

Appendix B - Methodology and Assumptions for GHG Quantification

OS-1 Open Space.

Maintain and increase the amount of open space in Sunnyvale consistent with the Parks of the Future Plan and the Open Space Element of the General Plan.

Action Items:

OS-1.1. Achieve and maintain an open space to population ratio of 5.5 acres per 1,000 residents.

OS-1.2. Provide availability and access to outdoor space for recreation or social purposes, including access to public open spaces on privately owned property.

Methodology:

The City of Sunnyvale Parks and Recreation Department completed the Parks of the Future Plan in November 2008. The plan states that Sunnyvale has a current park-to-population ratio of 5.5 acres of parkland per 1,000 residents. While the plan outlines ways in which the City can achieve a future ratio of 5.3 acres per 1,000 residents, this analysis assumes a more realistic target of maintaining the current park-to-resident ratio in 2020 and 2035. This would necessitate 113 more acres of parkland by 2020 and 226 more acres by 2035. This reduction measure assumes a rate of 10 new trees per acre of new parkland. This ratio is based on regional averages and observed practices. Total emissions reduction includes annual sequestration during a 40-year life cycle of open space vegetation and trees and avoided emissions from the reduction in electricity consumption as a result of direct shading and overall climate cooling. This measure assumes a distribution of 70% deciduous and 30% evergreen trees and a 30-60-10 distribution of large, medium, and small trees.

Sources:

City of Sunnyvale Parks and Recreation Department. 2008. Parks of the Future Plan.

McPherson, et. al. 2000. The potential of urban tree plantings to be cost effective in a carbon market.

OS-2 Outdoor Meeting Space.

Provide availability and access to outdoor space for recreation or social purposes, including access to public open spaces on privately owned property.

Action Items:

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Methodology:

This cost and greenhouse gas impact of this measure is unknown.

Sources:

N/A

OS-3 Urban Forestry.

Increase the number of shade trees planted in the community and protect the existing tree stock.

Action Items:

- OS-3.1. Continue to implement the City's Tree Preservation requirements.
- OS-3.2. Develop and implement canopy coverage requirements for City-owned parking lots, with exceptions for solar installations.
- OS-3.3. Promote tree planting on private property through incentive and support programs.
- OS-3.4. Expand existing park, open space, and boulevard tree inventory through the replacement of trees with a greater number of trees when trees are removed due to disease, park development, or other reasons.
- OS-3.5. Clarify codes and policies to maximize the preservation of the largest longest-living trees, and ensure the expansion of the urban forest over time as appropriate for the site.

Methodology:

Total emissions reduction includes annual sequestration during a 40-year life cycle of a forestry program and avoided emissions from the reduction in electricity consumption as a result of direct shading and overall climate cooling. The City of Sunnyvale maintains over 37,000 street trees. For this measure, we assume that there is one private property tree for every street tree in Sunnyvale and assume that the City will facilitate a 5% and 10% increase in trees by 2020 and 2035, respectively. This measure assumes a distribution of 70% deciduous and 30% evergreen trees and a 30-60-10 distribution of large, medium, and small trees. Distribution of trees is proportional to the distribution of the age of the city's building stock based on regional averages.

Sources:

McPherson, et. al. 2000. The potential of urban tree plantings to be cost effective in a carbon market

EC-1 Lighting Efficiency.

Increase the use of efficient indoor and outdoor lighting technologies.

Action Items:

- EC-1.1. Replace City-owned streetlights and park and parking lot lighting with energy-efficient lighting such as light-emitting diode (LED) or induction lights as technology becomes more affordable and when return on investment is less than five years.
- EC-1.2. Participate in an illumination bank that provides loans for upfront cost of energy-efficient lighting technologies to be paid back over 3–7 years.
- EC-1.3. Require new private parking lot lighting to use energy-efficient lighting technologies.

Methodology:

In 2007, the City completed a Climate Action Plan for City government operations. The CAP included an estimate of energy savings from LED streetlight replacements for the City's 8,862 streetlights. The kWh savings are for 2006 energy consumption; however, streetlight energy consumption is assumed to be consistent from year to year. Parking lot lighting is not quantified as part of this measure due to overlap with the City's Green Building Ordinance.

Source:

KEMA. 2007. City of Sunnyvale Climate Action Plan - City Operations.

EC-2 New Construction and Remodels.

Require green building practices in new residential and commercial development and remodels.

Action Items:

EC-2.1. Evaluate and update the 2009 Zoning Code for Green Buildings for single-family, multi-family, and non-residential building construction and major remodels every three to five years consistent with upgrades to the California Green Building Standards Code (CALGreen).

EC-2.2. Continue to require energy efficient siting of buildings. Buildings should be oriented and landscape material should be selected to provide maximum energy efficiency for the buildings.

EC-2.3. Continue to provide incentives for new construction and remodels to adhere to a higher green building standard than required by the City.

Methodology:

This measure calculates the impact of the adopted Sunnyvale Green Building Checklist for residential and non-residential buildings. The Build It Green and LEED checklists were analyzed for consistency with voluntary measures of the 2008 CALGreen Code and then analyzed using the 2008 Title 24 Impact Analysis completed by the California Energy Commission in 2007. Cost and savings to the community are based on the Pacific Gas & Electric analysis of a 15% of CALGreen standard for Sunnyvale's climate zone. The majority of City costs to update and maintain the Green Building Code are assumed to be covered by impact fees.

Sources:

California Building Standards Commission. 2010. 2010 California Green Building Standards Code. California Code of Regulations Title 24, Part 11. Sacramento, CA.

California Energy Commission. 2010. 2008 Title 24 Impact Analysis.
http://www.energy.ca.gov/title24/2008standards/rulemaking/documents/2007-11-07_IMPACT_ANALYSIS.PD

City of Sonoma. 2010. Analysis of CALGreen (California Green Building Standards Code) with Mandatory Tier 1 (CALGreen+Tier1) Compared to Existing City of Sonoma Green Building Requirements.
http://www.asgi.us/calgreen/CALGreenTier1_CityOfSonoma_analysis.pdf

City of Sunnyvale. 2010. Green Building Checklist.

