ENERGY AWARE PLANNING GUIDE INTRODUCTION

COMMUNITY ENERGY STRATEGIES

This section presents ways cities and counties can manage their energy use and energy supplies beyond those described in the transportation, land use, building, and water categories of the rest of this guide. Examples include distributed renewable generation on residential, commercial, and municipal facilities; procuring green electricity; promoting the local food movement; and reducing solid waste. Particular focus is given to identifying and financing renewable sources of energy. A number of innovative community energy strategies are being used in California to generate and finance alternative sources of energy, including:

» **Regional energy offices.** Some communities have set up regional entities to share staff and expenses in their energy reduction efforts. These regional energy offices have been able to identify funding, coordinate technical assistance, and assist in the implementation of energy efficiency programs that might otherwise have been off the radar screen of their constituents.

» **Locally produced energy sources.** Community choice aggregation (AB 117, Migden, Chapter 838, Statutes of 2006), signed into law in 2002, allows cities and counties, or groups of them, to procure or generate electricity for consumers within their jurisdictions. (Investor-owned utilities continue to provide transmission and distribution services.)

Solar photovoltaic panels on the roof of the Moscone Center.
Photo credit: San Francisco Public Utilities Commission.

» **Financial assistance programs.** In 2008, several communities set about establishing finance assistance programs to help constituents overcome the barrier to installing renewable energy systems and energy efficiency upgrades through municipal financing recovered on property taxes.

Community energy strategies are particularly important given that electricity is currently the second largest source of greenhouse gas (GHG) emissions in California (after transportation). Reducing the amount of GHGs generated from electricity will be essential for meeting the requirements of AB 32, California's Global Warming Solutions Act of 2006 (Núñez, Chapter 488, Statutes of 2006).

Community Strategies

C.1.1	Community Energy Authorities
C.1.2	Community Energy District Financing
C.1.3	Cool Communities
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CEC-600-2009-013-F-VI-E.1 • FEBRUARY 2011

COMMUNITY ENERGY AUTHORITIES

Some local governments may wish to undertake a very proactive role in managing energy efficiency, advancing renewable energy options, and even in generating electricity at the local level. This requires strong organizational frameworks that can directly focus on a complex subject that affects all local governments. The following are three examples of organizational frameworks communities are using to manage and/or produce local energy supplies.

1. Community Energy Authority

In 1984 the California Legislature enacted the Community Energy Authority (CEA) Act (Government Code 52000-52012). Its purpose was to provide a means for a city or county (or group of them through a joint powers agreement) to plan and implement a comprehensive energy strategy to encourage energy efficiency and conservation, and minimize the effect of future energy price increases. A CEA can be given bonding authority to generate the initial funds for renewable or efficiency projects.

2. Community Choice Aggregation

In 2002, the California legislature enacted AB 117 (Migden, Chapter 838, Statutes of 2002) Community choice aggregation (CCA) in California. CCA legislation allows cities and counties (or groups of them) to become the electric commodity provider for the electricity customers within their jurisdictions. The legislation allows the local governing body the authority to procure electricity from any source, including renewable sources, that can be transmitted through their existing utility. All customers must be given the chance to "opt out" of the program and remain customers of their existing utility. CCA can occur only in the service territories of the three investor-owned utilities (IOU) in California (Pacific Gas and Electric, Southern California Edison, and San Diego Gas & Electric) that will continue to provide transmission, distribution, billing and meter reading services.

Since 2003, the California Public Utilities Commission (CPUC) has been formulating the rules for CCA (R.03-10-003). As of early 2009, the CCA has yet to be successfully implemented although the San Joaquin Valley Power Authority near Fresno filed an implementation plan in 2008 with the CPUC, and Marin County has developed an implementation plan.

3. Regional Energy Offices

Some larger cities and counties have been able to sustain energy offices and/or staff due to their size (Los Angeles County), owning a municipal utility (San Francisco), or based upon their commitment (Santa Monica and Berkeley). But for many local governments, maintaining an energy focus except during times of crisis has not been possible. Regional energy offices have been established in Humboldt, San Diego, and Ventura counties to leverage energy resources and staff for greater benefit among residents, businesses, and public institutions countywide.

General Plan Language Ideas

» The city/county shall investigate establishing a community energy authority for implementing a comprehensive energy strategy.

» The city/county shall investigate the feasibility of creating a community choice aggregation program to provide electricity to its residential, commercial, and institutional constituents. The feasibility study should include the cost of providing ___ percent renewable content in the CCA electricity supply.

» The city/county shall investigate with neighboring jurisdictions establishing a regional energy office to share the cost of maintaining staff that can search out funding and technical assistance programs and help member jurisdictions implement energy efficiency, demand side management, and renewable generation programs.

Implementation Ideas

» **Fund a community energy authority feasibility study**.

» **Fund a feasibility study for a community choice aggregation program**.

» **Create a regional committee to investigate formation of a shared energy office**. Operational funding mechanisms could include a proportion of utility savings of the municipal facilities that benefit from the services of the office.

Examples of Energy Savings and Benefits

In its first five years, the Ventura County Regional Energy Alliance (VCREA) supported 107 energy efficiency projects by public agencies and nonprofit organizations that save more than 12.2 million kWh. During the 2006-2008 program cycle alone, 1,897 kW of demand reduction was achieved.[1]

The California Center for Sustainable Energy (CCSE) operated the Tax-Exempt Customer Incentive Program for military, public, or private K-12 schools, and local governments in the 2006-2008 public goods charge cycle. As of the end of 2007, more than 46 million kWh (89 percent of the goal) and 730,000 therms (760 percent of the goal) had been committed under the program.[2]

Environmental Benefits

The California Center for Sustainable Energy (CCSE) operates programs in the San Diego area. From 2004 through 2008, CCSE has sequestered or reduced 28,010 metric tons of CO_2e (equivalent to 79 million kWh of electricity) with the Cool Communities Shade Tree Program, the California Solar Initiative, the Solar Water Heating Program, and a group of energy efficiency programs. The CCSE also operates the Self-Generation Incentive Program (SGIP) in San Diego Gas & Electric's service territory. (SGIP carbon savings are not included in the number above because the program's benefits are still being assessed.)

Economics

A study sponsored by the California Energy Commission's Public Interest Energy Research (PIER) Program worked with 12 California cities and counties that were interested in using community choice aggregation as a way to increase the amount of renewable energy generated and consumed in their communities. Capital financing is less costly for public agencies than private companies such as utilities because of their tax-free bonding authority, lack of investor dividend payments, and no income tax liability. As a result, the study found it was feasible for CCAs to provide a higher renewable content (40 percent) to their customers at the same or lower rate as the IOUs' required renewable content (20 percent).

In its 2006-2008 public goods charge cycle, the Ventura County Regional Energy Alliance through its utility partnership program brought in almost $1.1 million in incentives for 72 energy efficiency projects in the county. The projects are estimated to save the public sector agencies and nonprofits almost $1 million per year in avoided utility costs. These incentives leveraged additional local dollars to complete the cost of improvement expenditures, a portion of which were directed to local suppliers, vendors, and contractors.[3]

Programs in Operation

The **San Joaquin Valley Power Authority** (SJVPA) is the first entity in the state to file a community choice aggregation implementation plan with the California Public Utilities Commission (CPUC). SJVPA is a joint powers authority of Kings County and 11 cities in the Fresno area. As the first potential CCA in the state, SJVPA's efforts have helped define the relationship between CCAs and investor-owned utilities, and the CPUC rulings that will govern those relationships. The SJVPA plans to phase in CCA service to municipal accounts first; then to large commercial and industrial customers; then to medium commercial customers; and finally to small commercial, agricultural, and residential customers. As of March 2009, the SJVPA had not started serving customers. http://www.communitychoice.info/sjvpa.

The **Marin Energy Authority** (MEA) is a joint powers authority formed to collectively study, promote, develop, and manage energy programs to address climate change. The MEA includes Marin County and eight cities located in the county. The MEA is the first joint powers agency established in California to reduce greenhouse gas emissions in compliance with California's global warming law, AB 32. Marin Clean Energy is a proposal under consideration by the Marin Energy Authority to directly buy renewable power collectively. If enacted, Marin Clean Energy would reduce Marin's greenhouse gas emissions by initially providing twice as much renewable power as PG&E. http://marincleanenergy.info.

The **California Center for Sustainable Energy** (CCSE) is a nonprofit corporation that helps residents, businesses, and public agencies save energy, reduce grid demand, and generate their own power through a variety of rebate, technical assistance, and education programs. CCSE evolved from the San Diego Regional Energy Office, which was created in the 1990s. CCSE provides the community with objective information, research, analysis, and long-term planning on energy issues and technologies. CCSE's mission is to foster public policies and provide programs, services, information, and forums that facilitate the adoption of clean, reliable, renewable, sustainable, and efficient energy technologies and practices. http://energycenter.org.

The **Ventura County Regional Energy Alliance** (VCREA) is a joint powers public agency that seeks funds to augment local government energy efficiency budgets with additional resources such as utility ratepayers' funds and grants. In addition to direct assistance to identify and implement energy efficiency projects, VCREA publishes a bimonthly newsletter, hosts technical training seminars, supports community events, maintains a local energy resource center, and provides customer information to libraries, Chambers of Commerce, and public agencies. Many services are specifically directed to local public agencies as well as nonprofit organizations. VCREA's governing board grew from four municipal members initially to nine diverse public member agencies as of 2009 and has become a mechanism for local elected officials, business, and community leaders to join forces and take action that leads to greater public awareness of energy efficiency and reliability. http://www.vcenergy.org.

The **Redwood Coast Energy Authority** (RCEA) develops and implements sustainable energy initiatives to reduce energy demand, increase energy efficiency, and advance the use of clean, efficient, and renewable resources available in the region. RCEA was formed in 2003 as a joint powers authority representing seven municipalities (the Cities of Arcata, Blue Lake, Eureka, Ferndale, Fortuna, Trinidad, and Rio Dell) and Humboldt County. The Redwood Coast Energy Information Center serves as a one-stop shop for energy efficiency information for residential, commercial/industrial, and public agency energy users in Humboldt County. http://www.redwoodenergy.org.

Resources

The **San Joaquin Valley Power Authority** maintains a website on community choice aggregation. http://www.communitychoice.info/about.

Information about the California Energy Commission's PIER Community Choice Aggregation project is available on the **Local Government Commission's** website at http://www.lgc.org/cca/index.html.

The **California Energy Commission** website hosts the final report for the PIER Community Choice Aggregation program (CEC-500-03-004). Appendices include reports on the CPUC decisions, sample data request letters for the utilities, a CCA implementation plan template, fact sheet, guidebook, and a sample business plan. http://www.energy.ca.gov/2008publications/CEC-500-2008-091.

Related Strategies

C.1.2 Community Energy District Financing
C.1.3 Cool Communities
C.2.1 Renewable Energy Resources
C.2.2 Distributed Generation

Endnotes

1. VCREA. 2008. *Ventura County Regional Energy Alliance 2008 Annual Report.* Ventura: Ventura County Regional Energy Alliance. http://www.vcenergy.org.
2. CCSE. 2007. *California Center for Sustainable Energy 2007 Annual Report.* San Diego: California Center for Sustainable Energy. http://digital.virtualmarketingpartners.com/vmp/CCSE/annual-report-08.
3. VCREA. 2008.

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COMMUNITY ENERGY DISTRICT FINANCING

According to the California Air Resources Board, about one-third of the greenhouse gases (GHG) emitted in California come from the electricity and natural gas sector, most of which is related to building energy use.[1] To meet the state's AB 32 goal of reducing GHG emissions by 2050, energy use in existing buildings must be dramatically reduced.

The largest impediment to implementing energy efficiency or renewable generation measures in existing structures has been the high initial cost, even if the investment will generate net cost savings in the future. Municipalities have worked to overcome this impediment by providing financing to property owners to make improvements, which the owner then repays over time via a voluntary contractual assessment on their property tax bill.

In 2007, the city of Berkeley developed a plan to set up an energy financing district to provide the initial funding that home and business owners would then repay on their property tax bills over a designated period. Berkeley enacted a Mello-Roos Special Tax through which to repay the funds rather than a contractual assessment. This tax commitment stays with the property so that upon sale it becomes the responsibility of the new owner who will reap the continuing benefit of the energy upgrade. AB 811 was enacted to allow non-charter cities and counties to implement this type of program.

The money to operate these programs and to provide the loans has come from various sources. The city of Palm Desert used money from its general fund. Others have approved bond financing (Boulder County, Colorado) or sought private financing (Berkeley). Sonoma County is using Treasury notes until a critical mass of loans have been made, at which time bonds will be issued. Regardless of where the program money comes from, the property assessment should cover all the costs associated with operating the program. (See the Economics section below.)

AB 811

AB 811 (Levine, Chapter 159, Statutes of 2008) authorized municipalities to implement certain innovative finance strategies to assist property owners in improving the energy efficiency of and adding distributed renewable energy generation to their buildings.

The municipality provides funds to the building owner to finance the energy improvement. In return, a voluntary contractual assessment is added to the property tax bill for a certain period. This assessment stays attached to the property even if the building is sold.

General Plan Language Ideas

» The city/county shall adopt an energy financing district program to help local residents and business owners install equipment to improve their buildings' energy efficiency and/or to generate clean, renewable energy. The program shall be cost-neutral to the city/county Staff shall investigate whether to join with other communities in a program or to do this program independently.

Implementation Ideas

There are several steps to adopting an AB 811 program:

» **Adopt a resolution of intention.** The resolution serves as notice to the community that an energy district financing program is under investigation.

» **Commission a staff report and public hearing.** The staff report should include whether the program should be independently operated, carried out under a joint powers authority with neighboring jurisdictions, or join the statewide effort by California Communities. (See Resources.) The report should identify and prioritize financing sources and ensure that the program costs can be recovered by the contractual assessment payments.

» **Adopt a resolution approving report and authorizing contracts and/or sale of bonds.**

Energy Savings

While California has the strictest energy standards in the country for new buildings, existing building stock, much of which was built before any energy standards, could use energy more efficiently. Contractual assessment financing district programs will increase the number of energy efficiency and renewal energy projects on existing buildings.

Energy efficiency is usually less expensive and more cost-effective than renewable energy projects, so it generally makes sense to undertake efficiency improvements first, or to combine them with renewable energy to reduce payback times. Some financing district programs require

Potential Legal Issues With Community Energy District Financing

AB 811 and Community Energy District Financing have raised some legal questions:

Is it appropriate to provide public funding for improvements that benefit private property owners? AB 811 states that there is a tangible public benefit to energy efficiency improvements to privately owned buildings.

- Do the property tax increases associated with funding community energy districts violate Proposition 218? **Proposition 218, passed in 1996, requires voter approval of all taxes and most other charges on property owners. Jurisdictions implementing these programs feel there is no conflict, since the AB 811 property tax assessment is voluntary.**

- Who owns the renewable energy or carbon credits associated with AB 811-funded energy improvements? **Do they belong to the property owners, the city/county providing the funding, the rebate providers, or the financers? In Sonoma County, the decision was made that the county, the water agency, and the transportation authority would jointly own the credits and would apply them toward the countywide reduction goals.**

- Can property owners choose to place a tax lien on their property that is superior to an existing mortgage on the property? **Cities and counties that currently operate these programs advise participants to check with their lenders on this issue. Some require commercial property owners to obtain consent and require residential property owners to notify lenders. This is programmatic rather than legislative.**

minimum energy efficiency compliance before participation is allowed. For example, Berkeley requires all properties to meet the standards of its residential energy conservation ordinance. Most, however, simply encourage investment in energy efficiency in advance of renewable energy improvements.

Environmental Benefits

AB 32 requirements for addressing greenhouse gas emissions from the building sector will be impossible to meet without addressing existing building stock. AB 811 programs help to overcome the hurdle of initial investment costs for efficiency improvements. In Sonoma County, building energy efficiency represents 12 percent of its community greenhouse gas reduction goal for 2015.

Economics

Many energy efficiency projects have payback periods of less than five years. Renewable energy installations have longer paybacks. If the cost of electricity rises, both kinds of investments will become more cost-effective. Ideally, the annual contractual assessment will be less than or equal to the utility energy savings of any individual project. After the assessment has been completely repaid, the energy savings continue for the property owner. Electricity costs are expected to rise in the future.

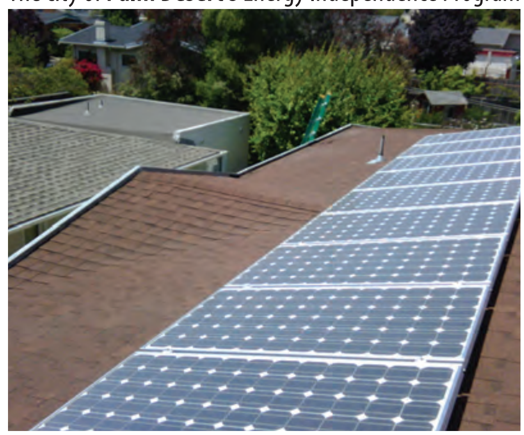
There are costs to a local government to develop and operate a district financing program including administration, district formation and validation, bond issuance (if bonds provide the financing), application processing, project verification, and a debt reserve fund (in case of default). All of these costs should be factored into the repayment schedule so that the program pays for itself.

These programs can facilitate green job development; at a minimum, the installation of the measures will be local, stimulating local economic growth:

Programs In Operation

Berkeley's Financing Initiative for Renewable and Solar Technology (FIRST) program is loosely based on "underground utility districts" where the city serves as the financing agent for a neighborhood when utility wires are moved underground. The city will provide the funding from a bond fund that it will repay through 20-year assessments on participating property owners' tax bills. The assessment is only placed on property owners who voluntarily use the program. The city requires all participants to comply with its Residential or Commercial Energy Conservation Ordinance. (See Strategies B.1.4 and B.1.5.) http://www.berkeleyfirst.renewfund.com

The city of **Palm Desert's** Energy Independence Program



Photovoltaic system on the first home in Berkeley to take advantage of the Berkeley FIRST program.
Photo credit: Community Energy Services Corporation

(EIP) is designed to help property owners save energy. The city has established a goal to reduce electric and natural gas energy consumption by 30 percent. Palm Desert intends to initially fund EIP with \$2.5 million for energy reduction investments that might not have otherwise been possible, with a maximum aggregate amount of \$25 million. The money is coming from the city's general fund. The city will make loans to property owners within the city to finance the installation of energy improvements. Property owners in the city will repay EIP loans through an assessment levied against their property, which is payable in semiannual installments on property tax bills. http://www.cityofpalmdesert.org/Index.aspx?page=484.

The **Sonoma County** Energy Independence Program (SCEIP) allows Sonoma County property owners to take loans from the county to install water conservation, energy efficiency, and renewable energy improvements. The loans are paid back along with the participants' property taxes over a period of up to 20 years. Because the loans are paid back, with interest, the program is cost-neutral. The SCEIP offices opened in March 2009 and had received $6.5 million in requests by the end of May. http://www.sonomacountyenergy.org.

The **ClimateSmart Loan Program** provides a voluntary mechanism for commercial and residential property owners to obtain financing for renewable energy and/or energy efficiency improvements to properties in Boulder County, Colorado. The program requires participants to pay for its administration so that there is no additional tax burden on those who choose not to participate. To accomplish this, residential loan applicants submit a $75 application fee via a Web interface at the time they apply. Voters approved $40 million in bonding capacity for the program. http://www.beclimatesmart.com.

Resources

The **California Statewide Communities Development Authority** (California Communities) is a joint powers authority sponsored by the California State Association of Counties and the League of California Cities. In the fall of 2009, the California Communities is expected to start a statewide program to help local governments develop and operate AB 811-type programs. Renewable Funding and the Royal Bank of Canada Capital Markets have been selected as the administrative and financing team for the project. Statewide program benefits are expected to include reducing the legal, administrative, and financing burden on a city or county; achieving economies of scale to reduce overall cost to the local government and property owner; and creating a standard program design that is easier to market and replicate. http://www.cacommunities.org.

Related Strategies

B.1.4 Retrofitting Residences
B.1.5 Retrofitting Commercial Buildings
C.1.1 Community Energy Authorities

Endnotes

1. California Air Resources Board, Greenhouse Gas Inventory, using 2004 estimates for electricity production and household natural gas use. http://www.arb.ca.gov/cc/inventory/archive/tables/ghg_inventory_ipcc_90-04_all_2007-11-19.pdf.

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ENERGY AWARE PLANNING GUIDE C.1.3

COOL COMMUNITIES

Buildings, streets, and other paved surfaces – and a consequent lack of vegetation – dominate modern urban areas. Because those surfaces absorb sunlight, which is then reradiated as heat, the local climate becomes warmer – a typical city is about 5°F hotter than the surrounding rural area on a clear summer afternoon – in what is called the "urban heat island effect."[1] This results in increased electricity use for cooling as well as reducing the overall habitability of the city. Researchers have studied ways to reduce the urban heat island effect and have identified vegetation – particularly shade trees, reflective "cool roofing" materials, and "cool pavements" as effective mitigation strategies.

