is, conducting comprehensive energy audit to examine energy use patterns and performance of equipment.


### MEASURE EE: H1 - CONDUCT MUNICIPAL ENERGY AUDIT

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 South Bay cities to provide a baseline for comparison. Annual review of energy use within each building is a best practice to see trends and determine if the energy efficiency retrofits are effective. 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.

### MEASURE EE: H2 - REQUIRE GREEN BUILDING CERTIFICATION

Leadership in Energy & Environmental Design (LEED) is a rating system for buildings, homes, and communities developed by the U.S. Green Building Council (USGBC).

**MEASURE EE: H3 - IMPLEMENT WATER LEAK DETECTION PROGRAM**

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

**MEASURE EE: H4 - PARTICIPATE IN DEMAND RESPONSE PROGRAMS**

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 EE: H5 - PARTICIPATE IN DIRECT INSTALL PROGRAM**

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 buildings 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.

### MEASURE EE: H6 - ADOPT A PROCUREMENT POLICY FOR EE EQUIPMENT

Energy efficient procurement policies can reduce government facility energy costs by about 5 to 10 percent. As municipal appliances wear over time; the cities should 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.

### MEASURE EE: H7 - INSTALL COOL ROOFS

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 CO2e.

### MEASURE EE: H8 - REQUIRE NEW OR RETROFITTED BUILDINGS TO EXCEED TITLE 24

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. Cities 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.

### MEASURE EE: H9 - INCREASE RECYCLED WATER USE

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

### MEASURE EE: H10- RETROFIT HVAC EQUIPMENT AND WATER PUMPS

Heating, ventilation, and air conditioning (HVAC) and/or water pump equipment at municipal facilities have been identified as potential retrofit opportunities and can qualify for incentives through the SCE ELP. By replacing aging equipment with newer, more efficient equipment, the cities will reduce energy consumption and associated GHG emissions.

### MEASURE EE: H11 - TRACK ADDITIONAL ENERGY SAVINGS

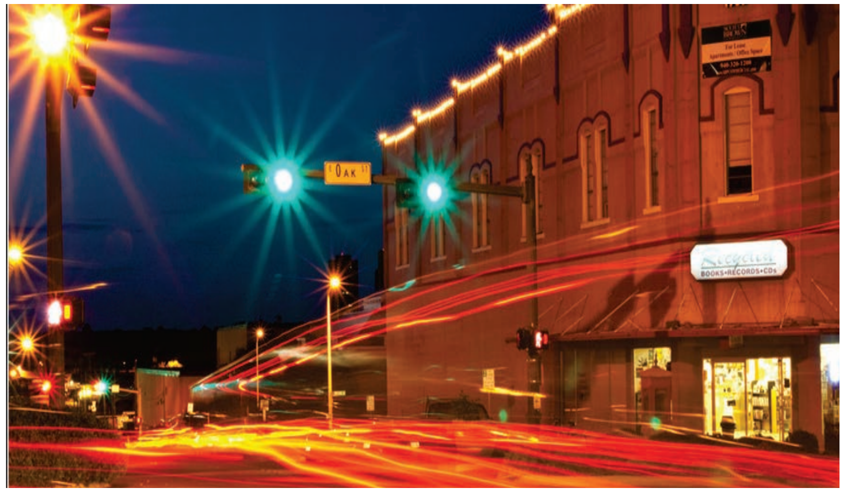
According to SBCCOG's Project Tracker database, cities within the Sub-region have achieved additional municipal energy savings since the data for their last inventory was calculated. These savings are not categorized into specific projects. This measure allows the ability for cities to take advantage 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 cities to determine the effectiveness of the energy savings.

### MEASURE EE: H 12- UTILIZE AN ENERGY MANAGEMENT SYSTEM

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. An Energy Management System tool allows City staff to observe "real-time" energy consumption and analyzes building energy consumption trends using utility bill information.