Pacific Gas & Electric. 2010. Codes and Standards Title 24 Energy-Efficient Local Ordinances.
http://www.energy.ca.gov/title24/2008standards/ordinances/sancarlos/2010-12-29_pge_zone_3_Cost_Study.pdf

EC-3 Residential Energy Efficiency

Reduce residential energy use, with emphasis on existing homes built before 1990.

Action Items:

EC-3.1. Establish a residential energy conservation ordinance that requires home owners to perform and disclose energy and water audits at time of sale.

EC-3.2. Participate in a Property Assessed Clean Energy (PACE) or similar financing program to offer low-interest loans to residents for energy efficiency upgrades.

EC-3.3. Prioritize non-general funds to assist low-income home owners achieve energy efficient improvements. Program annual Community Development Block Grant (CDBG) funds to fund weatherization programs.

Methodology:

Residential Energy Conservation Ordinance (ECO): It is generally understood that the average person stays in a home for 5-7 years. To make a conservative estimate, assume that 30% of existing (pre 2008) homes are turned over between the time of this measure's implementation and 2020 and 75% are turned over between the time of implementation of this measure and 2035. Assume that 30% of owners will implement the energy saving recommendations of the audit. Average savings are estimated to be 25% for electricity and natural gas. The community and city costs of an ECO program are based on costs for the program in Berkeley, CA.

Property Assessed Clean Energy: This measure assumes a 15% and 30% participation rate for homes 2020 and 2035, respectively. Savings are only applied to owner-occupied homes. A 25% savings in electricity natural gas consumption is assumed per home and businesses based on the past performance of PACE programs and as summarized by the National Resources Defense Council (NRDC). The community and City cost of a PACE program is based on the NRDC paper.

Low Income Weatherization: The energy savings from low income weatherization programs such as LIHEAP or CARE are included based on past performance of these programs. According to the state of California, 46% of eligible households have been served by a low-income weatherization program. This percentage was applied to Sunnyvale's eligible households per the Housing Element.

Sources:

California Energy Commission. 2010. Nonresidential Building Energy Performance Rating Disclosure Regulations. Sacramento, CA.

City of Berkeley. 2010. Berkeley FIRST Initial Evaluation. Berkeley, CA.

City of Sunnyvale. 2009 General Plan Housing Element. Sunnyvale, CA.

State of California, Department of Finance. 2008. California Statewide Population.

State of California, Community Services and Development. 2009. CSD Helps Low-Income Families Manage and Reduce Energy Costs.
[http://www.csd.ca.gov/Contractors/documents/Energy%20tab/LIHEAP-DOE%20Fact%20Sheet%20\(2008\).pdf](http://www.csd.ca.gov/Contractors/documents/Energy%20tab/LIHEAP-DOE%20Fact%20Sheet%20(2008).pdf).

Natural Resource Defense Council. 2010. Property Assessed Clean Energy Programs White Paper.
<http://pacenow.org/documents/PACE%20White%20Paper%20May%203%20update.pdf>

EC-4 Commercial Energy Efficiency

Establish a regulatory and incentive-based structure that facilitates commercial and industrial energy efficiency and conservation.

Action Items:

EC-4.1. Consistent with California AB 1103, require all nonresidential building owners to disclose building energy consumption and building energy ratings upon sale.

EC-4.2. Participate in a Property Assessed Clean Energy (PACE) or similar financing program to offer low-interest loans to businesses for energy efficiency upgrades.

EC-4.3. Require all nonresidential buildings to complete energy performance reports every two years as a condition of approval for business licenses, with the first report occurring before 2018.

EC-4.4. Establish a program, in partnership with the City's energy provider, to retrofit commercial and industrial businesses according to the energy performance report. If commercial energy reduction targets are not being met, consider a mandatory retrofit program.

EC-4.4. Identify businesses that are likely to be the largest consumers of energy within the city and target City outreach to these businesses.

Methodology:

Commercial Energy Conservation Ordinance: Energy Conservation Ordinance (ECO): It is generally understood that the average person stays in a home for 5-7 years. To make a conservative estimate, assume that 35% of businesses turn over between now and 2020 and 60% by 2035. Assume that 30% of owners will implement the energy saving recommendations of the audit. Average savings are estimated to be 25% for electricity and natural gas. These reductions are exclusive of the cool roof and insulations savings accounted for in the 2008 Title 24 standards for non-residential alterations. The community and city costs of an ECO program are based on costs for the program in Berkeley, CA.

Property Assessed Clean Energy: This measure assumes a 5% and 12% participation rate for homes 2020 and 2035, respectively. Savings are only applied to owner-occupied homes. A 25% savings in electricity natural gas consumption is assumed per home and businesses based on the past performance of PACE programs and as summarized by the National Resources Defense Council (NRDC). The community and City cost of a PACE program is based on the NRDC paper.

Sources:

California Energy Commission. 2010. Nonresidential Building Energy Performance Rating Disclosure Regulations. Sacramento, CA.

City of Berkeley. 2010. Berkeley FIRST Initial Evaluation. Berkeley, CA.

Natural Resource Defense Council. 2010. Property Assessed Clean Energy Programs White Paper.

<http://pacenow.org/documents/PACE%20White%20Paper%20May%203%20update.pdf>

EC-5 Smart Meters

Increase awareness and utilization of real-time energy consumption data and pricing available through PG&E's SmartMeter program.

Action Items:

EC-5.1. Require new construction and major remodels to install interior real-time energy monitors.

EC-5.2. Connect businesses and residents with rebate programs that give priority to appliances with smart grid technology.

EC-5.3. Inform the community of metering options, such as online applications and in-home monitors.