Trees

Trees and vegetation lower surface and air temperatures by providing shade and through evapotranspiration, where plants release moisture through their leaves. Shaded surfaces may be 20-45°F cooler than the peak temperatures of unshaded materials. Evapotranspiration, alone or in combination with shading, can help reduce peak summer temperatures by 2-9°F.[2]

Trees and vegetation are most useful as a mitigation strategy when planted in strategic locations around buildings or to shade pavement in parking lots and on streets. Researchers have found that planting deciduous trees or vines to the west is typically most effective for cooling a building, especially if they shade windows and part of the building's roof.[3]

Tree shaded neighborhoods are cooler and use less energy than unshaded ones.
Photo: Local Government Commission

Green Roofs

A green roof, or rooftop garden, is a vegetative layer grown on a rooftop. Green roofs provide shade and remove heat from the air through evapotranspiration, reducing temperatures of the roof surface and the surrounding air. On hot summer days, the surface temperature of a green roof can be cooler than the air temperature, whereas the surface of a conventional rooftop can be up to 90°F warmer.[4]

Cool Roof

Cool roofs are highly reflective and emissive (releasing infrared energy) materials that stay 50-60°F cooler in the summer sun, thereby reducing energy costs, improving occupant comfort, cutting maintenance costs, increasing the life cycle of the roof, and contributing to the reduction of urban heat islands and associated smog.[5] In addition, reflective surfaces actually offset global warming. Carbon in the atmosphere traps heat but allows light to pass through. Sunlight striking a dark surface is absorbed and reradiated as heat, while sunlight striking a white surface is reflected back into space. Replacing a 1,000 square foot dark roof with a white roof can offset roughly 10 metric tons of carbon emissions.[6]

Because it reflects the highest proportion of light, bright white roofs have the greatest impact and are appropriate for flat and low-sloping roofs. "Cool color" roofing materials are also becoming available at low additional cost. These materials can have double the reflectivity of their standard counterparts and include tile, metal, and composition shingles. They look the same because the pigments used have the same reflectivity in the visible spectrum but higher reflectivity in the infrared and near-infrared.

Title 24, California's Building Energy Efficiency Standards, now requires flat roofs to be white roofs, and credit is given for cool colors in some climate zones. The California Air Resources Board is also about to begin crediting roof albedo as a strategy to reduce greenhouse gases under AB 32 implementation.

Cool Pavement

Cool pavement refers to paving materials that reflect more solar energy, enhance water evaporation, or have been otherwise modified to remain cooler than conventional pavements. In typical applications, concrete paving has higher reflectivity than asphalt. For asphalt, the surface wears quickly to the color of the aggregate, so lighter color aggregate is preferred. Research is underway to develop and test cooler paving materials.

The Mayor of Palm Desert on the City Hall's cool roof.
Photo: Local Government Commission

Conventional paving materials can reach peak summertime temperatures of 120-150°F, transferring excess heat to the air above them and heating stormwater as it runs off the pavement into local waterways. Due to the large area covered by pavements in urban areas, they are an important element to consider in heat island mitigation.[7]

General Plan Language Ideas

» The city/county shall commit to developing a strategy to reduce the urban heat island effect of the built environment. The strategy shall be included in the community energy plan (or climate action plan.)

Implementation Ideas

» **Adopt a resolution stating the city/county's awareness of and interest in developing a heat island mitigation strategy**.

» **Implement an urban heat island mitigation project** such as a cool roof, green roof, or cool pavement project at a municipal facility. Revise bid specifications to include cool products.

» **Adopt a parking lot shade ordinance** as a cool community strategy that also lowers evaporative emissions from parked cars.

» **Provide incentives, such as density bonuses or expedited permitting, for projects that voluntarily incorporate cool communities strategies**.

» **Include a cool roof or green roof requirement** in the city/county's local green building ordinance.

Energy Efficiency in California

In 1973, Europe used roughly one half as much energy per capita as the United States, yet they weren't freezing and in the dark. How, then, did the Europeans maintain a similar standard of living with half of the energy use intensity? I realized one day that my office used about one kilowatt of energy for lighting, and the hallway between my office and car used about 20 kW. If I turned off all these lights over the weekend, I would save more petroleum than what my car would use. However, it was not an easy task – the light switches were covered with posters and bookcases and had never been turned off. An hour later, after reorganizing and turning off all the switches, I left for home thinking something was hopelessly wrong.

It turns out things were not so hopeless. Energy awareness and efficiency have improved dramatically since the 1970s in California. Between 1975 and 2005, per capita electricity sales in the United States increased by 52 percent, while California increased by only 2.8 percent. The Energy Commission attributes one-third of this difference to state energy efficiency standards put into place during this time. For example, refrigerators have progressively grown in size since the late 1970s, yet have managed to improve in efficiency 5 percent every year. Now, refrigerators are larger and have more features, but use one-quarter of the energy they would have before standards.

There are still innumerable opportunities for energy savings in the future. Using light-reflecting colors and materials on roofs, known as cool roofs, can decrease the temperature of a building, resulting in up to 20 percent lower electrical demand from air conditioning. Cool roofs also help mitigate the urban heat island effect – a phenomenon where dark colors used in urban areas, such as black asphalt and roofing, absorb solar radiation and generate heat, raising ambient temperatures as much as 10 percent. Simply put, a cool roof will save money on air conditioning bills as well as increase comfort. Other technologies, such as electric motors, air conditioning, lighting, and programmable thermostats, show similar potential.

Historically, energy efficiency upgrades have been the most cost-effective method of reducing energy use and greenhouse gas emissions. While many suggest we need to follow a path towards renewable energy independence – which we must – energy efficiency is an often overlooked solution that should be pursued first for greater and more cost-effective energy use reductions. Energy efficiency is the low-hanging fruit. Local governments are in a position to be leaders in these fields and the California Energy Commission is here to help you identify, understand, and benefit from energy efficiency opportunities.

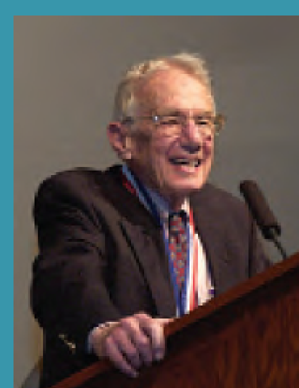

Photo: Energy Commission

Dr. Arthur H. Rosenfeld
Former Commissioner
California Energy Commission

Energy Savings

Measures that reduce the urban heat island effect can save energy directly and indirectly. Direct energy savings come from measures that keep buildings cooler, such as cool roofs and shade trees, and reduce the need for air conditioning. Indirect savings come from measures that reduce the ambient temperature in a neighborhood and thus further reduce the need for air conditioning. Indirect measures include cool pavements, cool roofs, and evapotranspiration from plants.

During the summer, a typical dark roof is 150-190°F at peak, while cool roofs peak at 100-120°F.[8] A cool roof transfers less heat to the building below, so the building stays cooler and uses less energy for air conditioning. In addition, it radiates less heat, thus reducing the local air temperature.

Environmental Benefits

Trees, vegetation, and green roofs can reduce heating and cooling energy use and associated air pollution and greenhouse gas emissions, remove air pollutants, sequester and store carbon, help lower the risk of heat-related illnesses and deaths, improve stormwater control and water quality, reduce noise levels, create habitats, improve aesthetic qualities, and increase property values.

Cool pavements can indirectly help reduce air pollution and greenhouse gas emissions. Depending on the technology used, cool pavements can improve stormwater management and water quality, increase surface durability, enhance nighttime illumination, and reduce noise.

Reflective urban surfaces and shade trees reduce smog. A national laboratory study simulated the cooling achieved by increasing the solar reflectance of roofs and roadways in the Los Angeles Basin. The results showed a 4°F cooling by noon, when smog is forming rapidly. Putting these results into the Los Angeles smog model then predicted a reduction in population-weighted smog of 10-20 percent.[9]

Widespread implementation of these strategies also provides additional benefits. For example, a single cool roof will mainly result in benefits to the building owner and occupants. Communitywide cool roof installations, though, will provide savings to the building owner and occupants and to the community at large, as a large number of cool roofs can reduce air temperatures, resulting in multiple benefits associated with cooler summertime air.[10]

Economics

Through direct shading and evapotranspiration, trees reduce summer cooling energy use in buildings at about 1 percent of the capital cost of avoided power plants plus air-conditioning equipment. Cool surfaces are more effective than trees and cost little if color changes are incorporated into routine reroofing and resurfacing schedules. In addition, the results from light-colored surfaces are immediate, while it may be 10 or more years before a tree is large enough to produce significant energy savings.[11]

Although the benefits of urban forestry can vary considerably by community and tree species, they are almost always higher than the costs. A study of five cities' urban forestry programs found that, on a per-tree basis, the cities accrued benefits ranging from about $1.50-$3.00 for every dollar invested. These cities spent roughly $15-$65 annually per tree, with net annual benefits ranging from approximately $30-$90 per tree.[12]

While the initial costs of green roofs are higher than those of conventional materials, building owners can help offset the difference through reduced energy and stormwater management costs, and potentially by the longer lifespan of green roofs compared with conventional roofing materials.

A California study found that cool roofs provide an average yearly net savings of almost 50 cents per square foot. This number includes the price premium for cool roofing products and increased heating costs in the winter as well as summertime energy savings, savings from downsizing cooling equipment, and reduced labor and material costs over time due to the longer life of cool roofs compared to conventional roofs.[13]

Comparing the costs of cool pavements with those of conventional paving materials is difficult. The cost of any pavement application varies by region, the contractor, the time of year, materials chosen, accessibility of the site, local availability of materials, underlying soils, size of the project, expected traffic, and the desired life of the pavement.

Programs in Operation

Cool roofs have been required since 2005 for new commercial flat roof construction under California's Title 24. The 2008 update to Title 24 will include some requirements for sloped roofs, residential construction, and some reroof projects.

California Center for Sustainable Energy's Cool Communities Shade Tree (CCST) Program has had direct energy benefits. The program provided 17,398 shade trees since 2006, which will result in an electric demand reduction of 2,958 kW and a total energy savings of 2.7 million kWh per year on average over the next 20 years. Since its inception in 2002, CCST has provided hands-on education and more than 35,000 trees to thousands of residents in San Diego County. http://energycenter.org.

Since 1990, the **Sacramento Municipal Utility District (SMUD),** in collaboration with the Sacramento Tree Foundation, has planted more than 450,000 trees in the Sacramento area. Together they provide expert advice on tree selection and planting techniques, as well as healthy trees from four to seven feet tall and stakes, ties, fertilizer, and tree delivery at no cost. SMUD has developed a web-based Tree Benefits Estimator that will assess the amount of energy savings and pollution removed when mature trees are planted in urban and suburban settings. In addition, SMUD funds another urban heat-island mitigation effort, Community Shade. The program offers free 15-gallon container trees for planting in public areas such as parks, playgrounds, and schools. http://www.smud.org/en/residential/trees/Pages/index.aspx.

Since 1983, an ordinance in **Sacramento's** zoning code has required that enough trees be planted to shade 50 percent of new or significantly altered parking lots after 15 years of tree growth. Sacramento's Parking Lot Tree Shading Design and Maintenance Guidelines: http://www.cityofsacramento.org/planning/long-range.

In 2001, **Portland, Oregon,** modified its zoning code to include an "eco-roof development bonus" for developers to install rooftop gardens or "eco-roofs." Title 33 of the Zoning Code contains a floor area ratio bonus for projects that install eco-roofs in Portland's central district. The bonus amount depends on the extent of the eco-roof coverage. If the eco-roof covers 60 percent or more of the roof surface, developers can build an additional three square feet for each square foot of green roof. If the green roof covers a lower percent of the surface, the bonus is reduced. Portland's Zoning Code (Section 33.510) is available at: http://www.portlandonline.com/auditor/index.cfm?c=28197.

The city of **Chicago** installed a green roof on its city hall that includes 20,000 plants, shrubs, grasses, vines, and trees. The city expects to save directly more than 9,270 kWh per year of electricity and nearly 740 million British thermal units (Btu) per year of natural gas for heating. This energy savings translates into about $3,600 annually, and savings will increase with higher energy prices. In addition to assessing energy impacts, the green roof has been designed to test different types of rooftop garden systems, success rates of native and nonnative vegetation, and reductions in stormwater runoff. This city hall green roof has helped to raise the visibility of green roofs and to increase public understanding of them.

After the success of its green roof demonstration project, Chicago established green and cool roof grant programs. In 2005, its first year, the program supported 20 green roof installation projects; in 2006, it helped fund four projects. Recipients can use grants for residential, commercial, or industrial buildings.

Resources

The **San Joaquin Valley Power Authority** maintains a website on community choice aggregation. http://www.communitychoice.info/about.

Information about the California Energy Commission's PIER Community Choice Aggregation project is available on the **Local Government Commission's** website. http://www.lgc.org/cca/index.html.

The **California Energy Commission** website hosts the inal report for the PIER Community Choice Aggregation program (CEC-500-03-004). Appendices include reports on the CPUC decisions, sample data request letters for the utilities, a CCA implementation plan template, fact sheet, guidebook, and a sample business plan. Website: http://www.energy.ca.gov/2008publications/CEC-500-2008-091.

Related Strategies

L.3.1 Complete Streets and Street Design
L.3.2 Street Trees

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RENEWABLE ENERGY RESOURCES

The state of California has adopted a preferred order for meeting future energy needs: efficiency and conservation first, then renewable generation, distributed generation, and finally, clean and efficient fossil fuel generation. California provides resources to implement this "loading order" through public good programs operated and/or overseen by the electric and gas utilities, the California Public Utilities Commission (CPUC), and the California Energy Commission.[1]

California has also enacted legislation to support renewable energy generation through a renewable portfolio standard (RPS) for private utilities overseen by the CPUC (20 percent renewable generation by 2010, with a goal of 33 percent by 2020), and the California Solar initiative, which has a goal of one million solar (photovoltaic and thermal) roofs totaling 3,000 megawatts by 2017. Publicly owned utilities set their own RPS goals recognizing the intent of the Legislature to attain a target of 20 percent of California retail sales of electricity from renewable energy by 2010.[2]

The electric utilities publish their Power Content Labels that disclose the percentage of electricity they supply by source (nuclear, natural gas, hydro, wind, solar, geothermal.) This information will provide a city or county with the percentage renewable versus nonrenewable electricity it consumes. When combined with electric consumption figures for municipal facilities and for the community as a whole, an estimate of greenhouse gas emissions is possible. Most California utilities can provide communitywide data on request.

Feed-in tariffs offer a price guarantee to eligible renewable generators over a certain period. Feed-in tariffs are in use in Europe (for example, Germany, Spain, Great Britain) and have increased the amount of renewable energy production there. Recently, California adopted a feed-in tariff.

Examples of renewable energy projects include generating electricity from the sun (either photovoltaic systems that convert sunlight to electricity or thermal projects that use sunlight to heat a liquid that then powers an electric turbine), solar water heating, wind, biomass (from organic material such as agricultural or forest waste), biogas (methane from landfills, wastewater treatment, or dairy farms), geothermal (steam), or small hydroelectric projects.

Landfill gas extraction for power production in Sonoma County.
Photo credit: Sonoma County

Landfill gas extraction for power production in Sonoma County.
Photo credit: Sonoma County

Local governments can take actions that can encourage renewable generation in their jurisdictions, or they can create obstacles, such as high permit fees or difficult permit requirements. Communities interested in encouraging renewable generation need to know what the potential resources are and where they are located, and then take action to protect them. For example, several communities in California have mapped the solar potential within their communities to estimate the potential for local generation.

Local governments can take an active role in developing renewable energy projects in their communities, through energy district financing programs (Strategy C.1.2) or by creating community energy authorities (Strategy C.1.1).

General Plan Language Ideas

» The city/county shall identity, protect, and develop the renewable energy resources within its jurisdiction and/or control to reduce dependence on foreign energy sources, improve the local economy, and reduce the community's impact on global climate change.

Implementation Ideas

» Identify and map the renewable energy resources in the community.

» Remove barriers to renewable energy investments such as streamlining the permit process, standardizing permitting requirements across nearby jurisdictions, and lowering or waiving permit fees.[3]

» Train municipal staff including building inspectors and permitting staff so that renewable projects do not meet with resistance.

» Provide residents and businesses with financial incentives such as rebates and/or low-interest loans, or develop an energy district financing program for efficiency and renewable projects. (See Strategy C.1.2.)

PVs on a commercial building in Sacramento.
Photo credit: Local Government Commission

» Invest in renewable energy projects on municipal buildings and facilities. The city/county can serve as a model for residents and businesses.

» Require solar on some new homes. The state has a goal to have all new homes be zero-net energy (for example, they generate as much energy as they consume) by 2020, and all new commercial buildings be zero-net energy by 2030. Work with the local utility to identify the best sites for these solar homes.

Energy Savings

Renewable energy projects will not save energy by themselves. However, they will reduce the amount of grid/utility energy that is generated from fossil fuels in California.

Environmental Benefits

The California Energy Commission's analysis of self-generation installations yielded a net reduction in both particulate matter ($PM_{2.5}$ that is, dust and soot) and greenhouse gases when compared to a natural gas-fired power plant.[4]

The Sonoma County Water Agency installed photovoltaic panels to help power its operations.
Photo credit: Sonoma County Water Agency

Economics

The Union of Concerned Scientists (UCS) has studied the job development implications of renewable energy for many years. In studies for several states (Colorado, Texas, Washington, Wisconsin), UCS found that various renewable portfolio standards (RPS) requirement amounts (10-20 percent) would generate between 1.8 and 2.8 times as many jobs as an equivalent amount of generation from fossil fuels. UCS found that if a nationwide RPS of 25 percent were enacted, 297,000 new jobs would be created.[5]

The California Energy Commission analysis of the state's Self-Generation Incentive Program (overseen by the California Public Utilities Commission and operated by the investor-owned utilities) found that program expenditures resulted in an estimated $1.7 billion in total value added to the state, and more than 15,000 full-time equivalent jobs.[6]

A report by the Center for Energy Efficiency and Renewable Technology found that building the power plants and green infrastructure to meet the 33 percent RPS goal for California by 2020 would put as much as $60 billion into the state's economy and generate between 100,000 and 235,000 new manufacturing, operations, and maintenance jobs.[7]

Programs in Operation

The city of **Redlands** Municipal Utility Department installed a 970 kW cogeneration system using landfill gas that was previously flared. The electricity and waste heat from cogeneration is used at the adjacent wastewater treatment plant. The city upgraded the plant to tertiary wastewater treatment so that it can supply recycled water to customers and meet all discharge requirements of the Regional Water Quality Control Board. The cogeneration system will offset the increased energy used for tertiary treatment. http://www.energy.ca.gov/efficiency/partnership.

The city of **Santa Monica** established the Solar Santa Monica program in late 2006. It was intended to fulfill the city's commitment to the Community Energy Independence Initiative that called for "net zero electricity imports" (electricity self-sufficiency) by 2020. To accomplish this goal – requiring nearly 150 megawatts of renewable, efficiency, and clean distributed generation – the city formed Solar Santa Monica. Since the main barrier to solar adoption is its high upfront cost, Solar Santa Monica sought ways to help residents get in "with little or no money down." In its first year, Solar Santa Monica identified and vetted four organizations prepared to lend for solar installations. The city also has a list of contractors to help participants get the work done. In three years, the amount of solar in Santa Monica tripled. http://solarsantamonica.com.

The city and county of **San Francisco** developed a solar map for the community that includes an estimate of roof size, usable roof size, and photovoltaic potential, electricity cost savings, and carbon savings by address. San Francisco offers incentives ranging from $2,000 to $4,000 for residents and up to $10,000 for businesses on top of what they can get from PG&E. Low-income residents can qualify for an additional $7,000. San Francisco has a goal of 10,000 solar rooftops by 2010. http://sf.solarmap.org.

With funding from the U.S. Department of Energy's Million Solar Roofs Initiative, the **Marin County** Solar Program was able to create a solar potential map of the county. The map uses topographic information to determine the amount of solar insolation an area receives. While not address-specific, the close-up maps include streets and display high to low solar potential. Building orientation and shading can reduce the potential. Marin County is also exploring development of a sustainable safety net as a model for renewable energy development, where renewable-powered (solar, wind, biogas) back-up systems are available during blackouts to provide power to emergency service providers, such as fire and police stations, and to designated emergency gathering places, such as community centers or schools. Web page: http://www.co.marin.ca.us/depts/CD/main/comdev/advance/sustainability/Energy/solar/solarpotent/solar_maps.cfm.

San Francisco has many solar installations on municipal property, including SFO airport.
Photo credit: San Francisco Public Utilities Commission

Resources

The **California Energy Commission** has mapped the potential for large renewable resource development in the state. The solar, wind, and geothermal maps are available at http://www.energy.ca.gov/maps.