# GOAL EE: I - INCREASE ENERGY EFFICIENCY IN CITY INFRASTRUCTURE

Retrofitting outdoor lighting and traffic signals, promoting water conserving landscape, and planting more trees are some of the steps that are taken by the city towards making its infrastructure more energy efficient.



**MEASURE EE: I1 - RETROFIT TRAFFIC SIGNALS AND OUTDOOR LIGHTING**

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 EE: I2 - UPGRADE OR INCORPORATE WATER-CONSERVING LANDSCAPE**

The majority of California's current water sources require high-energy inputs. Pumping, treating, transporting, and heating water currently represents nearly 20% of the energy used across the state. Much of this energy use is the result of a heavy reliance on "imported" water, because the majority of California's water users are concentrated far from major water sources. One consequence of the energy used to transport water is high GHG emissions. Transporting water via California's State Water Project alone is 2% to 3% of the state's total energy and results in roughly 4 million tons of GHG emissions per year . Furthermore, water scarcity is going to exacerbated with climate change.

This underscores the importance of water conservation. Developing drought tolerant landscapes and encouraging the use of recycled water are two ways to improve the resiliency of water supply and hence reducing GHG emissions.

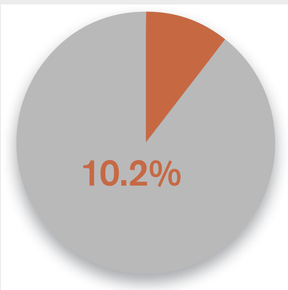

**MEASURE EE: I3 - PLANT TREES FOR SHADE AND CARBON SEQUESTRATION**

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.

# Solid Waste(SW)

**2020 GHG Reduction Potential**

SOLID WASTE




**Reduction of 2,799 MT CO2 e/yr**

100% equals all CAP GHG emission reductions from all CAP strategies. SW represents 10.2% reduction outlined in SW Chapter.

**Co-benefits**

**Public Health**

**Resource Conservation**

## Waste prevention and recycling - jointly referred to as waste reduction - help to better manage solid waste and reduce GHG emissions. Together, waste prevention and recycling:

- Reduce emissions from energy consumption: Manufacturing goods from recycled materials typically requires less energy than producing goods from virgin materials. When people reuse things or when products are made with less material, less energy is needed to extract, transport, and process raw materials and to manufacture products. Reduced energy demands lead to less combustion of fossil fuels and associated carbon dioxide (CO2) emissions.

- Reduce emissions from incinerators: Recycling and waste prevention allow some materials to be diverted from incinerators and thus reduce GHG emissions from the combustion of waste.

- Reduce methane emissions from landfills: Waste prevention and recycling (including composting) divert organic wastes from landfills, reducing the methane released when these materials decompose.

- Increase storage of carbon in trees: Trees absorb carbon dioxide from the atmosphere and store it in wood, in a process called "carbon sequestration." Waste prevention and recycling of paper products allow more trees to remain standing in the forest, where they can continue to remove CO2 from the atmosphere.

At the sub-regional level, the amount of GHG emission reductions achieved through Solid Waste reduction strategies is 10.2 percent and provides co-benefits of resource conservation and public health for communities and individuals throughout the sub-region.

A full list of SW Strategies along with references is available in the Appendix D. This CAP presents the solid waste goals and measures that most of the South Bay cities expressed interest in implementing. Cities selected the following SW goals and measures in consideration of its GHG reduction targets for 2020 and 2035 in support of the State of California 2050 GHG reduction goal. SW GHG reduction efforts undertaken by the Cities since 2012 (last inventory year) were included towards GHG emissions reductions of this plan.

## GOAL SW: A - INCREASE DIVERSION AND REDUCTION OF RESIDENTIAL WASTE

**Educating local communities about waste reduction is a key step for managing waste at the residential level. Better waste management practices lead to reduced energy consumption associated with waste removal and processing and associated GHG emissions.**


### MEASURE SW: A1 - EDUCATION AND OUTREACH TO THE RESIDENTS

Providing education and outreach to residents about opportunities to divert their waste away from the landfill will increase awareness of solid waste programs, encourage waste-reducing behaviors, and inspire participation in further environmental activities.