Methodology:

The integration of smart grid technology and implementation of dynamic pricing programs will provide energy users with detailed information about their energy use and the costs of energy. Energy customers will be able to use these technologies to track and monitor energy use in real time to understand the relationship between energy consumption patterns and energy costs. Smart grid technology equips individuals to alter behaviors to use less energy and shift higher energy uses to times when the costs are lowest. Research on consumer energy use and the rate of feedback on those patterns has shown that the more frequently a consumer is reminded of the level/amount of energy they are using, the more they will change their behaviors to consume less energy. Utility companies have demonstrated that by providing instantaneous energy data in addition to monthly utility bills with total energy consumption and costs, consumers are equipped to more effectively manage energy consumption. New tools such as web-based applications or indoor energy monitors provide instantaneous and constant feedback on energy use and have been shown to reduce energy use by an average of 7%. PG&E installed Smart Meters on all customer buildings in 2010 and the first quarter of 2011. This measure estimates that in 2020, 50% of energy customers will reduce their energy use by 7% and that by 2035, 80% of customers will reduce their energy use.

In addition to behavioral changes, the development of new household appliances that can be programmed or timed to operate when energy prices fall below a certain point will also promote energy-saving behaviors. While the widespread availability of these appliances is dependent on the gradual reduction in cost that will result from increased consumer demand and product options, up to an additional 7% energy savings may be achieved for households or businesses that install these smart grid appliances. Requirements for new residential and commercial development to include these appliances will further reduce the community's energy use, and such requirements may yield a larger impact when coupled with incentives to encourage current energy users to purchase smart grid appliances when replacing washers, dryers, dishwashers, and other appliances. The Energy Star Program illustrates the phasing of market penetration for energy-efficient appliances and demonstrates the feasible rate of integration of smart grid appliances. The program was launched in 1990, and by 2010, 12% of all homes included Energy Star products. Assuming that smart grid appliances are available within the next few years, we can anticipate similar growth in market penetration to the Energy Star program. The percentage of new buildings to include smart grid appliances by 2020 and 2035 is based on the current number of new buildings that include Energy Star products.

Sources:

Ehrhardt-Martinez, K.; Donnelly, K.; & J. Laitner. 2010. Advanced Metering Initiatives and Residential Feedback Programs: A Meta-Review for Household Electricity-Saving Opportunities. American Council for an Energy-Efficient Economy. Report Number E105. <http://www.aceee.org/sites/default/files/publications/researchreports/e105.pdf>

Energy Star. 2008. Clothes Washer Product Snapshot. http://www.energystar.gov/ia/partners/reps/pt_reps_res_retail/files/CW_ProductSnapshot_May08.pdf

Energy Star . no date. Residential New Construction: An Overview of Energy Use and Energy Efficiency Opportunities. http://www.energystar.gov/ia/business/challenge/learn_more/ResidentialNewConstruction.pdf

Pike Research. 2010. Smart Appliance Sales. <http://www.smartgridnews.com/artman/publish/Smart-Grid-Press-Releases/Smart-appliance-sales-to-start-off-slow-but-118-million-units-will-be-sold-worldwide-by-2019-forecasts-Pike-Research-3290.html> and <http://www.pikeresearch.com/>

EC-6 "Cool" Roofs and Pavements.

Reduce the amount of dark, non-reflective roofing and paving material in order to mitigate the urban heat island effect and reduce energy associated with heating and cooling.

Action Items:

EC-6.1. Require all new and resurfaced parking lots, sidewalks, and crosswalks to be made of materials with high reflectivity, such as concrete or reflective aggregate in paving materials.

EC-6.2. Require new multi-family buildings and re-roofing projects to install 'cool roofs' consistent with the current California Green Building Code (CALGreen) standards for commercial and industrial buildings.

EC-6.3. Commit to using a warm aggregate mix for all asphalt patching, overlay, and reconstruction.

EC-6.4. Consider the lifespan and embedded GHG content of pavement materials for public projects.

Methodology:

This measure includes the GHG benefit of cool pavements. Cool pavements retain less heat than traditional pavement materials like black asphalt, causing urban surface temperatures to decrease and creating less demand for air conditioning in buildings. Please note that this measure does not include the GHG impact of cool roofs, which is included in the quantification of the 2008 CALGreen Code (State mandated).

Sources:

Hashem Akbari. Energy Savings Potentials and Air Quality Benefits of Urban Heat Island Mitigation. <http://heatisland.lbl.gov/>

Pomerantz, Melvin. 2010. EPA Presentation, "Cool Pavements for Cool Communities."

U.S. Environmental Protection Agency. 2005. Reducing Urban Heat Island Compendium of Strategies: Cool Pavements. <http://www.epa.gov/heatisd/resources/pdf/CoolPavesCompendium.pdf>

EP-1 Renewable Energy Portfolio.

Increase the renewable energy portfolio of electricity delivered to Sunnyvale so that more than 50% of delivered energy comes from renewable sources by 2035.

Action Items:

EP-1.1. Create a community choice aggregation (CCA) program for the City of Sunnyvale in order for the City to take control of power generation for its residents and businesses.

Methodology:

Under this measure, the City would create or participate in a community choice aggregation (CCA) program. The program could follow the structure of Marin Clean Energy, by operating as an opt-out program. Under this structure, energy customers in Sunnyvale would automatically be enrolled in the "light green" option. Customers could opt out and receive PG&E's default renewable energy mix or they could opt in to the "dark green" option and receive 100% renewable energy. The light green option is estimated to achieve a 50% renewable mix by 2020 and a 65% renewable mix by 2035. Based on the current status of the Marin CCA program, this measure assumes that 20% of energy customers would opt-out. Of the customers participating in the CCA program, 80% of customers in Sunnyvale would remain in the light green option, and 20% would sign up for the dark green option.

Sources:

CPUC. 2009. 33% Renewable Portfolios Standard Implementation Analysis Report. <http://www.cpuc.ca.gov/NR/rdonlyres/1865C207-FEB5-43CF-99EB-A212B78467F6/0/33PercentRPSImplementationAnalysisInterimReport.pdf>.

Marin Energy Authority. 2010. Marin Clean Energy Implementation Plan. http://marincleanenergy.info/images/stories/PDF/MEA_Implementation_Plan_Jan_2010.pdf

EP-2 Local Small-Scale Renewable Energy.