The U.S. Department of Energy's Solar American Board for Codes and Standards created a permit process to meet the needs of the growing, small-scale PV market. It takes advantage of the many common characteristics inherent in most of the small-scale PV systems installed to streamline both the application and award of permits. Go to http://www.solarabcs.org/permitting

The **Go Solar California** website provides consumers with information on rebates, tax credits, and incentives for solar energy systems in California. The California Solar Initiative (CSI), overseen by the California Public Utilities Commission and operated by PG&E, Southern California Edison, and SDG&E, provides rebates for existing home solar installations. The New Solar Homes Partnership is run by the California Energy Commission and offers incentives for new homes. The site also includes links to equipment providers, installers, tax credit information, and more.

- » Web page: http://www.gosolarcalifornia.ca.gov.
- » PG&E Web page: http://www.pge.com/myhome/saveenergymoney/solarenergy.
- » Southern California Edison Web page: http://www.sce.com/solarleadership/gosolar/go-solar.htm.
- » SDG&E website: http://www.sdge.com/environment/solar/calSolarInitiative.shtml.

The California Energy Commission offers cash rebates on grid-connected small wind (50 kilowatts or less) and fuel cell renewable energy electric-generating systems through its **Emerging Renewables Program**. Website: http://www.consumerenergycenter.org/erprebate/index.html.

The California Public Utilities Commission oversees the **Self-Generation Incentive Program** (SGIP) that is implemented by PG&E, Southern California Edison, Southern California Gas Company, and by the California Center for Sustainable Energy in SDG&E's service territory. SGIP provides rebates for wind, microturbine, and fuel cell projects.

- » California Center for Sustainable Energy: www.energycenter.org.
- » Pacific Gas and Electric: www.pge.com/selfgen.
- » Southern California Edison: www.sce.com/sgip.
- » Southern California Gas Company: www.socalgas.com/business/selfgen.

Related Strategies

W.4.1 Efficient Wastewater Treatment
C.1.1 Community Energy Authorities
C.1.2 Community Energy District Financing
C.2.2 Distributed Generation
C.5.1 Municipal Procurement

Endnotes

1. California provides incentives for the following kinds of renewable energy projects: solar, wind, geothermal, biomass, and small hydroelectric (less than 30 MW).
2. "Each governing body of a local publicly owned electric utility shall be responsible for implementing and enforcing a renewables portfolio standard that recognizes the intent of the Legislature to encourage renewable resources, while taking into consideration the effect of the standard on rates, reliability, and financial resources and the goal of environmental improvement." Public Utilities Code Section 387.
3. A standard permit process for PV systems developed by the U.S. Department of Energy's Solar American Board for Codes and Standards can be found in a report titled, "Expedited Permit Process for PV Systems." For the report and more information, go to http://www.solarabcs.org/permitting . Guidelines to reduce the impact of wind turbines on birds and bats are available at http://www.energy.ca.gov/windguidelines/index.html
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DISTRIBUTED GENERATION

One of the paths toward greater energy independence in California is through distributed energy resources (DER), or distributed generation. DERs are small-scale power generation technologies (typically in the range of 3 to 10,000 kW) located close to where electricity is used (for example, a home or business) to provide an alternative to or an enhancement of the traditional electric power system. Examples of DERs include microturbines, fuel cells, combined heat and power, photovoltaic systems, and wind. Benefits of distributed generation include:

» Location-specific grid benefits when facilities are sized correctly. Such systems can avoid transmission and distribution costs and reduce congestion on the grid.

» Greater efficiency. Electricity is lost as it travels over transmission lines. Distributed generation consumed on site has none of this transmission loss.

» Reduced risk of blackouts due to overloading the grid, one of the primary reasons for major blackouts. Distributed generation can also keep vital services such as hospitals and police and fire stations operating during blackouts.[1]

Some DER systems can provide benefits beyond just those associated with generating the electricity locally. Locating DER systems near a fuel source, such as landfill or wastewater treatment gas, will take advantage of this resource that might otherwise be wasted. Colocating facilities, such as one that needs significant electricity and one that has a high heating or cooling load, can maximize the benefit of DER. Combined heat and power systems, or cogeneration systems, generate electrical/mechanical and thermal energy simultaneously, recovering much of the energy normally lost in separate generation. This recovered energy can be used for heating or cooling, eliminating the need for a separate boiler.

Despite their benefits, high capital costs are presently the norm for many DER technologies and serve as a deterrent to their widespread implementation. However, as production levels and sales increase, it is expected that economies of scale will result in decreased equipment costs.

Another significant issue with DER is the interconnection of the device to the electric utility system. In the United States, common standards for interconnecting DER devices into the utility system do not presently exist. The lack of common standards is considered a barrier to the wide acceptance and installation of DER technologies.

The California Energy Commission has sought to encourage DER by streamlining complicated regulations and the processes involving interconnection, standardization, certification, environmental review, and permits. The agency hopes that developers and consumers will build more of these small plants, thereby lessening the strain on the state power grid and easing the need for larger power plants.

General Plan Language Ideas

» The city/county shall encourage distributed generation within its borders to improve reliability, keep local dollars circulating within the community, and avoid using foreign fuels to generate electricity.

» The city/county shall codify the general plan to cite the benefits of distributed generation as a beneficial practice.

Implementation Ideas

» Provide a point of contact at the permit/planning department for all distributed generation permits including electrical, plumbing, and building into one easy-to-use packet and develop a timeline for review such that the process is consistent with other types of city/county review.

» Develop a revised zoning ordinance with provisions for the requirements for distributed generation as a permitted use in residential, commercial, industrial, public, open space, agricultural, and in cases as deemed necessary as a conditional use. The standards for noise and equipment should be no more restrictive than those for other similar equipment or appliances. Visual impacts should not be required to comply with conditions any more strict than used for other accessory equipment.

» Develop design standards for typical distributed generation technologies (for example, rooftop solar photovoltaic panels and water heating, small wind turbines) and provide them to building permit seekers.

» Implement expedited approval procedures for all distributed generation permits less than 10 kilowatts. Standardize approvals for all distributed generation less that 40 kilowatts.

» In concert with planned unit development (including office, residential, and commercial), use nonpropriety software to estimate the feasibility and sizing of distributed generation in the ranges of 1 to 20 megawatts.

Net Metering

California's net metering law, in effect since 1996, requires utilities to offer net metering to all customers for solar and wind-energy systems up to 1 megawatt (MW). Under net metering, customers who generate electricity on-site reduce their electricity costs up to the amount they use each month. Net excess generation (NEG) is carried forward to a customer's next bill for up to 12 months. Any NEG remaining at the end of each 12-month period is granted to the customer's utility at no cost.

Excess generation can be applied only to the meter where the generation occurs. For example, a homeowner with a primary residence and a vacation home cannot apply any excess generation at one location to the electric bill at the other location.

In 2008, AB 2466 (Laird, Chapter 540, Statutes of 2008) changed the rules for local governments. Cities and counties can now overgenerate at one facility and apply the excess to other municipal accounts. Some municipalities own facilities that have the space to locate large solar arrays but do not have large electric loads, such as land surrounding a water treatment plant. A city could set up a solar farm at such a location and net the excess generation against the bill at city hall or a library.

» Coordinate efforts with home builders and developers for the construction of zero energy homes.

» Coordinate with the air district with respect to air emissions to develop a standard procedure for the all major manufactured distributed generation products currently listed on the U.S. Department of Energy website for distributed generation.

» Undertake a review with the utility serving the community to identify points on the grid where overload or growth is forecast so as to reduce the need for new and expensive transmission and distribution upgrades.

» Undertake an evaluation with the utility where the distributed generation locations would provide demand response benefits as currently called for in the state's *Energy Action Plan*.

» Undertake a California Environmental Quality Act review for the cumulative impacts of multiple distributed generation (project level) toward the aim of proving significant system benefits and jump-starting the industry to reduce per-unit costs.

» Work with other neighboring local governments in a regional effort to enact a consistent set of DG zoning and permitting requirements so that applicants can take advantage of standardization.

» For solar distributed generation (photovoltaic panels), develop a recommendation for special handling, including expedited review, waiving of permit fees, and reduction of business/sales tax on materials.

» Provide an annual report on the activities underway under the distributed generation policy including amount of clean electric provide locally, reduction in carbon dioxide emissions, and net economic impacts.

» Convert any conventionally heated public swimming pools to solar water heating when any major renovations occur and/or when funding allows. The investor-owned utilities can provide financial assistance to switch to solar water heating.

Energy Savings

Distributed generation can be used on-site or within the local area served by a distribution feeder or substation. Placing generation close to load will reduce the amount of energy purchased from a utility and avoid transmission and distribution losses. To be most effective, the facilities consuming on-site generation should be made as energy-efficient as possible, reducing the size of heating, ventilation, and air-conditioning equipment, and potentially the size of the distributed generation system.

Combined heat and power systems can significantly reduce energy use, criteria pollutants, and carbon emissions through their improved efficiency of fuel use. Integrated systems for combined heat and power can increase the efficiency of energy usage to as much as 85 percent (compared to about 35 percent for conventional systems) and save about 40 percent of the input energy required by conventional systems.[3]

Environmental Benefits

Distributed generation from renewable resources, such as solar photovoltaic, solar thermal wind, dairy digesters, gas from wastewater treatment, and landfill gas, will offset the amount of energy generated from fossil fuels, thereby reducing greenhouse gas and pollutant emissions. The net impact of other types of distributed generation will depend upon emissions from the local power source as compared to grid-average emissions associated with electricity generation. By increasing the efficiency of energy usage, integrated systems for combined heat and power will decrease the amount of fossil fuel consumed per unit of energy used and can lead to a 45 percent reduction in air emissions, compared to conventional centralized power plants using the same fuel source.[4]

On a national scale, if all wastewater treatment facilities that operate anaerobic digesters and have influent flow rates greater than five million gallons per day were to install combined heat and power, approximately 340 megawatts of clean electricity could be generated, offsetting 2.3 million metric tons of carbon dioxide emissions annually. These emission reductions are equivalent to removing approximately 430,000 cars from the road.[5]

Economics

The cost of electricity produced by a DER technology can be estimated and compared to the price currently being paid for electricity from the power grid. Equipment costs for DER technologies are often quoted in terms of their cost per kilowatt of electricity produced, or $/kilowatt (kW). For example, a 50 kW microturbine may cost $1,000/kW, or $50,000. Combining some technologies, such as solar photovoltaic panels, with more cost-effective energy efficiency will greatly reduce the payback period.

The cost of electricity to facilities is generally based on power demand (measured in kW) and electric energy usage (measured in kWh). The power demand charge is generally a monthly charge ($/kW) based on the maximum power used during a month for a specified period, generally 15 minutes to 30 minutes. Combined heat and power systems reduce power demand in two ways: 1) by generating some of the power at site; and 2) by using thermal energy from power generation equipment, instead of electricity, for operating cooling, heating, and/or humidity control equipment.[6] Even though the initial cost of these systems is higher than purchasing all electric power needs and using conventional chillers and boilers for cooling, humidity control and heating needs, their life-cycle cost is often lower due to of the energy cost savings over their useful life of more than 20 years.[7]

Programs in Operation

The Santa Rita Jail is the largest consumer of energy of all the **Alameda County** government buildings. To reduce energy expenditures, in the spring of 2002 the county completed the largest rooftop solar system in the nation at the time at this facility, which produces 1.18 MW of power under peak sunlight conditions. The first year savings was $425,000, and the lifetime (25 year) savings is expected to be more than $15 million.[8]

Pasadena City College worked with Pasadena Water and Power to reduce energy costs by generating some of its own power, as well as using combined heat and power to heat a 750,000-gallon swimming pool that is maintained at 81°F. To heat the pool, two Capstone 60 kW microturbines with heat recovery were installed, using the same amount of gas as previously used to heat the pool while at the same time generating an extra 120 kW of power. As a result, the college is saving about $100,000 per year in electricity costs, which were realized with a four-month payback.[9]

The Atrium Hotel at **Orange County Airport** installed three 60-kW Capstone microturbines with integrated heat recovery. The turbines were intended to save energy costs associated with the natural gas used for heating water and providing heat to the rooms, while generating electricity for the hotel. The hotel has realized $139,000 in annual savings (both natural gas and electricity). While the total capital cost of the turbines was about $338,000, the hotel received a rebate of about $101,000, resulting in a net capital expense of $236,000, and a payback of less than two years.[10]

Santa Rita Jail with cool roof and PV system.
Photo credit: Alameda County

In August 2001, fifty 30-kW Capstone microturbines were installed at the **Lopez Canyon Landfill** in Lake View Terrace, California as part of the Green Power for a Green L.A. Program. The microturbines were funded through a Los Angeles Department of Water and Power (LADWP) commitment to the Southern California Air Quality Management District (SCAQMD) to spend $14 million on clean air projects. The microturbines operate on landfill gas that would otherwise be flared into the atmosphere. This project has eliminated approximately 10,000 pounds of nitrogen oxide emissions per year – the equivalent of removing 500 cars from Southern California roads. Combined, the 50 microturbine units generate a total of 1.5 megawatts of electricity, enough to power an estimated 1,500 homes in the Los Angeles area.[11]

In 2004, the **Los Angeles County Sanitation District** (LACSD) began operating a 250 kW fuel cell combined heat and power system at the Palmdale Water Reclamation Plant. Seventy to 80 percent of the digester gas produced by the facility is used by the fuel cell. The system produces 225 kW of electricity for use on site, while waste heat from the fuel cell exhaust is used to maintain proper temperature for digester operation. The combined heat and power system reduces annual carbon dioxde and nitrogen oxide emissions by 778 tons and 0.58 tons, respectively, and saves LACSD approximately $227,000 per year in energy costs.[12]

Resources

The California Distributed Energy Resources Guide contains a wealth of information regarding distributed energy resources. http://www.energy.ca.gov/distgen/index.html.

The California Energy Commission released a report in December 2000 titled *Distributed Generation: CEQA Review and Permit Streamlining*. This report describes the permitting processes conducted by city and county governments and air districts for small-scale electric generating facilities. For the complete report, see h ttp://www.energy.ca.gov/distgen/documents, Report No. 700-00-019.

The Energy Commission has mapped the potential for solar and wind energy throughout the state. The maps are available at:

» http://www.energy.ca.gov/maps/wind.html

» http://www.energy.ca.gov/maps/solar_potential.html

Related Strategies

B.1.3 Solar Energy
C.1.1 Community Energy Authorities

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CEC-600-2009-013-F-VI-E.2.C.2.2 • FEBRUARY 2011

LOCAL FOOD

A great deal of energy is used in the production and transport of food. Produce in the United States travels, on average, 1,300-2,000 miles from farm to consumer, and since the 1970s, has increasingly been moved by truck, which is less energy-efficient than other modes of transport.[1] The energy used to move food in California may be less because so much food is grown in the state.[2] A study by the American Farmland Trust found that 20 million tons of food is produced annually within 100 miles of San Francisco, where less than 1 million tons is consumed in a year. However, the energy associated with food production and transport remains very significant.

In general, the farther food travels and the longer it takes to get to a consumer, the more fossil fuels will be required for transport, and the less fresh it will be. Growing food locally will not always result in net energy savings, however. Growing some foods in unsuitable climates may use more energy than growing and shipping them from somewhere more appropriate. For example, it is more energy-efficient for Swedes to import tomatoes from Spain than it is for them to grow tomatoes themselves, since the latter requires heated greenhouses.[3]

Lake Merritt Community Garden in Oakland.
Photo credit: Erin Fisher, Community Energy Services Corporation

This section provides ideas for how local governments can promote consumption of locally grown food.

General Plan Language Ideas

» The city/county shall work to preserve regional agriculture and farmland as a source of healthy, local fruits and vegetables and other foods and connect local food markets to local agriculture.

» The city/county shall encourage, support, and find sites for farmers' markets and community gardens as important open space resources that build community and provide local food sources.

Implementation Ideas

Local government can provide a variety of opportunities for community gardens and urban farms.

» **Encourage the use of vacant lots for community gardens**, for example, by allowing community gardens as a use in all zones, creating a specific "community garden" zoning regulation, protecting gardens from confiscation, and providing free water/trash collection. A community garden provides green space in urban areas and encourages food production by providing gardeners a place to grow vegetables, fruits, and flowers. Community gardens strengthen communities, build social capital, and instill pride. Some community gardens have even become a source of income in which the produce grown from the garden is then sold in local farmers' markets.

» **Support the use of city streets and parking lots space by farmers' markets and pickup/dropoff sites** for community-supported agriculture. Community-supported agriculture allows consumers to pay growers for a share of farm produce, and growers provide the consumers with a weekly share of food. Members on average would pay about one-third more for the same food at a supermarket.[4]

» **Identify and inventory potential community garden/urban farm sites** on existing parks, public easements, rights-of-way, and schoolyards and prioritize site use as community gardens in appropriate locations.

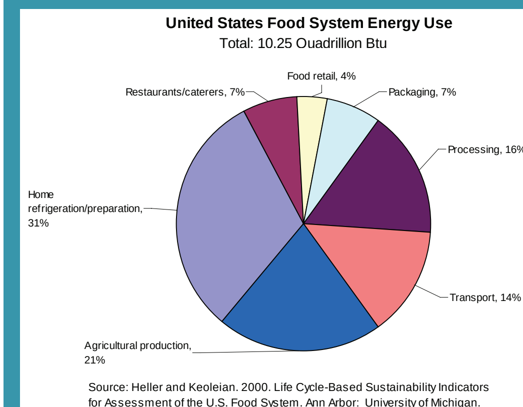
- Convert neglected areas into green spaces that can be used for community gardens or provide community garden grants and support. This can be done by issuing bonds to nonprofits to transform vacant lots, providing city resources to nonprofit groups who run community gardens, reducing or waiving plot fees or locating the gardens within walking distance of lower-income neighborhoods, or starting an initiative to redevelop and clean up vacant land.

» **Consider setting a community garden standard** (for example, at least one community garden for every 2,500 households).

» **Offer residents classes such as gardening or composting,** or support a community-based organization to do so; prioritize classes in neighborhoods that lack access to healthy foods and/or green space. Connect local agencies such as waste management who may be willing to deliver compost for free or provide composting services.

Food and Energy Use

Food production and transport account for 17 percent of fossil fuel use in the United States. Of the energy used for the food production system, 20 percent is used for actual production, and 80 percent is used for processing, transportation, home refrigeration, and preparation. (See below.)



» **Protect agricultural land from urban development** except where the general plan land use map has designated the land for urban uses. (Establish green belts for agricultural buffers around urban land; require developers to place lands within this buffer into permanent agriculture land trust or other agricultural easements.)

» **Support procurement of locally grown food.** Assess and plan for local food processing/wholesaling/distribution facilities to connect local agriculture to markets such as retailers, restaurants, schools, hospitals, and other institutions. Protect areas zoned for industrial use from being rezoned for other uses such as commercial or residential, so that local processing is not lost.

» **Support efforts to create a farms-to-schools program and school gardens.** A farms-to-schools program encourages schools to use locally grown produce for school meals, and supports local farmers and economies. School gardens reduce the need to transport food and help to develop future home and community gardeners.

Energy Savings

The closer that food is consumed to where it is grown and processed, the less transportation fuel will be needed. A University of Montana study found that replacing a year's supply of conventionally sourced hamburgers and fries with local ingredients at campus sites saved 43,000 gallons of fuel and the associated GHG emissions.[5]

Environmental Benefits

A study in Iowa found that for delivery of 28 locally available fresh produce items, using a conventional national delivery system consumed 4 to 17 times more fuel than Iowa-based regional and local systems, depending on the system and truck type. The same conventional system released from 5 to 17 times more carbon dioxde from the burning of this fuel than the Iowa-based regional and local systems.[6]

Economics

In the 1950s, farmers in the United States received 45-60 percent of the money that consumers spent on food. Today, they receive just 3.5 percent.[7] When farmers sell directly, as at farmers' markets or through community-based agriculture programs, they keep almost all the food dollars spent by consumers. This keeps the money in the local economy, as opposed to being spent on supermarket items that could come from anywhere in the world.

Kern County Department of Public Health Farmers Market.
Photo credit: Central California Regional Obesity Prevention Program

The Central California Regional Obesity Prevention Program (CCROPP) is dedicated to creating healthier environments that support healthy eating and active living. CCROPP is committed to addressing childhood and adult obesity through place-based policy change that supports access to healthy, affordable foods and physical activity resources in the San Joaquin Valley. This unique, comprehensive approach is being carried out by partnerships among public health departments, community-based organizations, and community councils in Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare counties. The program was developed by the Central California Public Health Partnership and is administered through the Central California Center for Health and Human Services at California State University, Fresno. Funding for this initiative was made possible by The California Endowment and the Robert Wood Johnson Foundation.

The Central Valley grows an abundance of fruits and vegetables; however, many residents have limited access to the locally grown produce. In Kern County, this problem is compounded by high rates of obesity and associated illnesses such as diabetes and heart disease.

The Kern County Department of Public Health (KCDPH) knew that they needed to address the obesity epidemic. To compete with the high concentration of nearby fast food restaurants and convenience stores, the KCDPH partnered with the CCROPP to institute an on-site farmer's market in 2007. The market had a slow start, but over time has grown not only for employees, but community residents, and recipients of the Women and Infant Children Farmer's Market Vouchers. The farmer's market was the first step for the both CCROPP and KCDPH to make an environmental change that would produce in healthier eating habits.