### MEASURE SW: A2 - IMPLEMENT RESIDENTIAL COLLECTION PROGRAMS TO INCREASE DIVERSION OF WASTE

Implementing collection programs for residents will divert waste from going to the landfill by providing opportunities for more recycling, composting, and source reduction.

## GOAL SW: B - INCREASE DIVERSION AND REDUCTION OF COMMERCIAL WASTE

**Education and providing better waste management options and tools to businesses will lead to a reduction in GHG emissions associated with processing and disposing of commercial wastes.**

### MEASURE SW: B1 - EDUCATION AND OUTREACH TO BUSINESSES

Providing education and outreach to businesses about opportunities to divert their waste away from the landfill will increase awareness of solid waste programs, encourage waste-reducing behaviors, and

### MEASURE SW: B2 - IMPLEMENT COMMERCIAL COLLECTION PROGRAMS TO INCREASE DIVERSION OF WASTE

Implementing collection programs for businesses will divert waste from the landfill by providing opportunities for more recycling, composting, and source reduction.

## GOAL SW: D - REDUCE AND DIVERT MUNICIPAL WASTE

**Increasing awareness through implementing education strategies are key to achieving waste reductions and diversion. Like residential and commercial sectors, the municipal sector will also benefit from implementing capacity building programs to educate employees about benefits and methods of waste reducing behaviors.**

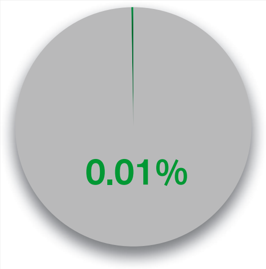
### MEASURE SW: D1 - EDUCATION AND PROGRAMS FOR MUNICIPAL EMPLOYEES/FACILITIES

Education to employees will increase awareness of solid waste programs, encourage waste-reducing behaviors, and inspire participation in further environmental activities. Some of these strategies are also very visible and will set an example for the community to follow. Reducing municipal waste will help the City lead by example and demonstrate to the community that the City is committed to diverting waste from landfills.

# Urban Greening (UG)

**2020 GHG Reduction Potential**

URBAN GREENING




**Reduction of 29 MT CO2 e/yr**

100% equals all CAP GHG emission reductions from all CAP strategies. UG represents 0.01% reduction outlined in UG Chapter.

**Co-benefits**

- Adaptation Strategy Support
- Air Quality
- Economy + Jobs
- Energy Conservation
- Public Health
- Resource Conservation

Urban greening includes spaces such as parks, forests, green roofs, local agriculture, street trees, and community gardens. These spaces are "carbon sinks" as they store greenhouse gas emissions that are otherwise emitted into the atmosphere. Other benefits include providing critical ecosystem services, promoting physical activities, improving the psychological well-being of the community, and reducing vehicle miles traveled.

At the sub-regional level, the amount of actual GHG emission reductions achieved through Urban Greening (UG) is negligible - less than 1 percent. While the calculated GHG reductions are small, it is important to note that urban greening, as a strategy to reduce GHG emissions for the South Bay cities, provides many advantageous co-benefits that are beneficial to communities and individuals throughout the sub-region.

A full list of UG Strategies along with references is available in the Appendix E. This CAP presents the urban greening goals and measures that most of the South Bay cities expressed interest in implementing. The Cities selected the following UG goals and measures in consideration of their GHG reduction targets for 2020 and 2035 and in support of the State of California 2050 GHG reduction goal.. While the chart (left) represents the total potential GHG emission reductions from all city selected strategies, the list below highlights only the most frequently selected measures.