Increase the number of on-site renewable energy installations in the community.

Action Items:

EP-2.1. Require new homes and businesses and major remodels to be 'solar ready' by pre-wiring for solar water heating and solar electricity.

EP-2.2. Participate in a Property Assessed Clean Energy (PACE) or similar financing program to offer low-interest loans to residents and businesses for renewable energy installations (also included as E-2.2).

EP-2.3. Prevent buildings and additions from shading more than 10% of roofs of other structures.

EP-2.4. Continue to allow and encourage solar facilities above paved parking areas.

EP-2.5. Maintain incentives for alternative energy installations in new and existing development, including solar and small-scale wind turbines.

Methodology:

This measure includes the anticipated benefit of a Property Assessed Clean Energy (PACE) program or equivalent financing mechanism to the number of solar photovoltaic (PV) and solar hot water systems in Sunnyvale. Based on the performance of existing PACE programs like that of Sonoma County and Palm Desert, it is estimated that 15% of residents will participate in the program by 2020 and 30% by 2035. It is estimated that 5% and 12% of non-residential establishments will participate by 2020 and 2035, respectively. Of these participants, 80% will install a small-scale solar PV or solar thermal system along with their energy efficiency retrofit. According to an independent review of nationwide PACE programs, the average residential solar PV system is assumed to be 3.4 kW, based on current installations sizes in the City of Sunnyvale. The average non-residential solar PV system is assumed to contribute 80% of the establishment's annual energy load.

Community costs are based on the current cost per kW of solar. City cost to establish a PACE program is based on cost estimates from other Bay Area communities.

Sources:

California Energy Commission. 2010. Nonresidential Building Energy Performance Rating Disclosure Regulations. Sacramento, CA.

California Solar Initiative. 2011. California Solar Initiative Geographic Statistics. http://www.californiasolarstatistics.ca.gov/reports/locale_stats/

Go Solar California. 2010. http://www.gosolarcalifornia.org/professionals/2-17-10_CalFIRST_FACT_SHEET.pdf

City of Berkeley. 2010. Berkeley FIRST Initial Evaluation. Berkeley, CA.

City of Sunnyvale. 2009 General Plan Housing Element. Sunnyvale, CA.

State of California, Department of Finance. 2008. California Statewide Population.

State of California, Community Services and Development. 2009. CSD Helps Low-Income Families Manage and Reduce Energy Costs. [http://www.csd.ca.gov/Contractors/documents/Energy%20tab/LIHEAP-DOE%20Fact%20Sheet%20\(2008\).pdf](http://www.csd.ca.gov/Contractors/documents/Energy%20tab/LIHEAP-DOE%20Fact%20Sheet%20(2008).pdf).

Natural Resource Defense Council. 2010. Property Assessed Clean Energy Programs White Paper. <http://pacenow.org/documents/PACE%20White%20Paper%20May%2003%20update.pdf>

WC-1 Water GHG content.

Decrease the amount of GHG emitted as a result of filtering, moving, and treating water used within Sunnyvale.

Action Items:

WC-1.1. Prepare a feasibility study to expand the City's current recycled water program citywide.

WC-1.2. Promote "purple pipe" (reclaimed water) infrastructure in new construction or major renovation in preparation for a growing, usable network.

WC-1.3. Create a purple pipe network for citywide use of recycled water for irrigation and other outdoor purposes.

WC-1.4. Create flexible provisions and encourage residents and businesses to collect rainwater to use for irrigation purposes.

Methodology:

The greenhouse gas reduction potential of a greywater system is based on an estimate that local recycled water will increase from 6.9% of the water supply to 15% in 2020 and 25% in 2035. The GHG reduction benefit of this change is calculated using the methodology outlined by CAPCOA. Although this change will result in a lower GHG inventory, the energy reduction benefit will largely occur outside of Sunnyvale and therefore community savings are low-medium.

Sources:

Bay Area Water Supply & Conservation Agency. 2010. Annual Survey and Water Conservation Report Fiscal Year 2008-2009.

California Air Pollution Control Officers Association. 2010. Quantifying Greenhouse Gas Mitigation Measures.

WC-2 Water Conservation.

Reduce indoor and outdoor potable water use in residences, businesses, and industry.

Action Items:

WC-2.1. Require new development to reduce potable indoor water consumption by 30% (Tier 1 CALGreen) and outdoor landscaping water use by 40%.

WC-2.2. Revise development standards to ensure the use of greywater, recycled water, and rainwater catchment systems is allowed in all zones.

WC-2.3. Require new development to treat at least 40% of the average annual rainfall on-site through low impact development strategies.

WC-2.4. Require a minimum of 20% of the total parking, walkway, and porch area surfaces serving single-family and multi-family residential buildings under 4 units to be permeable.

WC-2.5. Require new open space and street trees to be drought tolerant.

Methodology:

This measure calls for the City to require new development to achieve 30% indoor water savings and 40% outdoor water savings consistent with the 2008 CALGreen Code. This requirement would be adopted as a mandatory component of the City's Green Building Code and would occur upon the next update of the City's Code. City costs are anticipated to be low in combination with the enforcement of the City's Green Building Code.

Sources:

Bay Area Water Supply & Conservation Agency. 2010. Annual Survey and Water Conservation Report Fiscal Year 2008-2009.

California Building Standards Commission. 2010. California Code of Regulations, Title 24: Part 11: California Green Building Standards Code.

http://www.documents.dgs.ca.gov/bsc/CALGreen/2010_CA_Green_Bldg.pdf.

LW-1 Materials Management.

Reduce the availability or use of common materials that are not recyclable or that are cost ineffective to recycle.

Action Items:

LW-1.1. Reduce the use of plastic bags at grocery stores and convenience stores in the community through incentives or requirements.

LW-1.2. Ban the sale or dispersal of disposable, single use plastic water bottles at public events permitted by the City.

LW-1.3. Ban the use of expanded polystyrene (EPS) take-out containers at restaurants and fast food facilities.