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In addition to increasing residents' access to fresh produce, community gardens provide residents with environmental education, green space, and significant savings on their food. For example, community gardeners in Philadelphia reported an annual savings on food bills of $700 per family.[8]

Programs in Operation

The **Davis** Farm-to-School Connection embodies a systems approach to education by supporting programs within the local school district that connects classroom studies with hands-on experiences, such as garden-based learning, classroom cooking, cafeteria taste-testing, local farm visits for second graders, and waste management programs such as composting and recycling. The community was the first in the nation to vote in a parcel tax renewal to fund farm fresh produce to improve school lunches. http://www.davisfarmtoschool.org.

Berkeley's General Plan establishes open space (including community gardens) as the highest priority for city-owned vacant land. Measure L, passed by Berkeley voters in 1986, requires a vote of the people to use or to develop a public open space or park for any purpose other than a public park or open space, unless a state of emergency has been declared. http://www.ci.berkeley.ca.us/contentdisplay.aspx?id=494.

To create **Fresno's** Green Strategy, planning staff partnered with Fresno Metro Ministries and Central California Regional Obesity Prevention Program, along with other farmers' market stakeholders, to amend the zoning code to define farmers' markets and allow them in all commercial zones and even the most basic residential zone district R-1 (with a conditional use permit), allowing farmers' markets in residential areas brings fresh food to where it is most needed. http://www.fresno.gov.

The **San Luis Obispo** Downtown Association is an advisory body to the City Council funded by sales tax proceeds from its district. In 1983, the Downtown Association decided to barricade six blocks of one street on Thursday nights so people could shop late and enjoy special activities and entertainment. http://www.downtownslo.com/farmers.html.

Portland, Oregon's, zoning code allows community gardens in all residential areas. Park and open spaces are uses of land focusing on natural areas, large areas consisting mostly of vegetative landscaping or outdoor recreation, community gardens, or public squares (city of Portland, 33.920.460). With special limitations, community gardens are allowed within all residential, commercial, and open space zones of the city (city of Portland, 33.100.100, 33.110.100, 33.120.100, 33.130.100). http://www.portlandonline.com/auditor/index.cfm?c=28197

Seattle, Washington's, P-Patch Program provides 68 gardens for residents throughout Seattle and was to add another four gardens in 2009. The community-based program offers community gardening, market gardening, youth gardening, and community food

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KCDPH has provided technical assistance to other agencies in initiating their own farmer's markets, and helped the city of Delano incorporate zoning language supportive of farmer's markets into its general plan.

The KCDPH has included language on operating an annual farmers market in their worksite wellness policy and has plans to operate more markets in other low-income communities. The intangible idea of changing the environment has grown to several tangible markets with the outcome of providing an access to healthy produce to those in need.

Avtar Nijjer-Sidhu is the Community Health Capacity Building Specialist for the Kern County Department of Public Health. Avtar works at building the internal capacity of the public health department to respond to the obesity epidemic through CCROPP. In addition, Avtar works in partnership with Get Moving Kern, a local CCROPP community partner, at improving local environments for healthy eating and active living.

Photo credit: Brandie Banks-Bey

security. These programs serve all citizens of Seattle with an emphasis on low-income and immigrant populations and youth. The community gardens serve more than 3,800 urban gardeners on 23 acres of land. http://www.seattle.gov/Neighborhoods/ppatch

New York City has established a mobile markets initiative that has put "green carts" full of fresh fruits and vegetables in lower-income areas that have the least access to fresh produce and where residents report the lowest consumption of fruits and vegetables. New York City partnered with a nonprofit small business lender to provide low-interest loans to green-cart vendors. The loans cover start-up costs, such as equipment and inventory. In a related measure, the city's health department launched a Healthy Bodegas Initiative, whereby the city helps neighborhood bodega owners promote the offering of low-fat milk and fresh produce in communities that have the highest rates of poverty and diet-related diseases in the city. http://council.nyc.gov/html/releases/011_022708_prestated_greencarts.shtml

Resources

The **National Sustainable Agriculture Information Service** website is sponsored by the National Center for Appropriate Technology and funded by a grant from the U.S. Department of Agriculture's Rural Business-Cooperative Service. It provides information and other technical assistance to farmers, ranchers, Extension agents, educators, and others involved in sustainable agriculture in the United States. *Bringing Local Foods to Local Institutions: A Resource Guide for Farm-to-School and Farm-to-Institution Programs* is one of its programs. http://attra.ncat.org.

The **Local Harvest** website provides information on farmers' markets, family farms, and other sources of sustainably grown food throughout the United States where produce, grass-fed meats, and many other food items can be purchased. http://www.localharvest.org

Planning for Healthy Places (PHP), a program of Public Health Law & Policy, works to engage public health advocates in the planning decision-making process throughout California. PHP develops tools for training advocates in the relationship between the built environment and public health and provides technical assistance for creating and implementing land use policies that support healthier communities. It is developing model general plan language to protect community gardens. Many of the implementation ideas above come from the Healthy Places publication *How to Create and Implement Healthy General Plans: A Toolkit for Building Healthy, Vibrant Communities Through Land Use Policy Change*. http://www.healthyplanning.org.

Ecotrust is working on a wide-range of initiatives to promote "farm to school" programs that enable schools to feature healthy, locally sourced products in their cafeterias, incorporate nutrition-based curriculum in all academic disciplines, and provide students with experiential agriculture and food-based learning opportunities, from farm visits to gardening, cooking, composting, and recycling. http://www.ecotrust.org/farmtoschool

The **Farm-to-School Program** website provides resources broken down by state. It includes guides, reports and strategies. The site also includes state and local policy recommendations aimed at fixing the current school meal programs to incorporate fruits and vegetables from local farms. http://www.farmtoschool.org

The **FoodRoutes Network** is a nonprofit organization that provides information about promoting community-based food systems. http://www.foodroutes.org

The **U.S. Department of Agriculture's** *Farmers Market Promotion Program Guidelines* help entities seeking funding from the USDA Farmers' Market Promotion Program. Eligible entities include local governments, nonprofit corporations, agricultural cooperatives, and other domestically located entities whose main source of income results from producing and selling produce directly to consumers. http://www.ams.usda.gov

The **Local Government Commission** has developed the *Cultivating Community Gardens: The Role of Local Government in Creating, Healthy, Livable Neighborhoods* fact sheet. http://www.lgc.org

The **Wallace Center** offers information on "Getting Started with Farmers' Markets" and "Recruiting Vendors for a Farmers' Markets." http://www.wallacecenter.org and http://www.farmersmarketsusa.org

Related Strategies

C.1.1 Community Energy Authorities

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SOLID WASTE

Energy is used to manufacture products and to collect and transport solid waste. Policies that reduce waste, increase reuse, and increase recycling will save energy.

Waste reduction (or prevention) is the preferred approach to waste management because it saves the cost and energy associated with collecting, separating, and transporting waste material and integrating the recycled materials back into the manufacturing process.

Reusing products and materials in their original form can save more energy than recycling because energy is not used to transform the materials into new products. Many materials that would otherwise be thrown away can be reused with little cleaning or repair. Materials such as appliances, furniture, bags, boxes and other containers, building materials (doors, windows, bricks, and so forth) scratch paper, clothing, and wood pallets can often easily be reused.

Recycling used materials by transforming them into new products also can save energy. For example, making new aluminum cans from used cans requires 95 percent less energy than producing cans using virgin ore.[1]

Most of the focus of recycling programs implemented by California jurisdictions over the last two decades has been on the residential sector, although commercial businesses in California generate more than half of all solid waste.[3]

California's Integrated Waste Management Act

In 1989, the state legislature passed the California Integrated Waste Management Act, AB 939 (Sher, Chapter 1095, Statutes of 1989), requiring each jurisdiction to divert 25 percent of waste by 1995 and 50 percent by 2000.

Eighty-five percent of California's local governments have met the 50 percent diversion requirement; most of the others have made a good faith effort to do so.

As of the end of 2008, California diverted 54 million tons of the 93 million tons of solid municipal wastes it generates yearly, an amount equal to 58 percent. In 1990, California diverted just 10 percent of its garbage (Source: California Department of Resources Recycling and Recovery).

Reuse Area at the Sonoma County Central Disposal Site.
Photo credit: Sonoma County Department of Transportation and Public Works

General Plan Language Ideas

» It shall be the policy of the city/county to purchase products that: 1) are made from recycled materials; 2) can be recycled; and/or 3) have a minimum amount of packaging. By [date] the council/board shall adopt an ordinance establishing specific procurement standards and preferences for products that are recycled, recyclable, and have minimal packaging. Additional preference will be given to products produced locally.

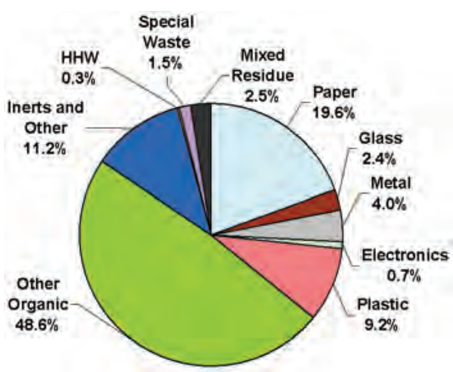

Figure 1. Material Classes in California's Residential Disposed Waste Stream, 2008

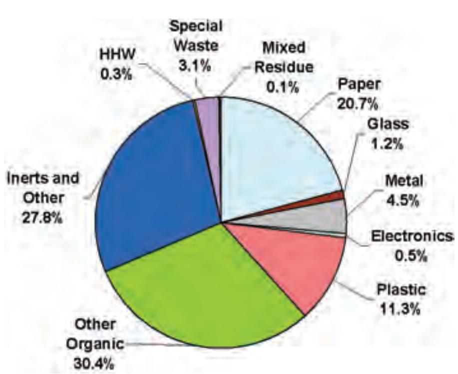

Figure 2. Material Classes in California's Commercial Disposed Waste Stream, 2008
Source: California 2008 Statewide Waste Characterization Study. [2]

» The city/county shall provide education and incentive programs to encourage xeriscaping, backyard composting and mulching.

» To provide an incentive to reduce and recycle and to reward residents who already actively reduce and recycle, residential garbage collection fees will be based upon the amount of garbage collected rather than a flat fee.

» The city/county shall establish a mandatory commercial recycling ordinance, a construction and demolition ordinance, and a space ordinance requring new developments to secure enough space for recycling receptacles on their property.

» The city/county shall facilitate the establishment and retention of reuse and recycling businesses by providing appropriate zoning, technical assistance, and incentives. This includes businesses that 1) use post-consumer materials to manufacture products, 2) process recyclable materials for use by other businesses, and 3) sell used and refurbished items. If not already in a recycling market development zone, consider working with the California Department of Resources Recycling and Recovery to establish one.

» The economic development and solid waste management departments shall coordinate activities to locate new and retain existing reuse and recycling businesses in the community.

Implementation Ideas

» **Adopt a procurement policy or ordinance.** Local governments can adopt policies (administratively or through ordinance) that give price preferences to products that are recycled, recyclable, or made with minimal packaging. They can also require a percentage of government product purchases (for example, paper) to meet these requirements. Purchasing costs may be reduced by buying in bulk with neighboring jurisdictions. Purchasing specifications can be reviewed and modified to ensure they do not inadvertently discriminate against recycled products. Municipal "buy recycled" programs can be publicized to local businesses.

» **Start a backyard composting education program.** An education program can include workshops, printed brochures and pamphlets, individualized instruction, demonstration compost sites (combined with low-water demonstration gardens), presentations to community groups, displays at community events, public buildings and garden supply stores, information hotlines, newspaper features, utility bill inserts, and school programs. The University of California Cooperative Extension Service, Conservation Corps, college and university academic departments (for example, horticulture, landscape architecture), garden clubs and other interested groups can help set up a program, and volunteers can help staff the program.

» **Provide residents with free or discounted composting bins and tools.** Bins come in a variety of types and materials, including open-air wood bins, wood frames with wire mesh, plastic open- and closed-air bins, and rotating drums.

Compost bins.
Photo credit: San Mateo County.

High-Tech Trash

Electronics are a fast-growing portion of America's trash – 250 million computers are destined to become obsolete by 2005. Researchers estimate that 75 percent of old electronics are in storage. (Source: Environmental Protection Agency).

In California, more than 500 million pounds of televisions and computer monitors have been recycled since 2003. (Source: California Department of Resources Recycling and Recovery)

» **Promote composting and mulching to commercial gardeners and landowners.** While on-site composting may not be possible at many commercial sites, mulching can be practiced nearly anywhere to retain moisture, suppress weeds, and protect plants from extreme temperature changes. Locally composted materials and mulch have less embodied energy than materials that are transported long distances. Some non-residential sites, such as golf courses, college and university campuses, and cemeteries, might be able to compost on-site.

» **Investigate a commercial recycling ordinance.** The investigation shall determine the amount and types of materials that could be diverted. Recommended thresholds for participation (for example, all commercial and multifamily operations, commercial entities with ___ number of employees, generate ___cubic yards per week or more of solid waste, multifamily entities of ___units or more) will be based on maximizing diversion at minimal expense.

» **Adopt a construction and demolition (C & D) recycling/reuse ordinance.** Waste from new construction sites and demolition projects can create significant waste. Materials often can be recycled or reused, such as windows, doors, lights, plumbing fixtures, sinks, tubs, toilets, and concrete. C & D materials can stimulate local reuse businesses such as Urban Ore in Berkeley and Habitat for Humanity stores throughout the United States.

» **Compost and mulch green wastes from city/county landscaping.** Provide a model for residents and businesses. Composting sites can be located in parks and public golf courses.

» **Establish variable garbage can rates.** Offer residents the option to use a smaller garbage container for a reduced fee or charge residents per can.

» **Encourage and facilitate new reuse and recycling businesses.** Host workshops for potential entrepreneurs about how to start a new reuse and recycling business in the city. Provide support in the form of contacts, grant application assistance, financial support (for example, tax incentives, low-interest loans, bond financing, redevelopment funds, reduced business license fees, community development block grants or loans), and supportive infrastructure expansion. If the city/county is not already in a recycling market development zone, consider working with the Department of Resources Recycling and Recovery to establish one. (See Resources.)

» **Use zoning to encourage new recycling businesses.** Revise the zoning code to allow recycling businesses, particularly in new or existing redevelopment areas and industrial parks. Allow reuse and rental shops (a form of reuse) in shopping centers and other prominent locations. Provide streamlined processing and eliminate or reduce application and development fees for reuse and recycling businesses.

» **Support existing recycling businesses.** Maintain and/or expand existing reuse and recycling businesses and retool manufacturing operations for recycled feedstocks. Make sure that new local codes or requirements do not pose problems to reuse and recycling businesses. Include reuse businesses in city/county programs to collect bulk wastes, such as spring cleanup days.

» **Provide recycled materials to local reuse and recycling businesses.** Require that materials collected through residential curbside recycling programs and other city/county recycling programs be offered to local recycling processors and industries first. Establish a local material exchange program or become a partner with CalMAX and promote it on the municipal Web page. See the Resources section below for a link to the CalMAX program.

» **Cooperate regionally.** Work with neighboring governments to attract and maintain businesses that need large amounts of recycled materials. Institute regional agreements to guarantee a steady and large supply of recycled feedstock for local manufacturers.

Energy Savings

If less wate is generated, less waste is used in the manufacturing and transport or wasted materials. Recycling can also save energy because in some cases it takes less energy to recycle new materials than it does to obtain new materials. For example, less energy is required to produce a gallon of re-refined oil than creating new oil.

Reducing the amount of garbage collected at homes can reduce the energy used to transport garbage if garbage routes can be consolidated. This means fewer trips to the landfill or transfer site. Fuel savings may be partially offset by an increased need for curbside pickup of recyclables.

Backyard composting reduces transportation energy needs if garbage routes can be consolidated, requiring fewer trips to the dump. Almost half of residential waste is organic, most of which can be composted. If one-third of households compost one-half of that waste, 8 percent of household waste will be diverted from the local landfill. With this reduction, 1 out of every 13 trips to the landfill can be eliminated.[4]

Environmental Benefits

The California Center for Sustainable Energy (CCSE) operates programs in the San Diego area. From 2004 through

2008, CCSE has sequestered or reduced 28,010 metric tons of CO_2e (equivalent to 79 million kWh of electricity) with the Cool Communities Shade Tree Program, the California Solar Initiative, the Solar Water Heating Program, and a group of energy efficiency programs. CCSE also operates the Self-Generation Incentive Program (SGIP) in San Diego Gas & Electric's service territory. (SGIP carbon savings are not included in the number above because the program's benefits are still being assessed.)[8]

Economics

Increasing demand for recycled products can translate into increased local manufacturing, business startups, and business expansion. Local governments "close the loop" by using community waste to serve community needs. The energy used to transport commodities to markets in other states or countries is saved.

California has created an industry of 5,300 businesses connected to recycling. Recycling now accounts for 85,000 jobs, generates $4 billion in salaries and wages, and produces $10 billion worth of goods and services annually.[9] Recycled Market Development Zones have helped businesses divert 7 million tons of solid waste and created 8,800 jobs.[10]

If garbage collection fees are based on the volume or weight of garbage disposed, rather than a flat fee, residents are given an economic incentive to reduce and recycle waste.

Programs in Operation

Local governments in California have been operating and/or participating in solid waste diversion programs for many years. In 2006, 331 jurisdictions had achieved 50 percent waste diversion or greater.

Resources

The **Department of Resources Recycling and Recovery** (CalRecycle) has many resources to help local governments, residents and businesses to reduce solid waste. Some include:

» CalRecycle Home Page: http://www.calrecycle.ca.gov

» Local Government Central: http://www.calrecycle.ca.gov/LGCentral

» CalMAX (material exchange): http://www.calrecycle.ca.gov/CalMAX

» Buy Recycled program: http://www.calrecycle.ca.gov/BuyRecycled

» Environmentally Preferred Procurement: http://www.calrecycle.ca.gov/EPP/

The **CalRecycle's Recycling Market Development Zone** (RMDZ) program combines recycling with economic development to fuel new businesses, expand existing ones, create jobs, and divert waste from landfills. This program provides attractive loans, technical assistance, and free product marketing to businesses that use materials from the waste stream to manufacture their products and are located in a zone. The zones cover roughly 71,790 square miles of California from the Oregon border to San Diego. Local zone administrators and CalRecycle's Referral Team (R-Team) provide assistance. Local government incentives may include relaxed building codes and zoning laws, streamlined local permit processes, reduced taxes and licensing, and increased and consistent secondary material feedstock supply. http://www.calrecycle.ca.gov/rmdz

The **United States Environmental Protection Agency** has many resources to encourage waste reduction. http://www.epa.gov/epawaste/nonhaz/municipal/index.htm

Californians Against Waste is dedicated to conserving resources, preventing pollution, and protecting California's environment through the development, promotion, and implementation of waste reduction and recycling policies and programs. http://www.cawrecycles.org

Alameda County's StopWaste.org has numerous programs, guides, and information for residents, businesses, and local governments in the Bay Area on all kinds of recycling and waste prevention programs. Model ordinances and general plan language area also available. http://www.stopwaste.org.

The **Electronics Industries Alliance**, in cooperation with contributing manufacturers Canon, HP, JVC, Kodak, Nokia,

Sonoma County Central Disposal Site.
Photo credit: Sonoma County Department of Transportation and Public Works

Panasonic, Philips Electronics, Sharp, Sony, and Thomson, has initiated an innovative electronics collection and recycling pilot project. Check with other manufacturers directly to see if they have programs. http://www.eiae.org/index.php

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CALIFORNIA
ENERGY COMMISSION

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CEC-600-2009-013-F-VI-E.2.C.4.1 • FEBRUARY 2011

MUNICIPAL PROCUREMENT

Local governments have many opportunities to affect the amount of energy they consume through their procurement choices, whether it be purchasing reused, recycled, or sustainably sourced products; buying electricity from renewable resources; or procuring vehicles for municipal fleets. (See C.5.3 Municipal Fleet Efficiency.) The benefits of these strategies are covered elsewhere in this guide. This chapter focuses on the mechanics of procurement.

General Plan Language Ideas

» The city/county shall adopt an environmentally preferred procurement policy to:

- Conserve natural resources.
- Minimize environmental impacts such as pollution and overuse of water and energy.
- Eliminate or reduce toxics that create hazards to workers and the community.
- Support strong recycling markets.
- Reduce the amount of material going to landfills.
- Increase the use and availability of environmentally preferable products that protect the environment.

The Cost of Sustainable Procurement

Purchasing re-used, recycled, and energy efficient products may be harder to justify if up-front costs are higher than those for conventional products. This disparity may be lessened or eliminated, however, when the costs of operation and disposal over the period of ownership are taken into account. This accounting technique is referred to as "ownership costing." Higher costs may also be attenuated by aggregating purchases with other communities, through buying cooperatives or through the California Multiple Awards Schedule (CMAS) program. (See the Resources section for more information.)