## GOAL UG: A - INCREASE AND MAINTAIN URBAN GREENING IN THE COMMUNITY

**The expansion of green spaces in Urban areas, is a pathway for reducing the CO2 emissions and energy use. Urban vegetation reduces the CO2 concentration from the atmosphere via photosynthesis and by carbon sequestration through plant growth. It also reduces the energy use and CO2 emissions associated with water delivery by providing a medium for wastewater recycling and increased storm water retention.**


### MEASURE UG: A1 - INCREASE COMMUNITY GARDENS

Encouraging the community to create new gardens can contribute to GHG reductions by establishing new vegetated open space that will sequester CO2 from the atmosphere. Community gardens can also potentially reduce GHG emissions by providing the community with a local source of food. This measure may reduce the number of vehicle trips and miles traveled across the sub-region by both delivery service and the consumers who travel to grocery stores. It may also displace carbon-intensive food production practices.

### MEASURE UG: A2 - SUPPORT LOCAL FARMS

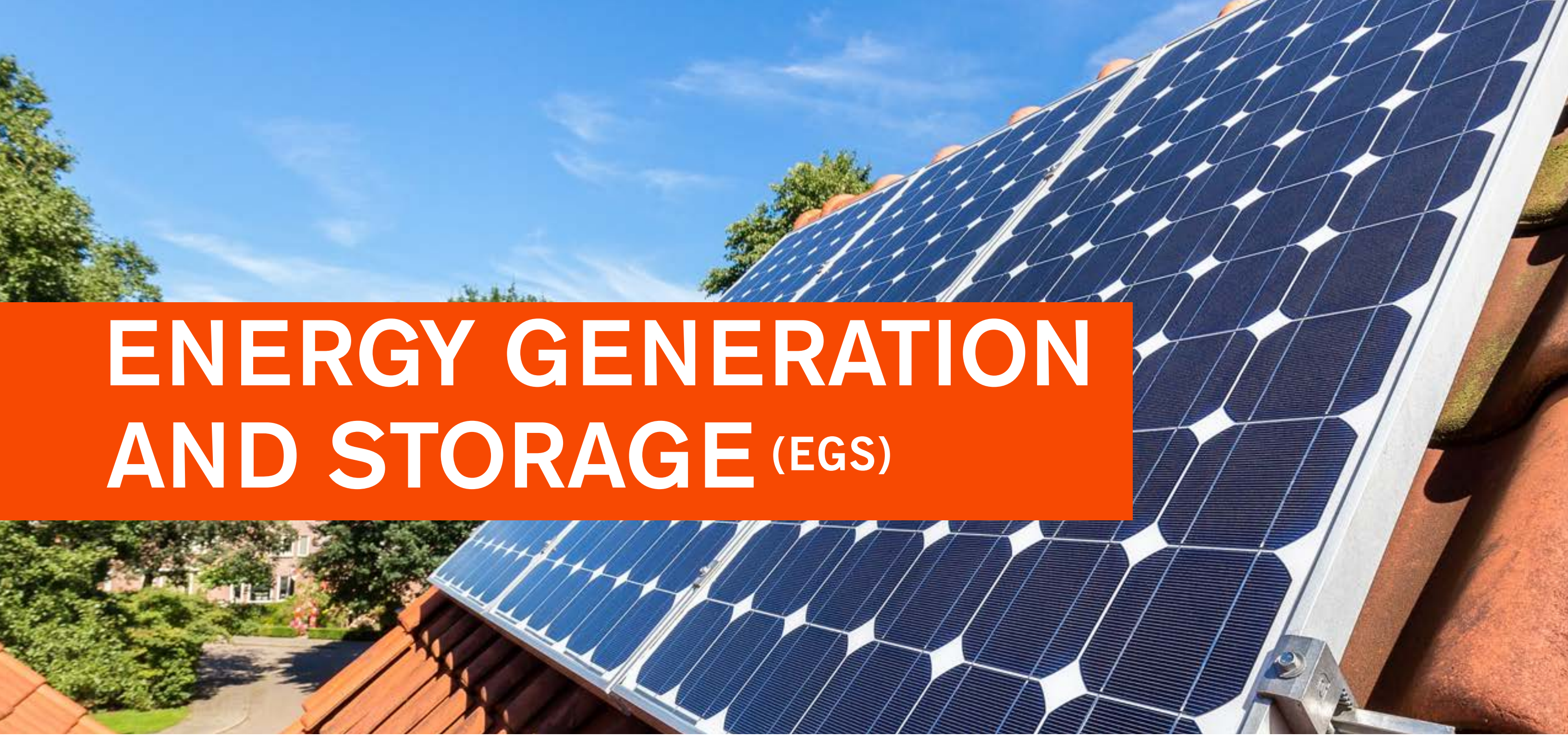
Local farmers markets reduce GHG emissions by providing the community with a more local source of food, potentially resulting in a reduction in the number of trips and vehicle miles traveled by both the food delivery service and the consumers traveling to grocery stores. If the food sold at the local farmers market is produced organically, it can also contribute to GHG reductions by displacing carbon-intensive food production practices.