Methodology:

This is a supporting measure for LW-2, Recycling and Composting. The cost and savings to the community are currently unknown for a plastic bag ban.

Sources:

N/A

LW-2 Recycling and Composting.

Increase the amount of waste recycled and composted by 1% per year according to the City's Zero Waste Strategic Plan.

Action Items:

LW-2.1. Require multi- family homes to participate in the City's Multi-family Recycling Program

LW-2.2. Select materials to be targeted for diversion and diversion methods, services, or technologies based on the results of the Zero Waste Strategic Plan.

Methodology:

The GHG reduction benefit of this measure is based on the assumption that waste per person per day will decrease to 2 pounds per day (PPD) in 2020 and 0.5 PPD in 2035. The cost of this measure is unknown until the Zero Waste Strategic Plan is complete.

Sources:

Cal Recycle. 2011. Jurisdiction Diversion/Disposal Rate Summary.
<http://www.calrecycle.ca.gov/LGCentral/Tools/MARS/DrmcMain.asp>

OR-1 Lawn and Garden Equipment

Encourage residents and businesses to use efficient lawn and garden maintenance equipment or to reduce the need for landscape maintenance through native planting.

Action Items:

OR-1.1. Partner with BAAQMD to re-establish a voluntary exchange program for residential electric lawnmowers and backpack-style leaf blowers.

OR-1.2. Require new buildings to provide electrical outlets on the exterior in an accessible location to charge electric-powered lawn and garden equipment.

OR-1.3. In project review, encourage the replacement of high-maintenance landscapes (like grass turf) with native vegetation to reduce the need for gas-powered lawn and garden equipment.

Methodology:

The GHG reduction potential of switching leaf blowers and lawnmowers to electric from gasoline or diesel will result in decreased fuel consumption and air pollution but will also result in a small increase in electricity use to power this equipment.

Sources:

Bay Area Air Quality Management District. 2010. History of the Air District: 1995-200. <http://www.baaqmd.gov/Divisions/Communications-and-Outreach/News-Media-and-Features/History-of-Air-District-2005/1995--2000.aspx>

California Air Resources Board. 2007. Off-Road Software.

California Air Pollution Control Officers Association. 2010. Quantifying Greenhouse Gas Mitigation Measures.

OR-2 Construction Equipment

Reduce emissions from heavy-duty construction equipment by limiting idling and utilizing cleaner fuels, equipment, and vehicles.

Action Items:

OR-2.1. Idling times will be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure Title 13, Section 2485 of California Code of Regulations [CCR]), or less. Clear signage will be provided at all access points to remind construction workers of idling restrictions.

OR-2.2. Construction equipment must be maintained per manufacturer's specifications.

OR-2.3. Planning and Building staff will work with project applicants to limit GHG emissions from construction equipment by selecting one of the following measures, at a minimum, as appropriate to the construction project:

- a. Substitute electrified or hybrid equipment for diesel- and gasoline-powered equipment where practical.
- b. Use alternatively fueled construction equipment on-site, where feasible, such as compressed natural gas (CNG), liquefied natural gas (LNG), propane, or biodiesel.
- c. Avoid the use on on-site generators by connecting to grid electricity or utilizing solar-powered equipment.
- d. Limit heavy-duty equipment idling time to a period of 3 minutes or less, exceeding CARB regulation minimum requirements of 5 minutes.

Methodology:

Reducing maximum idling times from the State requirement of 5 minutes to 3 minutes will result in approximately 40% less fuel used for idling equipment. It is estimated that idling accounts for 5% of all fuel used in construction equipment. Additionally, voluntary conversion of construction equipment from diesel to CNG, electric, or biodiesel will result in fewer GHG emissions.

Sources:

California Air Resources Board. 2007. Off-Road Software.

California Air Pollution Control Officers Association. 2010. Quantifying Greenhouse Gas Mitigation Measures.

CA-1 Community Outreach and Involvement.

Educate and involve the community regarding actions they can do at home to reduce energy, water, waste, and fuel consumption.

Action Items:

CA-1.1. Create a structure or partner with other groups for volunteers, residents, and other organizations to help achieve Sunnyvale's sustainability goals.

CA-1.2. Provide regular communication with schools, business, faith groups, community members, and neighborhood groups to increase participation in the City's progress toward sustainability.

CA-1.3. Develop and encourage a mechanism for neighborhoods to share equipment and resources to improve sustainability.

CA-1.4. Provide a toolkit of resources, including web-based efficiency calculators, for residents and businesses to analyze their greenhouse gas emissions in comparison to their neighborhood, the city, and the region.

CA-1.5. Develop and implement a competitive greenhouse gas reduction program with an award component between groups of citizens in the city.

CA-1.6. Use sustainability initiatives within City operations to educate the community of ways to achieve sustainability by example.

CA-1.7. Actively promote use of alternative modes of transportation as safe modes of travel. When applicable, promote viable programs sponsored by 511.org, the Air District, and other recognized agencies on the City's website and publications.

CA-1.8. Through selected projects and efforts to improve City operations, demonstrate how sustainability efforts are possible and successful.

CA-1.9. Make comparison an intrinsic part of consumption. Bring awareness of how our consumption compares to other communities, regions, and others in our neighborhood.

CA-1.10. Use the City's Sustainability Commission and coordinator as a structure to coordinate with other groups for volunteers, residents, and other organizations to help achieve Sunnyvale's sustainability goals.

CA-1.11. Actively engage with Sunnyvale businesses to identify areas for GHG reduction and financial savings.

Methodology:

Community outreach is essential to the implementation of the CAP goals and measures; however, outreach does not have a direct GHG reduction.

Sources:

N/A

CA-2 School Education and Involvement.

Educate local school children about climate change and ways that they and their families can reduce greenhouse gas emissions.

Action Items:

CA-2.1. Use the Air District curriculum or other for local school teachers to teach children about climate change, greenhouse gas emissions, and local actions.

CA-2.2. Continue to provide and improve the bicycle driver education program for elementary, middle, and high school students.