Several avenues are available to reduce the cost of renewable energy, including direct rebates from the California Solar Initiative (CSI) program and federal tax credits. While local governments cannot take advantage of tax credits, through power purchase agreements (PPA) a city or county can host and agree to purchase the electricity from a renewable system that is owned by a private entity that is able to take the tax credits.

- Identify environmentally preferable products and distribution systems.

- Reward manufacturers and vendors that reduce environmental impacts in their production and distribution systems or services.

» The city/county shall develop and abide by an environmentally and socially responsible procurement policy that emphasizes long-term values and will become a model for other public as well as private organizations. The adopted procurement policy will be applicable to city/county programs and services in all areas.

» The city/county shall investigate ways to keep the cost of environmentally and socially responsible procurement economically feasible including, but not limited to, use of ownership costing, aggregated purchasing, and participation in the CMAS program.

Implementation Ideas

» **Conduct a pilot study of environmentally preferable purchasing** by developing environmental selection criteria for products used to maintain city/county buildings and vehicle fleets. The pilot program should demonstrate whether products meeting these criteria are available, cost-competitive, and effective at meeting the city/county's performance standards. If the pilot program is deemed successful, adopt an environmentally preferable purchasing program for the city/county.

» Decide when a recycled product can perform the function as well as a product from only virgin materials and the cost reasonably approximates the cost of the product from virgin materials. Adopt a policy that products should be purchased which contain, in order of preference:

- The highest percentage of post-consumer recovered material available in the marketplace.

StopWaste.Org has developed a resource guide for environmentally preferred products that contains more than 100 items. (See the Resources section for more information.) Some typical products that local governments purchase that have sustainable options include:

» Computers
» Copy paper
» Writing tablets
» Envelopes
» File folders
» Card stock
» Self stick notes
» Newsprint
» Paper towels
» Toilet tissue
» Facial tissue
» Paper napkins
» Corrugated boxes
» Padded mailers
» Printer cartridges
» Printer ribbons
» Compact discs (rewritable)
» Plastic or cardboard binders
» Pens and pencils
» Batteries
» Energy star electronics
» Cleaners
» Trash bags
» Food service plates, cups, flatware
» Coffee filters
» Office furniture
» Carpeting
» Park benches

- The highest percentage of pre-consumer recovered material available in the marketplace.

- Paper products that at a minimum meet the state of California's definition of "recycled paper products."

» Incorporate energy and water expenses into purchasing decisions. While inefficient equipment may be less expensive to purchase initially, the utility costs over the lifetime of the item may be significantly higher. Lifecycle costing incorporates this information into the procurement process. (See C.5.2 Municipal Facilities.) A "green audit" of all municipal purchases could be conducted to identify environmentally preferable alternatives.

» Establish a bidding preference to local businesses for city/county contracts. Purchasing goods and services locally contributes to sustainable economic development by reducing environmental impacts related to transportation, employs local residents, and redistributes city/county funds back into the community.

» Develop green building guidelines to help reduce negative environmental impacts from construction and development in the city/county. The guidelines should include required and recommended practices to reduce life-cycle environmental impacts from the construction and operation of both commercial and municipal developments and major remodel projects. These guidelines should provide specific green design and construction strategies and specifically address the purchase of building materials, electrical equipment, plumbing fixtures, and landscaping materials.

Energy Savings

Procurement programs that specify recycled content, renewable energy or energy-efficient products will reduce the amount of energy consumed by the city or county. See strategies C.2.1 Renewable Energy Resources and C.4.1 Solid Waste for details.

Environmental Benefits

In June 1999, the city of Santa Monica entered into a contract with Commonwealth Energy Corporation for the purchase of 100 percent renewable energy to power all city facilities. Santa Monica was the first municipality in the United States to obtain all of its electricity from renewable sources. A projection based on the city's 1998 energy use data indicated the switch to 100 percent renewable electricity will annually reduce GHG emissions by 13,672 tons, nitrous oxide (NOx) emissions by 16.2 tons, sulfur oxide (SOx) emissions by 14.57 tons, particulate matter (PM_{10}) by 2,285 lbs. and reactive organic groups by 190.5 lbs.[1]

One metric ton of carbon dioxide equivalent is eliminated when replacing a product made from virgin material with any of these choices:

» 20 cases of 30 percentn post-consumer-content copy paper.

» 6 cases of 100 percent post-consumer-content copy paper.

» 15 recycled plastic park benches with backs made with 98 percent post-consumer content.

» 900 pounds of 100 percent post-consumer-content recycled rubber.[2]

Economics

Santa Monica contracted for 100 percent renewable energy during the period when "direct access" was allowed by California's restructuring of the electric industry. As a result, the city's electricity rates following the market upheavals in 2000 and 2001 were lower than the rates they would have been paying had they stayed with Southern California Edison. The rate comparison in subsequent years has varied.[3]

Certain products may have a higher initial purchase cost but may require less maintenance or long-term costs over their lifespan. That's why it is important to consider short-term and long-term costs when comparing product alternatives, when feasible. This includes evaluating the total costs expected during the time a product is owned, including, but not limited to, acquisition, extended warranties, operation, supplies, maintenance, disposal cost and expected lifetime compared to other alternatives. Often when these "ownership" costs are considered, the least expensively price product is not the most economical in the long run.

Programs in Operation

In 1994, the city of **Santa Monica** adopted its environmentally and socially responsible procurement program as one of the eight guiding principles of its Sustainable City Program. The city's procurement plan considers such issues as recycled content in purchased materials, toxic use reduction, fleet maintenance, tropical rainforest wood, ozone depleting chemicals, energy-efficient office equipment, print shop inks, renewable energy for city facilities, green building guidelines, and a preference for accepting bids from local business. Santa Monica released its Green Office Buying Guide website in 2009. It is an interactive green purchasing site, and a good resource for municipalities. http://www.smgov.net/uploadedFiles/Departments/OSE/Categories/Buying_Green/Sustainable_Procurement_policies.pdf

The Green Office Buying Guide can be found at http://www.sustainablesm.com/buygreen.

San Francisco has adopted an environmentally preferable purchasing ordinance to reduce negative impacts to human health and the environment. San Francisco's specifications for purchases:

» Reduce exposure to potentially toxic chemicals for city staff, residents, and visitors by purchasing products for use in city operations that do not harm human health or the environment.

» Reduce San Francisco's contribution to global climate change by purchasing products reduce greenhouse gas emissions from commodities.

» Improve San Francisco air quality by purchasing vehicles and motorized equipment that minimize emissions of air pollutants.

» Protect the quality of San Francisco's ground and surface waters by eliminating the use of chemicals known to contaminate local water resources.

» Preserve resources locally and globally through purchasing practices that include:

- Maximizing water and energy efficiency and favoring renewable energy sources.
- Maximizing post-consumer-recycled content and readily recyclable or compostable materials.
- Favoring long-term use by evaluating a product's durability, repairability, and ability to be recycled.
- Considering life cycle economics of a product that includes manufacture, transportation, use and disposal.

Are All Recycled Content Products Created Equal?

Pre-Consumer Versus Post-Consumer Recycled Content

Many products are made from recycled materials. Items that use materials that have gone through their life cycles as consumer products and then are collected and used to make new products are called post-consumer materials. Preconsumer materials are generated by manufacturers and processors, and may consist of scraps, trimmings, and other by-products that have never been used by consumers. Products usually list the percentage of recycled materials and may include both pre- and post-consumer content.

Ventura County adopted a green procurement policy for county agencies that includes a 10 percent premium for qualified recycled paper products and the use of life cycle cost analysis that considers final, disposal, and replacement costs when feasible and appropriate. http://portal.countyofventura.org

Sacramento County's Public Works Agency adopted an environmentally preferred purchasing policy consistent with AB 939, which requires a 50 percent reduction of material going to landfills, and with the economics of effectively managing costs for solid waste disposal. This policy:

» Encourages waste prevention, recycling, market development, and the use of recycled or recyclable materials through lease agreements, contractual relationships, and purchasing practices with vendors, contractors, businesses, and other governmental agencies.

» Establishes waste prevention, recycling, and the use of recycled supplies and materials as an agency priority.

» Generates less waste material by reviewing how supplies, materials, and equipment are manufactured, purchased, packaged, delivered, used, and disposed.

» Serves as a model for others in the Sacramento region to prevent waste, encourage recycling, and develop wise procurement policies.

http://www.ciwmb.ca.gov/Buyrecycled/Policies/SacCounty.htm

Resources

These organizations already have developed advanced, sustainable procurement procedures. They share their expertise on their Internet sites.

Alameda County's StopWaste.Org Web page offers resources for developing and implementing an environmentally preferred procurement policy. This site includes a model policy, implementation guidelines, resource guides for environmentally preferred products, a guide to green maintenance and operations, and metrics for greenhouse gas savings. http://www.stopwaste.org

ABAG Publicly Owned Energy Resources (ABAG POWER) is a separate joint powers agency whose primary goal is to conduct pooled purchasing of natural gas on behalf of local governments and special districts that voluntarily join the pool. Pooled purchasing enables local governments to achieve more competitive pricing from suppliers who are interested in larger and more attractive combined loads. The pool is currently purchasing natural gas for 39 local governments and special districts in the Bay Area. http://www.abag.ca.gov/services/power

California's Department of General Services, California Multiple Awards Schedule (CMAS) offers a wide variety of commodities, non-IT services, and information technology products and services at prices that have been assessed to be fair, reasonable, and competitive. Suppliers may apply for a CMAS contract anytime, and no bids are required. The use of these contracts is optional and is available to both California state and local government agencies. http://www.pd.dgs.ca.gov/cmas/default.htm

Through its Buy Recycled program, the **California Department of Resources Recycling and Recovery** promotes the State's policy to "buy green." To assist potential grant applicants, as well as any local governments or businesses that consider creating a procurement policy, the Buy Recycled program compiles actual and proposed environmentally preferred procurement policies as a resource. http://www.calrecycle.ca.gov/Buyrecycled/Policies

The **Solana Center of Encinitas,** with funding support from U.S. EPA Region 9, provides recycled paper procurement to the public and private sectors through the Recycled Products Cooperative (RPC). To increase the use of recycled paper, the cooperative provides 30 percent post-consumer recycled paper that meets or beats the price that many businesses and public agencies pay for virgin fiber paper. There is no cost to be a member of the cooperative. Interested parties contact the Solana Center to receive pricing information and a customer number, which guarantees the co-op's discount pricing schedule. The paper available is tested and recommended by the U.S. Government Printing Office. http://www.recycledproducts.org

Related Strategies

C.1.1 Community Energy Authorities
C.2.1 Renewable Energy Resources
C.4.1 Solid Waste
C.5.3 Municipal Fleet Efficiency

Endnotes

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MUNICIPAL FACILITIES

The potential for saving money through energy and water fficiency in municipal facilities is tremendous but requires commitment and organization. Lighting retrofits, HVAC replacements, and drought-tolerant landscaping are just a few of the ways local governments can reduce their energy and water use. Developing a comprehensive plan and providing staffing and other resources to implement it will ensure longer lasting savings that could more than pay for themselves in the future.

General Plan Language Ideas

» The city/county shall develop a comprehensive strategy to reduce energy and water consumption in public facilities. The strategy shall include a management structure to oversee energy and water efficiency programs, quantitative objectives for reductions in energy and water consumption, specific programs to achieve objectives (including regular audits of facilities), a time schedule for implementation, identification of responsible departments, and sources of funding.

» The city/county shall evaluate the effectiveness of retrofitting all facilities with energy- and water-saving devices, including efficient indoor and outdoor lighting, improved heating, ventilation and air-conditioning equipment, equipment controls, low-flow plumbing fixtures, and energy- and water-efficient landscaping.

» All new and renovated city/county facilities shall use energy-efficient designs that exceed current building and appliance standards. Lifecycle costing shall be used in major purchasing and construction decisions.

Implementation Ideas

» **Enter into a local government-utility partnership.** The California Public Utilities Commission (CPUC) oversees the spending of public goods charge energy efficiency funds that utilities collect from their customers. The CPUC has identified local government partnerships with utilities as a key element in its goal of reducing energy use statewide. Partnerships can focus first on improving the energy performance of municipal facilities, and then extend to the broader community.

» **Develop a comprehensive energy and water efficiency strategy.** Appoint an interdepartmental task force to develop the strategy, which should include specific objectives, implementation measures, time schedules, funding sources, and department responsibility.

» **Provide departments with information and incentives.** Track energy and water use by department and/or building (for example, each fire station). This may require submetering. Post results regularly to maintain awareness and interest. Provide awards (monetary or other) to departments that meet conservation objectives. Departments could be charged for their individual energy and water use, providing additional incentives for reduction.

» **Assign overall responsibilities to a management-level employee.** One person should be responsible for overall development, management, and monitoring of the program. Appointing a full-time energy/water manager may be appropriate in a large jurisdiction. Smaller jurisdictions may combine these functions with other responsibilities, such as facilities management. With either option, make sure the person is given enough support to carry out objectives in a timely manner.

» **Monitor progress.** After efficient equipment or practices are implemented, monitor energy and water consumption to track benefits. Software programs that account for changes in weather are available to help track energy use. Monitoring energy and water consumption helps to identify problems and measure successes.

» **Inform decision-makers of progress.** Energy and water conservation programs will save the city/county money. To maintain a commitment to the program, council members and supervisors should be informed regularly of these savings and specific implementation programs

» **Educate employees.** Provide employees with new and useful information. Encourage employee involvement in the program, through task forces and suggestion boxes, so that educational materials are appropriate and effective. Educate employees about simple methods to avoid waste, such as turning off lights.

» **Perform regular audits and retrofit facilities.** All facilities should be audited for energy and water consumption regularly. Retrofit buildings with a package of measures to maximize efficiency.

» **Incorporate energy and water expenses into purchasing decisions.** While inefficient equipment may be less expensive to purchase initially, the utility costs over the lifetime of the item may be significantly higher. Lifecycle costing incorporates this information into the procurement process. (See Strategy 5.1 Municipal Procurement.)

» **Establish a fund or identify outside funding for efficiency improvements.** Efficiency improvements often require upfront capital expenses. These expenses will eventually be recovered through lower utility bills, sometimes within a few years. A fund could be established, initially through bonds, general funds, or other sources, to provide capital funding for efficiency projects. Alternatively, a source of outside funding, such as the Energy Commission and/or utility loan programs, could provide capital funding for projects. All or part of the savings from utility bills resulting from the projects and utility rebates should be reinvested into the fund to continue developing savings into the future.

» **Speed up project authorization.** Approving capital expenses can often be a time-consuming process in local government. To take advantage of deadlines for utility incentives and rebates, this process may need to be shortened.

» **Incorporate efficiency into new building design.** Energy and water efficiency improvements are usually less expensive and more effective when incorporated into the initial building design. Require buildings to exceed current minimum state standards for energy efficiency. (See Strategy B.1.2 Going Beyond State Minimum Energy Standards.)

» **Implement a regular maintenance schedule.** Regular maintenance of equipment such as heating, ventilation, and air-conditioning systems can improve efficiency.

» **Install an energy management system** (EMS). A computerized energy management system monitors energy use and controls heating, ventilation, and air-conditioning (HVAC) equipment to maximize efficiency. Not all facilities are suited to EMSs. Some energy management systems can be integrated with other building functions such as security and fire safety. Budget for the cost of training staff.

» **Replace inefficient street lighting.** Street lighting usually represents a sizable portion of a jurisdiction's energy use. Consider installing induction lighting or solid state lighting (LEDs) and photocells that automatically turn lights on and off. Use induction or other efficient lighting fixtures in public parking lots and garages as well. Where electricity is unavailable, explore the availability of solar-powered street lighting. Consult with the Energy Commission, utilities, and the California Lighting Technology Center for information on the latest types of cost-effective street and outdoor lighting.

» **Use pool covers, alternative pumping strategies, and energy-efficient pool lighting.** Pool covers are a cost-effective way to reduce pool heating needs. Analyze the effectiveness of solar heating for public pools and install a system if feasible. Also consider alternative pool pumping strategies, including the use of two-speed or variable-speed pumping. Consider use of LED pool lighting when pools are operated in the evenings.

» **Install energy and water-efficient landscaping.** Planting shade trees and other landscaping features can reduce heat gain in the summer. Water-efficient landscaping will save water and energy along with reducing maintenance. (See Strategies B.1.7 Shade Trees and W.2.1 Water-Efficient Landscaping.)

Energy Savings

The city of Fairfield reduced energy needs by more than 1.8 million kWhs and more than 182,000 therms per year and reduced peak demand by 274 kW, saving more than $283,000 annually. A series of energy efficiency improvements funded with $2 million low-interest loan from the Energy Commission, (including improvements to the existing HVAC system, controls and cogeneration system, lighting retrofits and recommendations for equipment maintenance) helped the city reduce utility bills and equipment maintenance costs. In addition, the city received rebates from PG&E for reducing peak energy loads.[1]

Contra Costa County implemented energy efficiency retrofits to eight buildings that reduced energy use by an average of 28 percent, saving 18,000 therms, 528,000 kilowatt-hours and $112,000 per year, which lowered building maintenance costs and improved indoor comfort for employees. The measures included replacing pneumatic controls with direct digital controls, controlling hot water pumping, and replacing variable inlet vanes on air-handling unit fans with variable frequency drives. The project was financed using two loans from the Energy Commission and county funds with a simple payback period of just over 6 years.[2]

A study of more than 1,700 buildings in the United States, Canada, and Europe found that the median energy savings from retrofitting office buildings was 23 percent. The study also found that retrofit projects do not always achieve their maximum potential savings due to improper installation and calibration, lack of maintenance, and inappropriate usage. The researchers concluded that energy management must be viewed not as an event but rather a process, one that incorporates both an understanding of proper building operation on the part of the facility manager and the long-term tracking of energy performance and specific indicators of operating problems.[3]

Environmental Benefits

Any reduction in electricity and natural gas use will result in fewer air pollutants entering the atmosphere. For example, using 1,000 kWh of electricity in California produces 690 pounds of greenhouse gases.[4] That amount of electricity could be saved in one year by replacing four 75-watt incandescent light bulbs with compact fluorescent lamps.[5]

Reducing energy consumption, particularly electricity use during the peak period, can help improve air quality by reducing pollutants from natural gas-fired power plants.

Energy efficiency also reduces the environmental impacts of energy extraction and generation, including those caused by mining and transporting fuels and disposing of utility wastes. Water conservation helps to maintain fragile wildlife habitats, avoid construction of new dams and conveyance systems, and reduce wastewater.

Economics

The city of Oakland cut its annual energy costs by an estimated $72,000 through energy retrofits at the Oakland Museum of California and at several fire stations, city libraries, recreation centers, senior centers, parking garages, and tennis courts. These projects include the conversion of electric ovens to gas and retrofitting the central cooling plant at the museum, and installing energy efficient lamps and ballasts at several city facilities. The city recovered the initial cost of the retrofits ($348,000) within five years.[6]

The city of San Carlos is saving $80,000 a year in energy costs after retrofitting city hall with lighting, HVAC, variable air volume, air handler, and control upgrades. The city's maintenance costs have been reduced. The retrofits addressed indoor comfort problems (localized hot and cold spots) associated with the old heating and cooling system, which required the building to be heated and cooled at the same time. The Energy Commission loan covered 97 percent of the project cost with a simple payback period of 8.1 years.[7]

Programs in Operation

Alameda County has undertaken a municipal energy and water conservation program that has reduced its energy usage by one-third and saves taxpayers $6.5 million annually. It includes a countywide lighting retrofit of three million square feet in 50 buildings and a lighting retrofit, boiler plant renovation, water conservation, hot water, and energy reclamation system for the laundry, new cooling water treatment system, and a heating and hot water system retrofit at the county jail. Water conservation measures include "Bay-Friendly" landscaping at the County Administration Building and low-flow toilets, urinals, showers, faucets, and irrigation at the jail. The jail also houses one of the largest photovoltaic arrays and fuel cell projects in the country. http://www.acgov.org/gsa/sustainability.htm

The **Ventura County Regional Energy Alliance** (VCREA) assisted in the development and implementation of lighting retrofit projects in six gymnasiums throughout Ventura County. Retrofitting metal halide lighting with new generation fluorescent and motion sensor activation created dramatic reductions in hours of use and improvements in light levels and quality. The completed projects reduced kWh by an average of 49 percent, with an annual electricity cost reductions of 48-55 percent. The projects averaged a 50 percent return on investment. http://www.vcenergy.org

Resources

The California Energy Commission's **Energy Partnership Program** offers cities and counties one-on-one technical assistance to improve energy efficiency in their facilities. The program also offers energy audits, review of proposals and designs, and equipment performance specification. http://www.energy.ca.gov/efficiency/partnership/index.html

The California Energy Commission's **Energy Efficiency Financing Program** provides low-interest loans for the installation of energy-saving measures in schools, special districts, hospitals, and other municipal buildings. http://www.energy.ca.gov/efficiency/financing

Most utilities offer rebates and design assistance for the installation of energy-conserving fixtures and equipment. Local governments can partner with investor-owned utilities to develop comprehensive municipal energy programs for residents and businesses. Check with your local utility for details.