## GOAL UG: B - INCREASE AND MAINTAIN URBAN GREENING IN MUNICIPAL FACILITIES

**Implementing urban greening strategies in municipal facilities will reduce GHG emissions while demonstrating to the community cities' commitment to improving the environment. Cities are also responsible for maintaining urban forest on municipal properties such as parks. Maintaining the urban forest reduces GHG emissions from decomposition of plant material.**


### MEASURE UG: B1 - RESTORATION/PRESERVATION OF LANDSCAPES

Urban and community forests broadly include urban parks, street trees, landscaped boulevards, public gardens, river and coastal promenades, greenways, wetlands, nature preserves, natural areas, and shelter belts of trees. Maintenance of landscapes is necessary to prevent the increase of emissions. If the urban forest is not maintained in the community, the decomposition of trees is a source of emissions.



# ENERGY GENERATION AND STORAGE (EGS)

**Co-benefits**

- Adaptation Strategy Support
- Air Quality
- Economy + Jobs
- Energy Conservation
- Public Health
- Resource Conservation
- Transportation System Improvement

## Energy generation and storage (EGS) strategies involve supporting clean renewable energy, and decreasing dependence on traditional, GHG-emitting power sources. Renewable energy technologies such as wind, solar, geothermal, hydroelectric, and biomass — provide substantial benefits for the climate, human health, and economy.

Some renewable energy technologies such as wind and solar have variable outputs which can cause them to generate power inconsistently. Storage technologies have the potential for smoothing out the electricity supply from these sources and ensuring that the supply of generation matches the demand. Different energy storage technologies such as thermal storage, compressed air, hydrogen, pumped hydroelectric storage, flywheels, and batteries contribute to electricity stability by working at various stages of the grid -- from generation to consumer end-use. The Cities in the South Bay recognize the importance of energy generation and storage and will continue to explore how some of these technologies can be used both locally and collectively, across the South Bay. Because these strategies are exploratory, the GHG reductions were not be quantified for this CAP. In the future, as the South Bay Cities Council of Governments and cities in the South Bay identify and implement EGS strategies, the associated GHG reductions will be quantified.

This CAP presents the EGS goals and measures that most of the South Bay cities expressed interest in implementing. A full list of EGS Strategies selected by the cities along with references is available in the Appendix F.

## GOAL EGS: A - SUPPORT ENERGY GENERATION AND STORAGE IN THE COMMUNITY

**To expand the usage of renewable energy generation and storage technologies, it is critical to implement the right policy tools and educate the public about the benefits of these technologies.**

### MEASURE EGS: A1 - COMMUNITY CHOICE AGGREGATION

Community Choice Aggregation (CCA) allows cities and counties, to combine the electricity demand of customers in their jurisdictions and procure electricity for these customers through their own generation or through the market. Benefits of aggregation include increased local control over electricity rates, possible savings to the customer, and the option to use more renewable energy.

### MEASURE EGS: A2 - SITING AND PERMITTING

To accelerate the implementation of renewable energy technologies, regulatory barriers need to be addressed to help ensure smooth deployment. Streamlining the siting and permitting process and reducing administrative burden to developers will help speed up the process of bringing these projects to reality.