Methodology:

Community outreach is essential to the implementation of the CAP goals and measures; however, outreach does not have a direct GHG reduction.

Sources:

N/A

LUP- Parking.

1

Reduce the amount of free or unrestricted parking available within the City to promote alternative modes of transportation and avoid unnecessary vehicle circulation.

Action Items:

LUP-1.1. Build and maintain an electronic parking management system for City-owned parking structures in the downtown and consider expanding to other City lots in the downtown and in proximity to other commercial areas.

LUP-1.2. Create maximum parking requirements and reduce minimum parking requirements for mixed-use development. Require parking lot sharing for mixed use or commercial development with complementary hours of operation.

LUP 1.3. Implement parking management tools for residential uses such as decreased or flexible standards, unbundled parking, and shared parking plans.

LUP-1.4. Establish parking meters throughout downtown Sunnyvale to optimize parking availability and reduce unnecessary vehicle circulation.

LUP-1.5. Establish a residential parking permit program for residential areas adjacent to commercial areas of the city where parking is in higher demand.

LUP-1.6. Designate street parking stalls in the vicinity of key commercial and multi-family residential locations for efficient or alternatively fueled vehicles.

Methodology:

This measure includes the GHG benefit of LUP-1.2 (Parking Requirements) and LUP-1.3 (Unbundle Parking Costs). The remaining measures are included in the City's Transportation Demand Forecast model or are not quantifiable.

Sources:

California Air Pollution Control Officers Association. 2010. Quantifying Greenhouse Gas Mitigation Measures.

LUP-2 Transit-Oriented, Higher Density, Mixed-Use Development.

2

Facilitate development in designated core and corridor areas that is transit-oriented, higher density, and mixed-use.

Action Items:

LUP-2.1. Continue to plan for most new residential, commercial and industrial developments in specific plan areas, near transit, and close to employment and activity centers.

LUP-2.2. Continue to identify underutilized areas that can support higher density housing and mixed-use development.

LUP-2.3. Facilitate the development of affordable housing near transit.

LUP-2.4. Expand the zoning opportunities for the construction of accessory dwelling units in existing residential neighborhoods near transit as a means to increase affordable housing near transit.

LUP-2.5. Continue to allow for the development of live/work spaces in commercial zoning districts and mixed-use residential zoning districts.

Methodology:

This measure includes the GHG benefit of increased density and greater below market rate housing. Density reductions are based on citywide changes in dwelling units per acre according to the City's Transportation Demand Forecast model. Finally, the benefit of below market rate housing is based on the assumption that 15% of new housing units in Sunnyvale will be deed-restricted below market rate.

Sources:

California Air Pollution Control Officers Association. 2010. Quantifying Greenhouse Gas Mitigation Measures.

LUP-3 Local Commerce and Food.

Increase the amount of locally generated and consumed goods in order to decrease the need for travel and promote healthier communities.

Action Items:

LUP-3.1. Amend the Zoning Code to allow small-scale, commercial urban farms to operate in residential areas.

LUP-3.2. Ensure that every village core has opportunities for growing produce locally.

LUP-3.3. Establish community gardens for public use.

LUP-3.4. Develop and implement a purchasing policy that requires food and other appropriate materials purchased by the City to be purchased from as local a supply as possible.

Methodology:

This measure does not have a quantifiable VMT or GHG reduction benefit.

Sources:

California Air Pollution Control Officers Association. 2010. Quantifying Greenhouse Gas Mitigation Measures.

LUP-4 Jobs/Housing Balance.

Plan for an improved jobs/housing balance in order to reduce the need for long-distance travel between residences and places of work.

Action Items:

LUP-4.1. Support the retention and expansion of local anchor and growth industries.

LUP-4.2. Review land-use plans and regulations and revise as needed to support additional live-work opportunities and home occupations, provided they are compatible with the existing neighborhood.

Methodology:

The benefit of destination and land use diversity is applied to mixed-use areas such as downtown Sunnyvale and Lawrence Station vehicle miles. These areas have a beneficial jobs/housing balance, a greater distribution of services, and higher density. The GHG benefit of this measure is shared between LUP-2 (Transit-Oriented, Higher-Density, and Mixed-Use Development), LUP-4 (Jobs/Housing Balance), and LUP-5 (Distributed Services).

Sources:

California Air Pollution Control Officers Association. 2010. Quantifying Greenhouse Gas Mitigation Measures.

LUP-5 Distributed Services.

Encourage the wider distribution of commonly-used facilities and services in order to reduce the need for or length of vehicular trips to and from places of work and residence. .

Action Items:

LUP-5.1. Encourage the establishment and even distribution of neighborhood-serving facilities such as day care providers, banking/ATM locations, markets, and drugstores in existing residential, commercial, and industrial areas in order to reduce the need for vehicle trips.

LUP-5.2. Require new development to reduce the need for external trips by providing useful services/facilities on-site such as an ATM, vehicle refueling, and shopping.

Methodology:

Quantifying the GHG reduction benefit of distributed services is difficult to separate from diversity of land uses and other transportation measures and has therefore been quantified as part of other transportation and land use measures.

Sources:

California Air Pollution Control Officers Association. 2010. Quantifying Greenhouse Gas Mitigation Measures.

CTO-1 Bicycle, Pedestrian, and Transportation Design Elements.

Create streets and connections that facilitate bicycling, walking, and transit use throughout the city.

Action Items:

CTO-1.1. Incorporate the provisions of AB 1358, the California Complete Streets Act of 2008, into all roadway design, construction, and maintenance activities.

CTO-1.2. Implement the street space allocation policy in coordination with road reconstruction or resurfacing projects to provide road configurations that accommodate all travel modes.

CTO-1.3. Require new development to provide cross-parcel access and linkages from the development entrance to the public sidewalk system, transit stops, nearby employment and shopping centers, schools, parks, and other parcels for ease of pedestrian and cyclist access.