The **California Department of Water Resources** (DWR) offers grants and loans for water conservation, agricultural water recycling, groundwater management, water quality and supply, and studies and activities to enhance local water supply reliability. http://www.grantsloans.water.ca.gov

Related Strategies

C.1.2 Community Energy District Financing
C.1.3 Cool Communities
C.2.1 Renewable Energy Resources
C.2.2 Distributed Generation

Endnotes

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CEC-600-2009-013-F-VI-E.2.C.5.2 • FEBRUARY 2011

MUNICIPAL FLEET EFFICIENCY

Local governments in California own and operate hundreds of thousands of vehicles. By increasing the fuel efficiency of individual vehicles, operating them more efficiently, and improving overall fleet management, cities and counties can save significant amounts of energy and money while helping to address the risks associated with air pollution and climate change.

General Plan Language Ideas

» The city/county shall adopt a policy to purchase and/or lease the most fuel-efficient vehicles for the tasks they will perform.

» The city/county shall operate its vehicle fleet to improve fuel efficiency and reduce costs. Within one year, the fleet manager shall develop an energy-conserving fleet management plan. The council/board shall provide the support necessary to implement the plan, which will then serve as a model for private fleet operators in the community.

Implementation Ideas

» **Put in place a management information system.** Document the impact of fleet activities by carefully inventorying all of your vehicles. Include the types of vehicles, how many of each type you have, and the kind and amount of fuel they use. By closely tracking maintenance schedules, fuel consumption, mileage, and other information, the fleet manager can identify problems and develop solutions to reduce costs and fuel consumption.

» **Purchase fuel-efficient and appropriately sized vehicles.** By analyzing the needs of their fleet, managers may be able to "downsize" it – substituting smaller vehicles for larger, less efficient ones when making new purchases. In all purchasing decisions, fuel efficiency should be a major criterion. Include minimum fuel efficiency in procurement specifications. Use life-cycle costing, including the cost of fuel, to fairly compare one vehicle purchase against another.

» **Assign vehicles appropriate to the task.** Often larger, more powerful vehicles are used when smaller, more efficient ones would perform the task just as effectively. The fleet manager should have the authority to analyze how vehicles are used and assign those that are the most appropriate for the task. Using a powerful pickup truck for a trip that does not require hauling large or heavy items is not energy-efficient.

San Mateo County's hybrid fleet.
Photo credit: San Mateo County Fleet and Facility Operations.

- **Reduce the fleet size.** If some vehicles are used infrequently, consider reducing the overall fleet size. If more vehicles are used at certain times, mid-week versus Mondays and Fridays for example, consider ways to level out the peak to allow for reducing the number of vehicles. Reducing fleet size will lower maintenance and insurance costs and may reduce the practice of using vehicles for personal business.

- **Practice preventive maintenance.** Keeping tires properly inflated and performing regular tune-ups will improve fuel efficiency. In addition, regular preventive maintenance may avoid costly and time-consuming repairs.

- **Train maintenance staff.** Make sure maintenance staff is aware of practices to improve fuel economy. Staff should also recycle used oil, tires, and batteries, and use non-toxic or low-toxic cleaning materials.

- **Inform drivers of fuel-efficient driving techniques.** Excessive idling, quick starts, and speeding increase gasoline consumption. Make sure drivers are well-versed in ways to cut fuel use.

- **Rental rates should reflect all costs.** If departments are charged for vehicle use, the rates should reflect the true cost of owning, operating, and replacing the vehicle. If charges are too low, departments receive the wrong price signals, and fleets may not operate efficiently. For some trips, it may be less expensive and more energy-efficient to use local transit or intercity trains.

- **Centralize fleet operations.** Many cities and counties have several departments that operate fleets independently and, as a result, inefficiently. By centralizing fleet operations under one management system, economies of scale can reduce costs, and fuel efficiency programs can be implemented more effectively.

- **Automate the fueling station.** Automated fueling stations can accurately keep track of how much fuel each vehicle uses. This can be used to track fuel efficiency, schedule preventive maintenance, and discourage excessive personal use of fleet vehicles.

Energy Savings

Fixing a car that is noticeably out of tune or has failed an emissions test can improve its gas mileage by an average of 4 percent, though results will vary based on the kind of repair and how well it is done. Fixing a serious maintenance problem, such as a faulty oxygen sensor, can improve mileage by as much as 40 percent.[1]

Keeping tires inflated to the proper pressure can improve gas mileage by around 3.3 percent. Underinflated tires can lower gas mileage by 0.3 percent for every one pound per square inch (psi) drop in pressure of all four tires. Properly inflated tires are safer and last longer.[2]

Using the manufacturer's recommended grade of motor oil can improve gas mileage by 1 to 2 percent. For example, using 10W-30 motor oil in an engine designed to use 5W-30 can lower gas mileage by 1 to 2 percent. Using 5W-30 in an engine designed for 5W-20 can lower gas mileage by 1-1.5 percent. Look for motor oil that says "Energy Conserving" on the API performance symbol to be sure it contains friction-reducing additives.[3]

Aggressive driving wastes gas. Speeding, rapid acceleration, and quick braking can lower gas mileage by 33 percent at highway speeds and by 5 percent around town.[4]

While each vehicle reaches its optimal fuel economy at a different speed (or range of speeds), gas mileage usually decreases rapidly at speeds above 60 mph.[5]

Combining errands into one trip saves time and money. Several short trips taken from a cold start can use twice as much fuel as a longer multipurpose trip covering the same distance when the engine is warm. Trip planning ensures that traveling is done when the engine is warmed-up and efficient and can reduce the distance traveled.[6]

The amount of energy saved from downsizing a fleet will depend upon the efficiency of the existing fleet and the rate that vehicles are replaced. For example, replacing 20 percent of the fleet with vehicles that average 30 mpg instead of 25 mpg would reduce overall fuel consumption by 4 percent, assuming that the new vehicles are driven the same amount as the vehicles they replaced.

Environmental Benefits

Reducing fuel consumption through improving efficiency directly reduces carbon dioxide and other air pollutant emissions. For every gallon of gasoline saved, about 25 fewer pounds of carbon dioxide (CO_2) are emitted. (See Appendix A.)

Economics

Reducing fuel consumption in city/county fleets results in direct economic savings. Reducing fuel consumption by just 10 percent through regular maintenance, proper tire inflation, and downsizing a portion of the fleet would reduce fuel costs by a comparable percentage. In addition,

Plug-in hybrids and charging stations.
Photo credit: Sonoma County Fleet and Facility Operations.

regular maintenance to improve fuel efficiency can eliminate costly repairs. In most cases, the costs of providing regular maintenance can be absorbed in the existing budget and will be offset by avoided repair work.

The cost of computer software for an information management system will depend upon a department's needs and its computer hardware. Public domain software is available. Magazines aimed at fleet managers often list available software.

Programs in Operation

On Earth Day, 1993, **Denver, Colorado,** created the first Green Fleets program in the nation. The Green Fleets executive order requires the managers of both Denver's city vehicles and the fleet at the Denver International Airport to purchase the most cost-effective and lowest emission vehicles possible and to include fuel-efficiency standards in their procurement specifications. The Green Fleets review process also includes "right-sizing" fleets by reducing vehicle size and eliminating old and underused vehicles. The effectiveness of the program is measured by fleet energy use and CO_2 emissions. In 2008, alternatively fueled or powered vehicles made up 43 percent of the city's total fleet of 3,533 vehicles. Switching to more fuel-efficient vehicles, as well as ones that use cleaner biofuels, is helping Denver to reach its goal to reduce per-capita greenhouse gas emissions by 10 percent below 1990 levels by 2012. http://www.greenfleets.org

In 2007, the city of **San Jose** adopted a Green Fleet Policy to make every effort to purchase and use the lowest emission vehicle or equipment item possible, while taking into account the vehicle's life-cycle costs and the ability to support city operations and services. Through implementation of this policy, the city sought to decrease total vehicle emissions by 25 percent by fiscal year 2012-13, using 2002-03 as a baseline year. San Jose's Green Fleet Strategies include:

» Optimizing fleet size.

» Decreasing vehicle emissions.

» Reducing vehicle size.

» Increasing use of alternate fuel vehicles and equipment.

» Implementing best practices to minimize vehicle miles traveled (VMT).

http://sanjoseca.gov/esd/PDFs/GreenFleetPolicy_091707.pdf

The city of **Berkeley** partnered with City CarShare, a San Francisco Bay Area carsharing organization, to replace municipal fleet vehicles with carsharing vehicles. This has allowed the city to quickly transition to using new, super fuel-efficient hybrid Toyota Prius vehicles without additional costs. http://www.mayorsinnovation.org/pdf/park_june05.pdf

Resources

The Sierra Club developed the website coolfleets.com to help commercial, government, and municipal fleets to model vehicle alternatives and to better understand carbon outputs and lifecycle costs. Car and truck fleets are significant contributors to greenhouse gases, and the selection of vehicles that are more fuel-efficient can not only reduce CO_2, but can also lower the total cost of fleet operations. http://coolfleets.com

The Puget Sound Clean Air Agency and Puget Sound Clean Cities Coalition have developed a comprehensive step-by-step guide to greening public and private vehicle fleets. Their website includes a process for developing a green fleets plan and an emissions calculator. http://psgreenfleets.org/reduction-strategies/develop-a-plan

The U.S. Department of Energy Alternative Fuels and Advanced Vehicles Data Center (AFDC, formerly known as the Alternative Fuels Data Center) provides a wide range of information and resources about using alternative fuels. It also explains other petroleum reduction options such as advanced vehicles, fuel blends, idle reduction, and fuel economy. The site is sponsored by the U.S. Department of Energy's Clean Cities initiative. http://www.afdc.energy.gov/afdc

City CarShare vehicles used by City of Berkeley staff on weekdays, and by the public on evenings and weekends.
Photo credit: Cambridge Systematics, Inc.

Endnotes

1. U.S. DOE & US EPA. Accessed August 2009. US Department of Energy & US Environmental Protection Agency, fueleconomy.Gov. http://www.fueleconomy.gov/feg/maintain.shtml.
2. Ibid.
3. Ibid.
4. Ibid.
5. Ibid.
6. Ibid.

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APPENDIX A

GREENHOUSE GAS EMISSIONS FACTORS

ENERGY AWARE PLANNING GUIDE

GREENHOUSE GAS EMISSIONS FACTORS

Individuals and organizations are increasingly trying to obtain information about greenhouse gas emissions. The reasons for needing such information vary, but four common ones include:

To build and maintain a GHG emissions inventory.

To estimate GHG reductions from a project.

To estimate GHG benefits of a policy or program.

To claim a product or the firm is carbon neutral.

As the Overview of California Energy Supplies describes (Section II), it can be challenging to obtain accurate and consistent information about the GHG emissions associated with a product, a service, or any type of change in energy supply or demand. Emission factors can help when more specific information is not available.

An emissions factor relates the quantity of an emission released to the atmosphere (for example, carbon dioxide) with a measurable level of activity that leads to the emissions release (for example, gallons of gasoline consumed). These factors are usually expressed as the weight of the emission divided by a unit weight, volume, distance, or duration of the activity causing the release (for example, pounds of CO_2 emitted per gallon of gasoline consumed). Such factors help estimate emissions from various sources of air or water pollution. In the *Energy Aware Planning Guide*, emission factors for GHGs are based upon carbon dioxide (CO_2) or carbon dioxide equivalent (CO_2e). A carbon dioxide equivalent involves converting the warming potential of non-CO_2 gases into an equivalent amount of CO_2. For an explanation of global warming potential (GWP), see: Table 2.14, page 212 of Chapter 2, Working Group I, Fourth Assessment Report, Intergovernmental Panel on Climate Change (2007), at: http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter2.pdf.

General or default emission factors for six types of energy supply in California are shown in the following table. These energy supplies include: electricity, natural gas, gasoline, diesel, E85, and CNG. The transportation energy supplies have two emission factors. The factor for direct emissions is needed when preparing and maintaining an annual GHG emissions inventory. The full fuel-cycle factor can be used when estimating the emissions benefits of policies or programs that reduce consumption – where benefits accrue up the supply chain for any particular energy supply that is reduced. Full fuel-cycle factors are also useful when calculating the cost-effectiveness of different measures to reduce transportation emissions.

GHG Emission Factors for Energy in California

TYPE OF ENERGY	EMISSIONS FACTOR		UNITS	SOURCE / NOTES
ELECTRICITY » Annual Consumption	Obtain Annual Factor from Electricity Provider (see Figure 4 in Section 2)		lbs CO_2 per MWh	Individual electricity providers report annual GHGs to ARB; purchased electricity GHGs are "indirect" for inventory
» Programs that Reduce Consumption	690		lbs CO_2 per MWh	California Energy Commission - Electricity Supply Analysis Division
NATURAL GAS	11.69		lbs CO_2 per therm	US EPA (2009) GHG reporting rule
	10.87		lbs CO_2 per 100 scf	Lower Heating Value 930 Btu/scf
TRANSPORT	**DIRECT EMISSIONS**	**FULL- FUEL CYCLE**	**UNITS**	**SOURCE / NOTES**
CA Gasoline (CaRFG)	17.79	24.78	lbs CO_2e per gallon	LCFS (ARB 2009); 10% average Midwest ethanol
Ultra-Low Sulfur Diesel (ULSD)	22.20	28.08	lbs CO_2e per gallon	LCFS (ARB 2009)
E85 (85% ethanol)	3.79	18.58	lbs CO_2e per gallon	LCFS (ARB 2009), average Midwest ethanol; biogenic CO_2 not included; direct emissions do not include sources from fuel production
Compressed Natural Gas (CNG)	12.48	14.64	lbs CO_2e per 100 scf	LCFS (ARB 2009)

Source: Fuels and Transportation Division, California Energy Commission

Water Supply and Embodied Energy

Water is a vital resource for California residents, businesses, and healthy ecosystems. The Energy Commission reported in 2005 that activities related to water account for nearly 20 percent of total energy consumed in the state. In terms of an organization's GHG emissions inventory, the consumption of water is a source of indirect GHG emissions. The GHG emissions result from embedded energy in water supply and wastewater treatment. The California Utilities Commission (CPUC) is conducting a series of studies on the embedded energy of water. Results from these studies suggest that no single GHG emission factor can be applied to all supplies of water throughout the state. Water suppliers all differ in the amount of energy required to extract, convey, treat, and distribute potable water, as well as handle wastewater.

The Water Use Cycle provides an effective framework for understanding the primary drivers of energy use by water and wastewater agencies, and the resultant range of energy intensities within each segment. A range of

Energy Intensity of California Water Supplies

Range of Energy Intensities Observed Through CPUC Studies
Units: kilowatt hours per million gallons (kWh/MG)

	Supply & Conveyance				Water		Wastewater		Recycled Water	
	Surface	Groundwater	Brackish Desal	Seawater Desal	Treatment	Distribution	Treatment	Collection &/or Distrib	Treatment	Distribution
Calexico, City of					1,114-1,214		3,842-4,472			
Calif American Water - Monterey	3,546-6,666	2,099-4,373		12,276					1,422-1,994	
Central Valley Project	715-1,313									
Coachella Valley Water District		1,970-3,753			923-1,437					
Colorado River Aqueduct	6,064									
Contra Costa Water District	625-1,704			12,276	895-1,210	688-1,524				
East Bay Municipal Utilities District	10-1,193			12,276	80-310	319-699				
Glenn-Colusa Irrigation District	26-39					39-116				
Inland Empire Utilities Agency			3,819-3,945				2,103-2,122	44	0	752-914
Los Angeles County Sanitation District							1,104-1,446	205-400		
Los Angeles Dept. of Water & Power	0									
Marin Municipal Water District	9-480			12,276	105-1,045	352-1,851	984-2,948			969-1,965
Metropolitan Water District of SoCA										
Modesto Irrigation District	0									
Monterey Regional WPCA							1,422-1,994	243-333		
Natomas Mutual Water Co.	0-12									
Oceanside, City of		1,117-2,009		12,276	43-86	134-247	1,062-1105	383-497		
Orange County Sanitation District							24-1,314	3-6		
Orange County Water District									3,258-3,503	458-1,122
Rancho California Water District		1,971-2,324				1,166-1,423			992-1,292	
San Diego County Water Authority	7,464									
San Francisco Public Utilities Comm.	2-724									
San Gabriel Water Co.	5-104	1,989-3,014				37-141				
San Jose Water Co.	10-464	1,452-2,098			167-2,220	605-4,045				
Santa Clara Valley Water District	2,670									
Semitropic Water Storage District		790-1,261								
Sonoma County Water Agency		1,728-1,975				273-610	1,812-4,941	0-2		0-509
State Water Project	568-14,252									
Suburban Water Systems		1,254-1,619				801-1,081				
Valley Center Water District				12,276		347-3,063				
Westlands Water District	1,044-1,341	1,571-2,530								

Source: Embedded Energy in Water Studies / Study 2: Water Agency and Function Component Study and Embedded Energy-Water Load Profiles; Appendix B – Agency Profiles. GEI Consultants/Navigant Consultants, prepared for the California Public Utilities Commission. May 2010.

energy intensities were observed through the CPUC's studies of the water-energy relationships for 31 water and wastewater agencies in California. The significant variability observed within each segment is attributable to the energy drivers of different types of water supplies, treatment technologies, and service area characteristics.

For example, significant quantities of energy are needed to transport water hundreds of miles across the state, and in one place, more than 2,000 feet over the Tehachapi Mountains. Clean sources of surface water that can be supplied by gravity require less energy than deep groundwater aquifers or desalinated seawater sources. The CPUC website has more information about the embedded energy in water studies, including a Water Energy Load Profiling Tool (WELP) in Microsoft Access® 2007 (see: http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/EM+and+V/Embedded+Energy+in+Water+Studies1_and_2.htm

Estimating GHG Emissions of an Organization

An organization may wish to create and maintain an inventory of its annual GHG emissions for a number of reasons. The intended use of an emissions inventory will dictate the level of effort and accuracy necessary to create and maintain it. An inventory can be prepared for mandatory reporting or voluntary reporting purposes. Currently both the State of California and the federal government have mandatory GHG emissions reporting programs for certain, typically large sources such as power plants, refineries, and cement producers.

California's mandatory GHG reporting program is led by the California Air Resources Board (ARB). Information about the state's mandatory program can be found at: http://www.arb.ca.gov/cc/ccei.htm. The federal mandatory GHG reporting program is led by the U.S. Environmental Protection Agency; information about this program can be found at: http://www.epa.gov/climatechange/emissions/ghgrulemaking.html. Both ARB and US EPA provide technical guidance on creating and maintaining GHG emissions inventories for mandatory reporting.

A number of programs provide guidance on voluntary GHG emissions reporting. The US EPA developed guidance on voluntary reporting through a program called Climate Leaders; this guidance can be found at: http://www.epa.gov/climateleaders/reporting/index.html.

The International Council on Local Environmental Initiatives (ICLEI) helps local governments prepare GHG emissions inventories. ICLEI partnered with The Climate Registry (TCR), the California Climate Action Registry (CCAR), and ARB to draft the Local Government Operations Protocol, which is available at: http://www.iclei.org/index.php?id=ghgprotocol.

Broader guidance on the preparation of a GHG emissions inventory can be found at the following three organizations:

» World Resources Institute/World Business Council on Sustainable Development (WRI/WBCSD): http://www.ghgprotocol.org/

» International Organization for Standardization (ISO): http://www.iso.org/iso/home.html, including ISO 14064 Parts 1-3 and 14065

» Intergovernmental Panel on Climate Change (IPCC), Task Force on National Greenhouse Gas Inventories: http://www.ipcc-nggip.iges.or.jp/

A number of non-profit organizations provide guidance or protocols to help develop, maintain, report, and verify annual GHG emissions. CCAR protocols initially focused on entitywide GHG emissions inventories. (See: http://www.climateregistry.org/tools/protocols/general-reporting-protocol.html). Voluntary reporting for CCAR members shifted to The Climate Registry after 2010, and TCR has its own set of guidance for GHG inventories (see: http://www.theclimateregistry.org/resources/protocols).

Many of the emission factors used to estimate an organization's annual greenhouse gas emissions are similar across these various GHG reporting programs. Generally the reporting programs acknowledge that site-specific or source-specific data can be more accurate than data used to establish default GHG emissions factors. Default emission factors often represent an average over a much broader set of similar types of emission sources.

Estimating GHG Emissions from a Project

GHG emission factors are commonly used to estimate the GHG reduction benefits of a particular project. As more and more organizations adopt climate action plans and establish baselines of annual GHG emissions, they will want to identify how specific projects or activities reduce those emissions. For example, the direct emission reduction from a project that avoids consumption of 1,000 gallons of diesel fuel can be estimated using the ultra-low-sulfur diesel (ULSD) default emissions factor shown in the table at the beginning of this section.