### MEASURE EGS: A3 - POLICIES AND ORDINANCES

Robust policies will help scale up the implementation of renewable energy technologies and will also make users more resilient to interruptions in power supply and price variations, while promoting the benefits of new local industries.

### MEASURE EGS: A4 - EDUCATION AND OUTREACH

Educating communities about the renewable energy generation sources and energy conservation is important to cause change in society towards a cleaner and greener future. Education and outreach strategies need to be catered to different stakeholder groups to address some of the key challenges facing the implementation of these technologies at the local level.

### MEASURE EGS: A5 - EXPLORE TECHNOLOGIES IN MUNICIPAL FACILITIES

Cities that utilize renewable energy and storage technologies in municipal facilities can help to increase energy capacity for municipal operations.  These activities can also set an example for the community.

# Implementation and Monitoring


The Sub-Regional Climate Action Plan is a policy-level document that provides South Bay cities with guidance for the implementation of their city specific climate action plan GHG reduction measures. The SBCCOG's role for the successful implementation and monitoring of these plans is to assist cities through its mission of environmental advocacy and outreach as well as its role in facilitating and securing funding for implementing cities' climate action program strategies to lower their GHG emissions. Additionally, the SBCCOG's role is to assist South Bay cities in the preparation of climate change through inventory updates as well as aiding cities in the future development of climate adaptation plans and programs. The following sections outline key program areas for the SBCCOG to assist in monitoring, financing and outreach:

### Monitoring: Baseline and GHG Inventory Updates

South Bay cities' GHG inventories were collected and analyzed in 2014. To understand and monitor the impacts of cities' implementation efforts, updates to the inventories will need to occur. The SBCCOG, in cooperation with its Utility Partners, will work to provide this information through the following opportunities:

- Continue to provide South Bay cities with resources to participate in the utility companies' Energy Efficiency Programs. These programs include:
    - Energy Efficiency Benchmarking for Municipal Agencies
    - Energy Efficiency Leadership Program

- Solicit and/or respond to funding and grant opportunities (Strategic Growth Council; California Energy Commission; etc.) to update city and sub-regional inventories.

### Financing: Implementation and Adaptation Projects

The SBCCOG will continue to seek Local and State resources to fund sub-regional and city specific sustainability strategies that advance the goals and measures chosen by cities to reduce GHG emissions. This will range from innovative pilot projects to those that will be scalable based on previous work. The SBCCOG will solicit program specific and/or innovation grants from a multiplicity of funding sources including:

- Metro Transportation Funds
- California Energy Commission Funds, including EPIC and ARFVTP grants
- Workforce Investment and Community Development Grants
- Air Quality Mitigation Grants through the South Coast Air Quality Management District
- California Air Resources Board Funds, Including Climate Communities grants
- Other funding mechanisms, including Electrify America settlement