CTO-1.4. Improve pedestrian safety and comfort through design elements such as landscaped medians, pedestrian-level amenities, sidewalk improvements, and compliance with Americans with Disabilities Act (ADA) design standards, particularly for areas serving high volumes of traffic.

CTO-1.5. Improve bicycle facilities and perceptions of comfort through pavement marking/coloring, physical separation, specialized signs and markings, and other design elements.

CTO-1.6. Require sidewalks to be a minimum of 6 feet wide in order to allow side-by-side walking at identified locations that currently serve high pedestrian traffic volumes or locations planned to serve high volumes of pedestrian traffic.

CTO-1.7. Actively promote intermodal linkages to and from regional transit options by establishing or improving well-defined, convenient intermodal hubs in downtown and specific plan areas. Work with the Valley Transportation Authority (VTA), Peninsula Corridor Joint Powers Board (PCJPB), the Advisory Committee on Accessibility (ACA), and others to establish best places for these locations.

CTO-1.8. Develop pedestrian thoroughfares throughout the city that significantly restrict motor vehicle access and greatly expand pedestrian and bicycle access. Businesses located along these routes should have no direct driveway entrance.

Methodology:

Providing a pedestrian access network to link areas within the City encourages people to walk instead of drive. This mode shift results in people driving less and thus a reduction in VMT.

Sources:

California Air Pollution Control Officers Association. 2010. Quantifying Greenhouse Gas Mitigation Measures.

CTO-2 Bicycle, Pedestrian, and Transportation Travel Operations.

2

Prioritize safe, efficient, and convenient access for non-automotive travel to destinations in and outside of Sunnyvale.

Action Items:

CTO-2.1. Require public areas and new development to provide bicycle parking consistent with the Valley Transportation Authority (VTA) Bicycle Technical Guidelines, as amended.

CTO-2.2. Require secure bicycle parking at public and large private events.

CTO-2.3. Update the City bicycle map to show locations of public and private bicycle parking. Create a web-based application for members of the public to identify locations of private parking for mapping purposes.

CTO-2.4. Fully fund the City's bicycle and pedestrian improvement plans for completion by 2035.

CTO-2.5. Remove crossing impediments and improve crossing time at signalized intersections for pedestrians and cyclists. Reduce crossing distances and provide center refuge areas for pedestrians and bicyclists to pause when crossing arterials.

CTO-2.7. Increase enforcement of pedestrian right-of-way laws.

CTO-2.8. Require drive-through food establishments to serve bicyclists as well as vehicles.

CTO-2.9. Create at least one day a year when a portion of streets and plazas are designated for pedestrian and/or bicycle access only.

CTO-2.10. Establish information kiosks at key city locations with information on alternative modes of transportation along with associated maps.

CTO 2.11 – Plan and implement a bike-sharing program for major commercial and industrial areas.

Methodology:

Providing infrastructure and facilities are both essential to facilitate non-automotive travel in Sunnyvale. Because the provision of both are essential, the GHG reduction benefit of this measure cannot be quantified separately from CTO-1.

Sources:

California Air Pollution Control Officers Association. 2010. Quantifying Greenhouse Gas Mitigation Measures.

**CTO-
3 Transit.**

Facilitate the use of public and private transit such as buses, Caltrain, Amtrak, and shuttles to and from Sunnyvale and within the city.

Action Items:

CTO-3.1. Continue sponsoring projects to provide transit rider amenities at bus stops and rail stations.

CTO-3.2. Work with the Valley Transportation Authority and neighboring jurisdictions to provide transit priority signal timing in order to decrease travel time.

CTO-3.3. Work with other agencies to provide High Occupancy Toll (HOT) lanes, and support expenditure of HOT lane revenue on projects that reduce vehicle miles traveled in Sunnyvale. Support regional congestion pricing measures.

CTO-3.4. Explore subsidizing a higher level of transit service or transit passes for residents and/or employees.

CTO-3.5. Advocate for transit service improvements by area transit providers consistent with established performance standards, with an emphasis on coordinating public transit schedules and connections.

Methodology:

The VMT reduction benefit of these measures are incorporated into the City's travel demand forecast model and to avoid double counting, this measure has been listed as a supporting measure.

Sources:

California Air Pollution Control Officers Association. 2010. Quantifying Greenhouse Gas Mitigation Measures.

CTO-4 Commute Programs.

Reduce single-occupant vehicle trips to major employers (100 employees or more) located in Sunnyvale.

Action Items:

CTO-4.1. Encourage employers to offer flexible work schedules that allow employees to telecommute or take off 1–4 days per month by providing resources, incentives, and education to businesses in Sunnyvale.

CTO-4.2. Connect residents and employees with an online system such as 511.org to identify carpool opportunities to and from Sunnyvale.

CTO-4.3. Require new major employers to provide a guaranteed ride home program for employees that ride transit, bicycles, carpools, or vanpools to work.

CTO-4.4. Require new major employers to provide parking “cash-out” programs.

CTO-4.5. Create a Transportation Demand Management (TDM) program for City staff to promote alternative transportation modes and carpooling to the greatest extent possible.

CTO-4.6. Continue to provide density and other zoning incentives or procedural or financial incentives to developments for establishment of alternative transportation infrastructure within the private as well as adjacent public right-of-way, such as increased bicycle parking, separated sidewalks, bike lanes and signage, and change and shower facilities.

CTO-4.7. Provide financial incentives for large employers to hire Sunnyvale residents by basing the business license fee on the number of non-resident employees.

Methodology:

A Commute Trip Reduction Program is a voluntary, multi-strategy program that encompasses a combination of individual measures such as transit fare subsidies, ride-share programs, parking permit programs, and alternative work schedules, among other opportunities. The quantification of this measure estimates that all employees within the Moffett Park Specific Plan would be eligible to participate, and approximately 25% of employees within other areas of the city would be likely participants.

Sources:

California Air Pollution Control Officers Association. 2010. Quantifying Greenhouse Gas Mitigation Measures.

CTO- School Commutes.

5

Encourage carpooling, bicycling, walking, and transit access to elementary, middle, and high schools so that the number of car trips is no more than 20% of the number of students at any school.