Many organizations now purchase GHG emission reductions (generally called "offsets") through rapidly expanding voluntary and regulatory carbon markets. Emission factors are used to quantify the annual GHG reductions that result from the different types of offset projects. Several entities develop protocols or methods to quantify, report, verify, register, trade, and track offset project emission reductions. Provided below are a few examples of organizations that develop project protocols and methods to establish project GHG emission reductions:

» Climate Action Reserve (CAR) http://www.climateactionreserve.org/how/protocols/

» The Clean Development Mechanism (CDM) http://cdm.unfccc.int/methodologies/index.html

» The Gold Standard (GS) http://www.cdmgoldstandard.org/Gold-Standard-Methodologies.347.0.html

» The Voluntary Carbon Standard (VCS) http://www.v-c-s.org/methodologies.html

Emission Factors for Policies, Programs, and Actions

A growing number of organizations have developed climate action plans. Others are addressing energy and climate change through programs or policies related to sustainability. Many of these efforts by corporations, governments, non-profits, and individuals include analysis of changes in GHG emissions over time or chart progress towards a reduction target. A wide range of tools are now available that help calculate changes in GHG emissions, from spreadsheet models to online calculators. All of these tools use GHG emission factors.

The following are examples of Internet tools available for estimating GHG emission reductions resulting from policies, programs, measures, or actions:

» *California's Climate Change Scoping Plan* encourages local governments to adopt a goal to reduce GHG emissions similar to the state's target, approximately 15 percent below 2008 levels by 2020. The Air Resources Board created a Local Government Toolkit that provides guidance and resources to assist local governments in reducing GHG emissions: http://www.arb.ca.gov/cc/localaction/localgovstrat.htm

» STAPPA and ALAPCO's Clean Air and Climate Protection Software (CACPS) is a Windows-based, user-friendly software tool that helps state and local governments analyze the benefits of various air pollution control scenarios to help them select the strategies that address not only traditional air pollutants (such as ozone precursors like nitrogen oxides and volatile organic compounds, carbon monoxide, sulfur oxides, and particulate matter), but also greenhouse gases: http://www.4cleanair.org/InnovationDetails.asp?innoid=1

» Project 2° is a partnership effort of the Clinton Climate Initiative (CCI) and Microsoft Corporation. The partnership also benefits from expertise provided by Ascentium Corporation, ICLEI – Local Governments for Sustainability - and the Center for Neighborhood Technology (CNT). Project 2° has software that allows cities to establish a baseline for their GHG emissions, manage inventories, create climate action plans, track effectiveness of reduction programs, and then share their experiences with others. Project 2° is a global, multilingual emissions measurement toolset available 24 hours a day, seven days a week via the internet: http://www.project2degrees.org/

Carbon Neutral or Reduced Carbon Footprint

One reason for interest in GHG emission factors is the potential benefits of "carbon neutral" or "zero carbon footprint" claims for a product or an organization. A number of firms sell GHG reductions that allow an individual or organization to offset or neutralize the adverse GHG impact of their activities (for example, air travel, music concerts, utility bill). These offset providers typically use GHG emission factors to estimate the GHG reduction necessary to render an activity carbon neutral or have its associated carbon footprint reduced.

Protocols and other forms of guidance help to verify claims of lowered carbon footprints or carbon neutrality. The United Nations Environment Programme (UNEP) provides a free publication titled "Kick the Habit: A UN Guide to Climate Neutrality" available at: http://www.unep.org/publications/ebooks/kick-the-habit/pdfs/KickTheHabit_en_lr.pdf. Other examples of organizations and types of resources available on this topic include:

» Climate Neutral Network
http://www.unep.org/climateneutral/

» Center for Resource Solutions
http://www.resource-solutions.org/

» Clean Air-Cool Planet
http://www.cleanair-coolplanet.org/

» The Carbon Neutral Company
http://www.carbonneutral.com/about-us/quality-assurance/

Conversion Factors

Mass			
1 pound (lb) =	453.6 grams (g)	0.4536 kilograms (kg)	0.0004536 metric tons (tonnes)
1 kilogram (kg) =	1,000 grams (g)	2.2046 pounds (lb)	0.001 metric tons (tonnes)
1 short ton (ton) =	2,000 pounds (lb)	907.18 kilograms (kg)	0.9072 metric tons (tonnes)
1 metric ton (tonne) =	2,204.62 pounds (lb)	1,000 kilograms (kg)	1.1023 short tons (tons)
Volume			
1 cubic foot (ft^3) =	7.4805 US gallons (gal)	0.1781 barrels (bbl)	
1 cubic foot (ft^3) =	28.32 liters (L)	0.02832 cubic meters (m^3)	
1 US gallon (gal) =	0.0238 barrels (bbl)	3.785 liters (L)	0.003785 cubic meters (m^3)
1 barrel (bbl) =	42 US gallons (gal)	158.99 liters (L)	0.1589 cubic meters (m^3)
1 liter (L) =	0.001 cubic meters (m^3)	0.2642 US gallons (gal)	0.0063 barrels (bbl)
1 cubic meter (m^3) =	6.2897 barrels (bbl)	264.17 US gallons (gal)	1,000 liters (L)
Energy			
1 kilowatt hour (kWh) =	3,412 Btu (Btu)	3,600 kilojoules (KJ)	
1 megajoule (MJ) =	0.001 gigajoules (GJ)		
1 gigajoule (GJ) =	0.9478 million Btu (MMBtu)	277.8 kilowatt hours (kWh)	
1 British thermal unit (Btu) =	1,055 joules (J)	1.055 kilojoules (KJ)	
1 million Btu (MMBtu) =	1.055 gigajoules (GJ)	293 kilowatt hours (kWh)	
1 therm =	100,000 Btu	0.1055 gigajoules (GJ)	29.3 kilowatt hours (kWh)
Other			
kilo =	1,000		
mega =	1,000,000		
giga =	1,000,000,000		
tera =	1,000,000,000,000		
peta =	1,000,000,000,000,000		
1 mile =	1.609 kilometers		
1 metric ton carbon (C) =	$^{44}/_{12}$ metric tons CO_2		

Example Calculation: Convert 1,000 lb C/kWh into metric tons CO_2 /GJ

$$1{,}000\ \frac{\text{lb C}}{\text{kWh}} \times 277.8\ \frac{\text{kWh}}{\text{GJ}} \times 0.0004536\ \frac{\text{metric tons}}{\text{lb}} \times 44/12\ \frac{CO_2}{C} = 462.04\ \frac{\text{metric tons } CO_2}{\text{GJ}}$$

Source: General Reporting Protocol (Version 1.0), The Climate Registry, page 157.

Converting Units of Measurement

Many individuals interested in this appendix will find helpful tools that assist with conversion of units. GHG emissions accounting is still relatively new, and agreement has yet to be reached on standard units to quantify many types of emissions. For example, motor vehicle emissions can be expressed as grams CO_2 equivalent per mile (gCO_2e/mi), which mixes the metric system (International System of Units or SI) – grams – with the U.S. Customary System (also Imperial System or English Units) – miles – and makes access to unit conversion tools handy to those working with these types of measurements.

The international community relies upon the metric system for GHG emissions inventory purposes. The most common unit of measurement for inventories is million metric tons of carbon dioxide equivalent, often abbreviated as $MMTCO_2e$. Fortunately, a number of resources exist to help with the conversion of units, including appendices within most GHG accounting protocols, as well as online tools. Provided below are a few examples of resources related to conversion of units of measurement.

» U.S. EPA document on units conversion: http://www.epa.gov/cppd/pdf/brochure.pdf

- Energy Information Administration conversion tables: http://www.eia.doe.gov/pub/oiaf/1605/cdrom/pdf/gg-app-tables.pdf

- The National Institute of Standards and Technology (NIST): http://www.nist.gov/ts/wmd/metric/unit-conversion.cfm

Appendix C of The Climate Registry's General Reporting Protocol (Version 1.0) contains conversion factors. The table is an example of the types of resources provided in GHG reporting protocols or guidance documents available to the public. TCR's General Reporting Protocol can be found at: http://www.theclimateregistry.org/resources/protocols/general-reporting-protocol/

Glossary for Climate Change and Energy

Several glossaries on climate change and energy terminology are available on the Internet. Provided below are a few examples of these glossary resources:

- The California Energy Commission maintains a glossary related to energy at the following Web location: http://www.energy.ca.gov/glossary/

- The Energy Information Administration (EIA) within the U.S. Department of Energy maintains a glossary of energy terms at this website: http://www.eia.doe.gov/glossary/

- The U.S. EPA provides a glossary of climate change terms at: http://www.epa.gov/climatechange/glossary.html

- The California Energy Commission maintains a Climate Change Portal with access to a glossary of climate change terms at: http://www.climatechange.ca.gov/glossary/

Reference Documents

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Climate Change Proposed Scoping Plan – A Framework for Change. California Air Resources Board, October 2008.

Detailed California-Modified GREET Pathway for California Reformulated Gasoline (CaRFG) – Version 2.1. California Air Resources Board, Stationary Source Division, February 27, 2009.

Detailed California-Modified GREET Pathway for Compressed Natural Gas (CNG) From North American Natural Gas - Version 2.1. California Air Resources Board, Stationary Source Division, February 28, 2009.

Detailed California-Modified GREET Pathway for Corn Ethanol – Version 2.1. California Air Resources Board, Stationary Source Division, February 27, 2009.

Detailed California-Modified GREET Pathway for Ultra-Low-Sulfur Diesel (ULSD) from Average Crude Refined in California - Version 2.1. California Air Resources Board, Stationary Source Division, February 28, 2009.

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Updated Macroeconomic Analysis of Climate Strategies Presented in the March 2006 Climate Action Team Report – Final Report. Prepared by the Economics Subgroup of the Climate Action Team. October 15, 2007.

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APPENDIX B

AHWAHNEE PRINCIPLES

ENERGY AWARE PLANNING GUIDE

THE AHWAHNEE PRINCIPLES

The Ahwahnee Principles are a simple, concise set of principles intended to guide local governments in the development of sustainable, resource-efficient communities. The Ahwahnee Principles for Resource-Efficient Communities, Water, and Climate Change are listed below.

Ahwahnee Principles for Resource Efficient Communities

Preamble

Existing patterns of urban and suburban development seriously impair our quality of life. The symptoms are: more congestion and air pollution resulting from our increased dependence on automobiles, the loss of precious open space, the need for costly improvements to roads and public services, the inequitable distribution of economic resources, and the loss of a sense of community. By drawing upon the best from the past and the present, we can plan communities that will more successfully serve the needs of those who live and work within them. Such planning should adhere to certain fundamental principles.

Community Principles

» All planning should be in the form of complete and integrated communities containing housing, shops, work places, schools, parks and civic facilities essential to the daily life of the residents.

» Community size should be designed so that housing, jobs, daily needs and other activities are within easy walking distance of each other.

» As many activities as possible should be located within easy walking distance of transit stops.

» A community should contain a diversity of housing types to enable citizens from a wide range of economic levels and age groups to live within its boundaries.

» Businesses within the community should provide a range of job types for the community's residents.

» The location and character of the community should be consistent with a larger transit network.

» The community should have a center focus that combines commercial, civic, cultural and recreational uses.

» The community should contain an ample supply of specialized open space in the form of squares, greens and parks whose frequent use is encouraged through placement and design.

» Public spaces should be designed to encourage the attention and presence of people at all hours of the day and night.

» Each community or cluster of communities should have a well-defined edge, such as agricultural greenbelts or wildlife corridors, permanently protected from development.

» Streets, pedestrian paths and bike paths should contribute to a system of fully-connected and interesting routes to all destinations. Their design should encourage pedestrian and bicycle use by being small and spatially defined by buildings, trees and lighting; and by discouraging high speed traffic.

- Wherever possible, the natural terrain, drainage and vegetation of the community should be preserved with superior examples contained within parks or greenbelts.
- The community design should help conserve resources and minimize waste.
- Communities should provide for the efficient use of water through the use of natural drainage, drought tolerant landscaping and recycling.
- The street orientation, the placement of buildings and the use of shading should contribute to the energy efficiency of the community.

Regional Principles

- The regional land-use planning structure should be integrated within a larger transportation network built around transit rather than freeways.
- Regions should be bounded by and provide a continuous system of greenbelt/wildlife corridors to be determined by natural conditions.
- Regional institutions and services (government, stadiums, museums, etc.) should be located in the urban core.
- Materials and methods of construction should be specific to the region, exhibiting a continuity of history and culture and compatibility with the climate to encourage the development of local character and community identity.

Implementation Principles

- The general plan should be updated to incorporate the above principles.
- Rather than allowing developer-initiated, piecemeal development, local governments should take charge of the planning process. General plans should designate where new growth, infill or redevelopment will be allowed to occur.
- Prior to any development, a specific plan should be prepared based on these planning principles.
- Plans should be developed through an open process and participants in the process should be provided visual models of all planning proposals.

Authors: Peter Calthorpe, Michael Corbett, Andres Duany, Elizabeth Moule, Elizabeth Plater-Zyberk, and Stefanos Polyzoides. Editor: Peter Katz, Judy Corbett, and Steve Weissman. Adopted in 1991.

The Ahwahnee Water Principles for Resource-Efficient Land Use

Preamble

Cities and counties are facing major challenges with water contamination, storm water runoff, flood damage liability, and concerns about whether there will be enough reliable water for current residents as well as for new development. These issues impact city and county budgets and taxpayers. Fortunately there are a number of stewardship actions that cities and counties can take that reduce costs and improve the reliability and quality of our water resources.

The Water Principles below complement the Ahwahnee Principles for Resource-Efficient Communities that were developed in 1991. Many cities and counties are already using them to improve the vitality and prosperity of their communities.

Community Principles

- Community design should be compact, mixed use, walkable and transit-oriented so that automobile-generated urban runoff pollutants are minimized and the open lands that absorb water are preserved to the maximum extent possible. (See the Ahwahnee Principles for Resource-Efficient Communities)
- Natural resources such as wetlands, flood plains, recharge zones, riparian areas, open space, and native habitats should be identified, preserved and restored as valued assets for flood protection, water quality improvement, groundwater recharge, habitat, and overall long-term water resource sustainability.

» Water holding areas such as creek beds, recessed athletic fields, ponds, cisterns, and other features that serve to recharge groundwater, reduce runoff, improve water quality and decrease flooding should be incorporated into the urban landscape.

» All aspects of landscaping from the selection of plants to soil preparation and the installation of irrigation systems should be designed to reduce water demand, retain runoff, decrease flooding, and recharge groundwater.

» Permeable surfaces should be used for hardscape. Impervious surfaces such as driveways, streets, and parking lots should be minimized so that land is available to absorb storm water, reduce polluted urban runoff, recharge groundwater and reduce flooding.

» Dual plumbing that allows graywater from showers, sinks and washers to be reused for landscape irrigation should be included in the infrastructure of new development.

» Community design should maximize the use of recycled water for appropriate applications including outdoor irrigation, toilet flushing, and commercial and industrial processes. Purple pipe should be installed in all new construction and remodeled buildings in anticipation of the future availability of recycled water.

» Urban water conservation technologies such as low-flow toilets, efficient clothes washers, and more efficient water-using industrial equipment should be incorporated in all new construction and retrofitted in remodeled buildings.

» Ground water treatment and brackish water desalination should be pursued when necessary to maximize locally available, drought-proof water supplies.

Implementation Principles

» Water supply agencies should be consulted early in the land use decision-making process regarding technology, demographics and growth projections.

» City and county officials, the watershed council, LAFCO, special districts and other stakeholders sharing watersheds should collaborate to take advantage of the benefits and synergies of water resource planning at a watershed level.

» The best, multi-benefit and integrated strategies and projects should be identified and implemented before less integrated proposals, unless urgency demands otherwise.

» From start to finish, projects and programs should involve the public, build relationships, and increase the sharing of and access to information.

» Plans, programs, projects and policies should be monitored and evaluated to determine if the expected results are achieved and to improve future practices.

Authors: Celeste Cantu, Martha Davis, Jennifer Hosterman, Susan Lien Longville, Jeff Loux, John Lowrie, Jonas Minton, Mary Nichols, Virginia Porter, Al Wanger, Robert Wilkinson, Kevin Wolf. Editor: Judy Corbett. Adopted in 2005.

The Ahwahnee Principles for Climate Change

Preamble

Climate change is not just another environmental issue. Concentrations of human induced greenhouse gases (GHG) in the atmosphere have already reached unprecedented levels and are causing well documented adverse changes to our planet's physical and biological systems.

We must act decisively to reverse this trend, to lessen the potentially devastating environmental, economic and social impacts that could result.

At the same time, we must predict and prepare for, and adapt to, the unavoidable climatic changes that will likely occur due to the high concentration of greenhouse gas pollutants that are already in the atmosphere.

Community Principles

» Climate Action Plans for mitigating GHG emissions should be put in place by local governments; these will include inventories, targets for reduction, implementing strategies, timelines and a system for reporting annual progress. Plans should be incorporated into general plans either as a separate element that has influence over a broad range of activities or by incorporation into each of the traditional general plan elements.

» Emissions related to personal auto use are often the largest single source of greenhouse gas pollution, therefore, addressing this source should be central to a Climate Action Plan and a priority for early implementation. Infill development should be recognized as the primary location of new construction, however all new development, wherever it may occur, should be guided by the Ahwahnee Principles for Resource Efficient Communities. Development built according to these principles will display a compact mixed-use pattern that supports walking, biking and transit, and protects open space and agricultural land. Development plans should be coordinated with a regional plan, where one exists. This kind of development can reduce vehicle miles traveled (VMT) and CO2 emissions by 20 percent to 40 percent per capita (Growing Cooler, Urban Land Institute, 2008).

» The Electricity and Commercial/ Residential sector is likely the second largest source of community GHG emissions and an important target for reduction. Thus, energy conservation programs, energy efficiency and the use of a diverse array of clean alternative energy sources should also be central to the community Climate Action Plan and a priority for timely adoption. Applied to new and existing development, green building ordinances, energy conservation retrofit measures, energy efficiency standards for new buildings, and incentives/disincentives to reduce average square footage of new houses are among the measures that can be adopted (www.energy.ca.gov/energy_aware_guide).

» Climate Action Plans should also include strong water efficiency standards, increased water conservation and water recycling strategies guided by the Ahwahnee Water Principles.

» A Climate Action Plan should include measures that will help the community to adapt to the unavoidable impacts of climate change. This will involve planning for rising sea levels, shrinking water supplies, rising temperatures, food shortages and other challenges predicted to occur in the region.

» Local governments should lead by example in reducing their own carbon footprint by enacting and implementing policies to reduce GHG emissions from their municipal operations while preparing for unavoidable climate change impacts.

» Climate Action Plans should be developed through an open process that includes diverse members of the community and public health professionals. The process should include public outreach strategies and assure that the positive and negative impacts of reducing emissions are borne equally by all.

Regional Principles

» Each region should develop and adopt, with its cities and counties, a blueprint for growth that achieves regional GHG emissions reduction targets. Blueprints should form the basis for city-centered growth, infill development, open space protection, transit-oriented development and multijurisdictional corridor development. They should reflect differences among their communities.

» Regional Transportation Plans and major regional transportation projects should be consistent with the regional blueprint.

» Projects consistent with the blueprint that support infill development and reduce single occupant vehicle trips should be given priority in funding and a streamlined implementation process.

» Efforts should be made by regions to vocally support such projects and defend them against opposition.

» Regional Housing Needs Assessments that recognize the differences between regions and between communities should be coordinated with and reflect Climate Action Plans and other mechanisms for GHG emission reductions. Regional transportation, land use, and GHG reduction plans must recognize differences between regions and between communities.

Implementation Strategy

- All General Plans and Climate Action Plans should be made consistent with the principles contained in Regional Blueprint Plans and Regional Transportation Plans.
- General Plans and environmental review processes should be integrated with city and county Climate Action Plans to include climate change mitigation and adaptation measures and adoption procedures.
- Zoning codes should be modified to be consistent with the General Plan to ensure implementation of the integrated General Plan/Climate Action Plan. Performance and form-based codes should be used to achieve the specified outcome.
- City and county policies should be made consistent with the goals of the community Climate Action Plan (such as flexible work schedules, carsharing and bike-sharing programs, etc.)
- Monitoring and measurement of progress made in meeting both goals and targets set forth in the Climate Action Plan should be conducted regularly with results reported to the community.
- When appropriate, communities should form joint powers authorities to jointly implement their climate action plans through developing sustainability corridors between two or more jurisdictions.
- Cities and counties should coordinate with nearby jurisdictions and the regional government to share computer tools and other resources, and avoid duplicative efforts.

Authors: Larry Allen, San Luis Obispo County Air Pollution Control District; Geoff Anderson, Smart Growth America; Gary Cook, ICLEI; Councilmember Jennifer Hosterman, City of Pleasanton; Dr. Richard J.Jackson, MD, MPH; Mayor Jake Mackenzie, City of Rohnert Park; Jim Murley, Joint Center for Environmental and Urban Problems, Florida Atlantic University; Councilmember Pam O'Connor, City of Santa Monica; Geof Syphers, Codding Enterprises; Dr. Robert Wilkinson, Water Policy Program, UC Santa Barbara; Steve Winkelman, Transportation Program Center for Clean Air Policy. Editors: Gregg Albright, California State Department of Transportation; Councilmember Jon Harrison, City of Redlands; Judy Corbett and Kate Wright, Local Government Commission.