Table 9: Funding Sources

| Strategy | Federal Sources | State Sources | Local Sources |
|---|---|---|---|
| Accelerate the Market for Electric Vehicles | ▪ Recreational Trails Program (for NEVs)<br>▪ Economic Development Administration (EDA) Grant<br>▪ Surface Transportation Block Grant Program (STBGP) (multi-modal complete streets)<br>▪ Transportation Investment Generating Economic Recovery (TIGER) Grant | ▪ Infrastructure and Economic Development Bank - Infrastructure Revolving Fund Program<br>▪ Gasoline Taxes/Operations and Maintenance<br>▪ California Air Resource Board (CARB)<br>▪ California Energy Commission (CEC) | ▪ Transportation/Mobility Improvement Programs (Measure M)<br>▪ Southern California Edison Charge Ready Program<br>▪ South Coast Air Quality Management District (SCAQMD) Programs |
| Adopt Active Transportation | ▪ Surface Transportation Block Grant Program (STBGP)<br>▪ Economic Development Administration (EDA) Grant<br>▪ Recreational Trails Program (RTP)<br>▪ Safe Routes To School Program (SRTS) | ▪ Infrastructure Revolving Fund Program<br>▪ Gasoline Taxes/Operations and Maintenance<br>▪ Caltrans ATP Grant | ▪ Transportation/Mobility Improvement Programs (Measure M)<br>▪ Rule 20A Utility Set-asides<br>▪ Local Return on Measure M and Previous Initiatives<br>▪ Enhanced Infrastructure Financing District (EIFDs)<br>▪ Development impact fees |
| Integrate NOD | ▪ Surface Transportation Block Grant Program (STBGP)<br>▪ Community Development Block Grant (CDBG) Program<br>▪ Economic Development Administration (EDA) Grant | ▪ Infrastructure Revolving Fund Program<br>▪ Statewide Community Infrastructure Program<br>▪ Strategic Growth Council (SGC) Grant | ▪ Transportation/Mobility Improvement Programs (Measure M)<br>▪ Rule 20A Utility Set-asides<br>▪ Community Facilities Districts (CFDs)<br>▪ Community Revitalization and Investment Areas (CRIAs)<br>▪ Local Return on Measure M and Previous Initiatives<br>▪ Landscape and lighting districts (LLDs) |
| Transit Network Infrastructure | ▪ Surface Transportation Block Grant Program (STBGP) | ▪ Low Carbon Transit Operations Program | ▪ Los Angeles County Metropolitan Transportation Authority (Metro)<br>▪ Transportation/Mobility Improvement Programs (Measure M)<br>▪ Local Return on Measure M and Previous Initiatives<br>▪ Property and Business Improvement Districts (BIDs) |
| Land Use Element and Zoning Update (Affordable Housing) | ▪ Community Development Block Grant (CDBG) Program | ▪ Strategic Growth Council Transformative Climate Communities (TCC)<br>▪ Affordable Housing and Sustainable Communities (AHSC) Program | ▪ Property and Business Improvement Districts (BIDs) |
| Energy Efficiency | ▪ Solar America Cities Program<br>▪ Clean Cities program | ▪ Property Assessed Clean Energy Financing<br>▪ California Solar Initiative<br>▪ Financing Authority for Resource Efficiency in California<br>▪ Self Generation Incentive Program | ▪ Landscape and lighting districts (LLDs) |
| Waste, Greening, Energy Generation | ▪ EPA's Water Finance Clearinghouse<br>▪ Economic Development Administration (EDA) Grant | ▪ Low Carbon Transit Operations Program<br>▪ Reuse Assistance Grant Program | ▪ Community Facilities Districts (CFDs)<br>▪ Development impact fees |

### Sustainability projects for consideration will include strategies to:

- Promote the Electric Vehicles (EV) market
- Plan, install and maintain public EV charging infrastructure
- Identify opportunities where renewable energy technologies can be aggregated and used with battery storage to promote site specific and scalable Net Zero Micro-Grids
- Pilot projects to test renewable energy use such as community-based anaerobic digestors or urban geo-thermal technology
- Develop and implement a sub-regional "Slow-speed Network
- Identify Hazard mitigation and security Improvements
- Seek Workforce and community development programs
- Foster partnerships and programs in support of community health and wellness

### Environmental Advocacy and Public Outreach

Integral to the process of effective implementation is the engagement and education of city residents and businesses. Community education and involvement is essential to help the South Bay cities reach their GHG emission reduction goals. The SBCCOG will continue its outreach efforts through the program work and communications channels of its South Bay Environmental Service Center. Working with its environmental partners (including: SCE, The Gas Company, West Basin Water District, Los Angeles Department of Water and Power and the County Sanitation District and Los Angeles Metropolitan Transportation Authority) the SBCCOG will promote and market sustainability programs and information to South Bay residents and businesses. These include:

- Water Conservation
- Recycling Programs
- Home and Business Energy Efficiency Programs
- Renewable Energy Financing Programs
- Alternative Transportation Programs