Action Items:

CTO-5.1. Support the creation of walking school bus programs in coordination with schools and parent organizations.

CTO-5.2. Encourage schools to link employees and guardians of students with an online system such as 511.org that provides carpool matching.

CTO-5.2. Continue to implement a Safe Routes to School program for increased bicycle and pedestrian safety to and from schools.

Methodology:

The VMT and GHG reduction benefit of this measure is not possible to quantify without a complete understanding of baseline conditions and behaviors at City schools.

Sources:

California Air Pollution Control Officers Association. 2010. Quantifying Greenhouse Gas Mitigation Measures.

OVT- Clean Alternative Motor Vehicles and Fuels.

1

Promote the use of clean alternative motor vehicles and fuels to reduce emissions from vehicular travel.

Action Items:

OVT-1.1. Designate preferred parking stalls for electric, hybrid, and other alternative fuel vehicles in all public and private parking lots consistent with the California Green Building Code.

OVT-1.2. Require electric vehicle recharging stations or other alternative fuel vehicle support infrastructure in private parking lots.

OVT-1.3. Require sufficient electrical service in the garages/parking facilities of new residential development to support electric vehicle charging.

OVT-1.4. Increase the number of efficient or alternatively fueled vehicles in the City fleet as vehicles are turned over.

OVT-1.5. Require all taxi franchises to use low-emissions vehicles such as hybrids, compressed natural gas (CNG) vehicles, biodiesel vehicles, or electric vehicles.

OVT-1.6. Explore zoning or other incentives to encourage alternative fuel stations like biodiesel and compressed or liquefied natural gas in place of or in combination with traditional gasoline and diesel fueling stations.

OVT-1.7. Subsidize the cost and installation of materials used to convert diesel vehicles to biodiesel fuel.

OVT 1.8. Facilitate new fueling stations that offer biodiesel fuel.

OVT-1.9. Accommodate neighborhood electric vehicles (NEVs) by providing infrastructure and regulations consistent with the California Vehicle Code and the Manual of Uniform Traffic Control Devices (MUTCD).

Methodology:

This measure quantifies the VMT and fuel savings impacts of expanded use of electric vehicles through the installation of public and private electric vehicle charging stations. It is anticipated that approximately 2% of all new parking spaces will be installed with electric vehicle charging stations. Neighborhood electric vehicles are also included in this measure and are an effective form of transportation for short trips and on appropriate streets. It is estimated that 800 households will have NEVs by 2020 and will reduce VMT from traditional vehicles by approximately 12%.

Sources:

California Air Pollution Control Officers Association. 2010. Quantifying Greenhouse Gas Mitigation Measures.

OVT-2 Car Sharing.

2

Promote the use of carsharing in Sunnyvale in order to establish and maintain at least one viable car share operation within the City by 2020.

Action Items:

OVT-2.1. Work with car sharing companies such as Zipcar and City Car Share to increase the availability of car share programs in Sunnyvale.

OVT-2.2. Identify appropriate locations, and require facilities for car share vehicles in new parking garages, job, centers, commercial cores, neighborhoods, and transit hubs.

Methodology:

The increased availability and participation in car-sharing programs has been found to decrease VMT and even car ownership. It is estimated that the expansion of car-sharing programs will result in an approximate 0.4% decrease in VMT.

Sources:

California Air Pollution Control Officers Association. 2010. Quantifying Greenhouse Gas Mitigation Measures.

OVT-3 Traffic Calming and Idling

Improve the flow and efficiency of vehicular traffic throughout the City as to avoid idling and greater fuel consumption.

Action Items:

OVT-3.1. Install traffic calming devices such as landscaped median barriers, traffic circles, and bulb-outs so as to reduce traffic speeds and idling on neighborhood streets.

OVT-3.2. Increase signal coordination as warranted to facilitate traffic flow along arterials and major collectors.

OVT-3.3. Deploy Intelligent Transportation Systems (ITS) measures for managing traffic of large-scale construction projects and at major City and private events.

Methodology:

Continuing to improve and renovate streets to accommodate all transportation user modes will provide a safer pedestrian environment and encourage residents to make trips by foot or other alternative modes instead of by car. This analysis estimates that traffic-calming features will encourage increased walking, resulting in a VMT reduction of 0.3%.

Sources:

California Air Pollution Control Officers Association. 2010. Quantifying Greenhouse Gas Mitigation Measures.

A-1 Regional Coordination

Participate in regional efforts such as that of the San Francisco Bay Area Conservation and Development Commission (BCDC) and the Joint Policy Committee (JPC) to analyze and prepare for the impacts of climate change in the Bay Area.

Action Items:

A-1.1. Appoint a staff liaison to attend and participate in regional meetings focusing on adaptation and resilience and to report back to staff on a regular basis.

Methodology:

N/A

Sources:

N/A

A-2 Preparedness

Ensure that Sunnyvale is prepared for potential environmental risks and hazards related to climate change, with a special emphasis on vulnerable populations such as seniors.

Action Items:

A-2.1. Regularly train and inform the Department of Public Safety Office of Emergency Services (OES) on potential climate change risks and hazards.

A-2.2. Update the City Emergency Plan and Emergency Preparedness Workbook to address climate change impacts.

Methodology:

N/A

Sources:

N/A

A-3 Adaptive Planning

Integrate potential climate change impacts into local planning documents and processes.

Action Items:

A-3.1. Analyze and disclose possible impacts of climate change on the project or plan area with an emphasis on sea level rise.

A-3.2. Integrate climate change adaptation into future updates of the Zoning Code, Building Code, General Plan, and other related documents.

Methodology:

N/A

Sources:

N/A

A-4 Monitoring

Monitor climate change science and policy and regularly inform stakeholders of new information.

Action Items:

A-4.1. Dedicate a page of the City's website to climate change and climate change adaptation.

A-4.2. On a regular basis, assess adaptation efforts of the City, region, and state and identify goals or gaps to be addressed.

Methodology:

N/A

Sources:

N/A