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CEC-600-2009-013-F-APPX.B • FEBRUARY 2011

City Planners' Energy Action Resource Guide

Greenhouse Gas Reduction Measures for New Development

November 2011

ICLEI
Local Governments for Sustainability
USA

Statewide Energy Efficiency Collaborative

An Alliance to Support Local Government

This City Planners' Energy Action Resource Guide is a product of the **Statewide Energy Efficiency Collaborative** (SEEC). SEEC is a new alliance to help cities and counties reduce greenhouse gas emissions and save energy. SEEC is a collaboration between three statewide non-profit organizations and California's four Investor Owned Utilities.

SEEC members are:

- ICLEI – Local Governments for Sustainability USA
- Institute for Local Government
- Local Government Commission
- Pacific Gas and Electric Company
- San Diego Gas and Electric Company
- Southern California Edison Company
- Southern California Gas Company

Statewide Energy Efficiency Collaborative

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SEEC provides education and tools for climate action planning, venues for peer-to-peer networking, technical assistance and recognition for local agencies that reduce greenhouse gas emissions and energy use.

The collaborative effort is designed to build upon the unique resources, expertise and local agency relationships of each non-profit organization, as well as those of the four investor owned utilities.

This Resource Guide is adapted from an earlier document called the Community Planners' Early Action Handbook for GHG Reductions in New Development and was developed for the Bay Area Air Quality Management District (BAAQMD). Project team included Tim Rosenfeld, HMW International, Inc. (Principal Author); Deborah Fudge, Environmental Planner; Connie Meron, HMW International, Inc.; and ICLEI-Local Governments for Sustainability.

The program is funded by California utility ratepayers and administered by Pacific Gas and Electric Company, San Diego Gas and Electric Company, Southern California Edison, and Southern California Gas Company under the auspices of the California Public Utilities Commission.

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Introduction

Purpose and Scope

California has established aggressive targets for reducing emissions of greenhouse gases (GHG) to 1990 levels by 2020[1] in Assembly Bill 32 (AB 32) and to 80 percent below 1990 levels by 2050[2] through executive order. The policies and tools under AB32 and other state initiatives to guide local government land use planning will take years to fully develop and implement. However, new development projects will continue to arise before comprehensive emissions-reducing policies are developed, codified, and implemented through new programs and regulatory updates or revisions. Every subdivision that gets approved and every building that gets built in the interim is likely to be here for the next 50 to 100 years. If simple measures aren't taken today to ensure that these projects can reduce their carbon footprints in the future, communities will have a much harder time meeting the GHG reduction targets, especially the 80 percent GHG reduction needed over the next 40 years.

This Resource Guide provides local planning officials with information on implementing a small set of critical measures relating to energy efficiency in community design. These measures can be applied relatively quickly to new projects ahead of General Plan or Climate Action Plan processes. The Resource Guide attempts to fill the gap between the types of measures typically suggested and the information planners need to implement them.

The measures included in this Resource Guide are not new. All have been implemented by *some* communities and adopted as General Plan policies by *many* communities beginning in the late 1970's. What is surprising is how few communities have moved from general policy statements to rigorous implementation. California's Solar Rights Act of 1978[3] provides a case in point. The 30-year-old state law provides the legal authority for local governments to protect solar access and require subdivisions to be designed to enable passive solar in building designs. However, it leaves it up to local governments to apply the law. While we have found no comprehensive evaluation of how well solar access protection has been applied in California communities, we have found plenty of evidence that it has not.

Opportunities for Influence

Planning and building officials have multiple points in the planning process to influence the design of new projects. However, the "preliminary review" or initial contact to review projects may be the most important in influencing the design of the development. Providing clear direction or guidance to applicants at the outset establishes clear

[1] Targets established in AB 32, the Global Warming Solutions Act of 2006
[2] 2050 goals set in California Executive Order S-3-05
[3] Discussed in more detail in the "Solar Access" Section

expectations and even partnership between developers and agency staff, and is often more cost-effective than building in additional requirements later in the process. For these reasons, the implementation of climate action measures in the Guide focuses on the preliminary review.

Currently, much focus is being placed on CEQA requirements for including climate impacts in General Plan updates[4]. Environmental review of climate impacts will help communities weigh and prioritize policies and programs, and can build the foundation for a comprehensive and integrated climate action strategy for the decades ahead. While CEQA review may be an appropriate place to address the broader climate impacts of new development, as a point of intervention it occurs much too late in the process to effectively implement the critical climate action measures included here. By the time the CEQA review is conducted developers will have too much invested in their design and planning officials will already have tacitly if not explicitly signed off of those designs. Mitigation measures often become a patch on the design rather than an integral consideration, resulting in suboptimal outcomes and missed opportunities.

Legal Authority

Generally, local governments have the legal authority to implement the measures in this Guide. Certain measures might be enabled or limited by State law and the document includes relevant State legal authority for each measure. Provisions in the municipal code may also enable or limit the use of these measures as well as review requirements. Local governments can point to multiple State actions as the overarching basis for taking action on energy efficiency in community design. These include:

- The Governor's Executive Order S-3-05 establishing the first comprehensive policy to address Climate Change in 2005;
- AB 32, the Global Warming Solutions Act of 2006 codifying GHG reduction targets for 2020 and out to 2050;
- The Scoping Plan adopted by the Air Resources Board in November of 2008 (final supplement to the plan approved on August 24, 2011);
- SB 375 that directly targets regional transportation planning and local land use planning;
- The Attorney General's actions concerning the requirement to address GHG impacts under CEQA in General Plans; and
- The Office of Planning and Research 2009 guidelines for mitigating GHG impacts as required under SB 97.

[4] This has been the legal threat from the California Attorney General that has spurred action by many local governments with respect to General Plans. The California Air Pollution Control Officers Association released a new handbook, "Model Policies for Greenhouse Gases in General Plans: A Resource for Local Government to Incorporate General Plan Policies to Reduce Greenhouse Gas Emissions" in June 2009 that focuses on this topic.

Energy Action Measures in the Handbook

Measure 1 - Beyond Title-24

Local governments have several options for local energy efficiency building standards that go beyond California Title-24 statewide energy efficiency standards.

Measure 2 - Energy-efficient Street Design

Energy-efficient street design reduces the amount of heat absorbed by streets, translating into cooler neighborhoods and less air conditioning in buildings. Energy-efficient streets are often oriented to protect and enable solar access, narrower, better shaded, and constructed with cool paving materials.

Measure 3 - Energy-efficient Parking Lots

Parking lots occupy about 10% of the land in many of our communities. Shading of parking lots reduces the heat absorbed by the pavement which lowers the ambient air temperature and, in turn, reduces the cooling load in surrounding buildings.

Measure 4 - Solar Water Heating

Solar water heating systems convert sunlight into thermal energy to heat water used in homes and businesses. Typical solar water heating systems can offset up to 80% of the energy used to heat water in single and multifamily homes.

Measure 5 - Solar Access Protection

Solar access is about protecting solar energy systems from the effects of shading by buildings and vegetation on neighboring properties. This includes protecting existing systems and the potential for future systems.

Measure 1:

Beyond Title 24 - Local energy efficiency building standards

Title-24 Part 6 of the California Code of Regulations, also known as the Energy Efficiency Standards for Residential and Nonresidential Buildings, was established in 1978 to reduce the state's energy consumption. California's building efficiency standards have saved more than $56 billion in electricity and natural gas costs since 1978[5]. The most recent 2008 Standards went into effect on January, 1 2010. Local governments have several options for local energy efficiency building standards that go beyond California Title-24 statewide energy efficiency standards. These include building codes, conditions for approval, and incentives.

What the Measure Does

As good as California's Title-24 energy efficiency standards are, they still leave out plenty of cost-effective energy efficiency measures. Local governments have multiple options to go beyond the Title-24 standards. Several local governments have adopted local standards that save from 10 to 20 percent beyond Title-24 requirements.

Below are some approaches to local energy efficiency building codes that communities have adopted that can be applied to either residential or commercial projects.

Energy Budgets: Energy budget codes put a cap on the amount of energy that a particular building type and size can use on an annual basis, usually expressed as a percentage reduction from how much energy the same building would use if designed to the minimum Title-24 standards. For example, the State uses this approach to set additional energy efficiency requirements for developers participating in the New Solar Homes Partnership incentive program[6].

Energy Cap: An energy cap approach sets the maximum amount of energy a building can use regardless of size. For example, the local government determines how much energy a 2500 square foot home would use if designed to meet the minimum requirements of Title-24. The regulation doesn't place any size limit on the size home that can be built, but requires that the home cannot use more than what the 2500 square foot home would use. In order to meet such a

[5] http://www.energy.ca.gov/title24/

[6] In order to qualify for incentives under the California New Solar Homes Partnership, developers must reduce energy use beyond Title-24 combined space heating & cooling, and water heating energy use by 15% for Tier 1, and 35% for Tier 2, and 40% on cooling for Tier 2 as well.

cap, larger homes would ultimately not be able to meet the cap by energy efficiency alone but can offset additional energy use with onsite renewable technologies like solar thermal or PV. If the cap cannot be met with efficiency or onsite generation, the builder can offset the energy use by paying into a fund that will be used for efficiency measures or solar elsewhere in the community.

Prescriptive Measures and Point Systems: The prescriptive approach establishes a list of specific measures from which a builder must choose. The list can include mandatory and optional measures, optional packages of measures, or assign point values to measures and set the total point value a building must achieve. The community sets the savings target as in the prior options but then predetermines the energy savings value of the individual or packages of measures.

The energy cap and energy budget options are performance approaches requiring the builder to calculate the performance of the whole building design. While this may seem more complicated, builders generally use State approved commercial software, or services that do the calculations to comply with the reporting requirements of Title-24. The same software or service companies are used to comply with local performance codes. The alternative, prescriptive approach is simpler for compliance but limits design choices, so a performance-based option is generally provided. Title-24 provides both the prescriptive and performance based options.

Green Building Codes and Rating Systems: Green building codes and rating systems include energy efficiency as an element but address a broader set of environmental, health and socioeconomic impacts of building construction and operation. While these broader elements provide important reasons to adopt green building codes, they do not supplant Title-24 requirements and do not necessarily go beyond Title-24 in energy savings.

Point systems for green building simplify the compliance process but make it difficult to verify the GHG reduction being achieved.

Many jurisdictions have adopted green building rating systems to become part of their building code. These green building codes set forth a long list of measures, some mandatory and some voluntary, and the builder is required to achieve a certain number of points associated with the measures in order to reach certification within that rating system. While using a point system simplifies the compliance process, it also hides the specific impacts each point achieves such as energy savings versus improved indoor air quality. Under a point system, it is difficult to determine what amount energy savings beyond Title-24 is being achieved and the related GHG savings from a particular measure. While communities adopt green building rating systems to be a part of their codes for the broader set of goals, elected officials may be unclear as to the energy and GHG savings beyond Title-24 that is or is not being achieved.

The two principal types of rating sytems that have been adopted into code are the Build It Green "GreenPoint Rated" rating system for residential and the U.S. Green Building Council's LEED certification for commercial buildings. There are multiple types of LEED certification and multiple levels of performance, and jurisdictions that have adopted LEED into their code mandate compliance for buildings based on their size and/or construction cost. Build It Green's model code requires that homes must achieve 15% energy savings beyond Title-24. Only a small number of the more than 50 communities that have adopted some form of the GreenPoint Rated system have legally implemented the 15% requirement, which requires an application to the California Energy Commission demonstrating that the local code equals or exceeds Title-24 and is cost effective. Without adopting the prescriptive 15% provision by ordinance and obtaining approval from the CEC, enforcement and verification that your community is reducing energy use and GHG emissions may be a challenge.

CALGreen. On January 1, 2011, the 2010 California Green Building Standards Code, also known as CALGreen, went into effect. As the first statewide green building code in the nation, this landmark mandate requires all new residential and non-residential construction to be built to higher performing and healthier standards. Goals of the Code include:

- Reducing water consumption
- Employing building commissioning over 10,000 SF to increase building system efficiencies
- Diverting construction waste from landfills
- Installing low pollutant-emitting finish materials

CALGreen was designed to set minimum green building standards and not be a substitute for more stringent local green building codes. Pre-existing local green codes must be followed as long as they do not interfere with the mandatory requirements. Local jurisdictions must file amendments to CALGreen with the California Building Standards Commission if they decide to opt for more restrictive green building standards.

The City of Los Angeles no longer requires LEED Certification. In December of 2010, the city adopted CALGreen Tier 1 requirements for residential and non-residential projects. Density bonuses and expedited permitting are available to projects for meeting additional CALGreen voluntary requirements.

CALGreen includes both mandatory and voluntary measures. If a local government wishes to push the envelope further, CALGreen also includes a tiered system, also known as "reach codes," within the voluntary measures to allow municipalities to go beyond the minimum standards of CALGreen. Tier 1 and Tier 2 designations are only given once all provisions have been met, including meeting the mandatory requirements and exceeding 2008 Energy Efficiency Standards by 15% or 30%, respectively. A Tier 1 designation would be comparable to achieving LEED Certified or LEED Silver under USGBC's LEED rating system. At this time, this code does not address retrofits of existing buildings. Like all rating systems and building codes, CALGreen will continue to evolve as issues arise and need to be addressed.

Conditions for Approval: Local energy efficiency measures can be implemented at the subdivision level without adoption of a local building code. They can simply be negotiated as a condition of approval.

Incentives: Energy efficiency measures can be implemented on a voluntary basis and promoted with incentives such as expedited permit processing, fee waivers, merit review process, and public recognition. Voluntary programs work best to support emerging technologies and pioneering best practices that may not yet be mainstream or cost-effective.

Why This Measure is Important

Every building approved today is likely to be in continued operation in 50 years. If all cost-effective measures are not taken today to ensure that these projects can reduce their carbon footprints in the future, communities will have a much more difficult time meeting the long-term GHG reduction targets.

California has set a target for "zero net energy homes" by 2020 and "zero net energy commercial buildings" by 2030.

As good as Title-24 standards are, they still leave cost-effective energy efficiency measures on the table. If buildings are not designed and built to be as energy-efficient as is economically possible today, it will be much more expensive or prohibitive to reduce their minimum energy use in the future.

California has set a target for "zero net energy homes" by 2020 and "zero net energy commercial buildings" by 2030. Buildings that are built less efficient today will cost more to operate than buildings constructed 10 and 20 years from now. The more efficient they are today the more competitive they will be in the future. In terms of community economic development, reduced building operating costs could also have a multiplier effect in the local economy. .

Benefits and Costs

The State allows local governments to adopt energy efficiency codes exceeding Title-24, but with the condition that all measures must be cost-effective. Consequently, communities can be assured that any local code exceeding Title 24 will be at least cost-neutral or provide greater economic benefit. State review provides an independent verification of the cost-effectiveness of the code under consideration.

At a minimum, the benefits for GHG reduction are proportional to the percentage reduction in energy use. However, the GHG reduction can be much greater depending on the actual measures employed. For example, measures that reduce cooling loads as opposed to nighttime lighting may achieve greater reduction in GHG emissions because they offset peak demand currently supplied by natural gas generation. This kind of dynamic can influence the prioritization of measures depending on local conditions. Measures that reduce on-peak demand can be more cost-effective as well because they offset higher cost electricity.

The CEC applications for the local codes are provided in the Resource Library folder. These applications can provide a good idea of the range of prototype building designs and approaches used to exceed Title-24, and the relative cost effectiveness of the different approaches. You can look for a jurisdiction that may have similar residential and commercial building types to your community for a good idea of the energy and dollar savings that you can achieve.

Other Benefits and Drawbacks

The non-energy benefits of more energy-efficient buildings are extensive but vary depending on the design elements employed. They include benefits to multiple parties, including building owners and renters, the community, and utility service providers. Non-energy benefits can include comfort, better quality light, lower operating and maintenance costs, less illness, increased worker productivity and well-being, lower insurance costs, higher property value, reduced water use and wastewater, and direct and indirect local economic multipliers.

How to Implement - Legal Authority

California law permits local governments to adopt local codes that exceed Title-24 but only after they submit an application to the California Energy Commission (CEC) for review and approval. The following items are submission requirements to the CEC for this process:

- The text of the proposed ordinance;
- A study with supporting analysis showing how the local government determined energy savings;
- A statement that buildings covered by the ordinance shall use no more energy than permitted by the Title 24 building energy efficiency standards
- The basis of the determination that the ordinance is cost-effective

The completeness, accuracy or relevance of the cost-effectiveness study is the responsibility of the local government. In the application process, the CEC verifies that the cost-effectiveness study has been prepared and has been reviewed, publicly vetted, and approved by the City Council or Board of Supervisors. Ordinances and applications from local governments that have been approved by the CEC are included in this Handbook's Resource Library folder.

How to Implement - Next Steps

Examples of the various approaches to local codes are included in the Resource Library folder and discussed here. Even if you have adopted a green building code, you should consider going beyond Title-24 with a performance budget to capture the energy efficiency and resulting GHG savings. Most of the local governments that adopted codes going beyond Title-24 also adopted some form of GreenPoint Rated, LEED, or a CALGreen reach code.

The two green building rating systems adopted by many communities have been developed by non-profit organizations – Build It Green[7] and the U.S. Green Building Council[8] – who offer assistance in using their rating systems. Since each organization provides extensive information and documentation and regularly adds to and updates their information, check with both organizations through the websites below to get the latest information and tools.

[7] Link to Website: www.builditgreen.org
[8] Link to Website: www.usgbc.org

The analysis needed to determine the cost-effectiveness of the standards beyond Title-24 should be done using one of the commercial software programs approved by the California Energy Commission. The CEC Title-24 website has a link to California Association of Building Energy Consultants (CABEC) that lists consultants certified to perform Title-24 analysis. After the local energy ordinance has been adopted and approved by the CEC, it must be filed with the Building Standards Commission (BSC). The BSC is responsible for administering California's building codes, including adopting, approving, publishing, and implementing codes and standards[9].

Table 1 below lists jurisdictions that have adopted local energy or green building codes that go beyond the 2008 Title-24 standards and have been approved by the CEC. The tables summarize each jurisdiction's ordinance and provide links to the ordinances and CEC application documents in the Resource Library folder

Table 1

Examples of CEC Approved Local Codes Going Beyond Title-24 2008 Energy Standards

Jurisdiction	Type of Ordinance	Building Types	Applies to:	Exceeds 2008 Title-24
Chula Vista	Energy Efficiency	Low-rise & high-rise residential, commercial	New construction & some additions	15% for new residential and commercial buildings, low-rise residential additions > 1000 Sq Ft, high rise residential, & commercial > 10,000 Sq Ft
Hayward	Green Building (GreenPoint)	Low-rise & high-rise residential, commercial	All new construction & commercial additions or remodels >1000 Sq Ft	15% (per GreenPoint Rated standards) for new residential; 5% for overall energy budget for commercial; 15% reduction or provided by renewable energy for commercial lighting load
Richmond	Green Building (GreenPoint, LEED)	Residential, commercial	New construction & some additions	15% for all new residential and additions subject to design review; 10% for commercial buildings and additions > 5000 Sq Ft
San Jose	Green Building (GreenPoint, LEED)	Residential, commercial	New construction	15% (per GreenPoint requirement) or LEED Energy Requirement for new residential and commercial
Sonoma County	Green Building (CALGreen Tier 1)	Residential, commercial	New construction	15% for all new residential and commercial buildings

*Data based on information available as of 09-2011, all codes were approved by the CEC– check for updates at: http://www.energy.ca.gov/title24/2008standards/ordinances/

[9] For more information on the CEC Ordinance Adoption process: http://www.lgc.org/freepub/docs/energy/case_studies/ReachCodes.pdf

2010 California Green Building Standards Code, California Codes and Standards, Title 24, Part 11 (CALGreen Code)

Link: Beyond_T24-2010_CA_Green_Bldg_Codes.pdf
(California Building Standards Commission, June 2010, 193 pages, searchable)

Guide to the (Non-Residential) California Green Building Standards Code

This guide was developed and is distributed by the California Building Standards Commission as a means of introducing the 2010 California Green Building Standards Code, which is Part 11 of the California Building Standards Code in Title 24 of the California Code of Regulations. The contents of this guide will provide information as to the application of the California Green Building Standards Code and how to use it.

Link: Beyond_T24-CALGreen_Non-Res_Guide2010.pdf
(California Building Standards Commission, November 2010, 181 pages, searchable)

A Recommended Approach to California's New Green Building Code

This document provides a quick overview of CALGreen and offers a few recommendations for local governments.

Link: Beyond_T24-BACC_CalGreen_Recommendations.pdf
(Build It Green, August 2010, 4 pages, searchable)

Roadmap for Local Governments: Guidance for Developing a Residential Green Building Ordinance

This document provides guidance to cities and counties wishing to develop a green building or energy efficiency ordinance. It describes the process of developing such an ordinance and offers options and components local governments.

Link: Beyond_T24-Roadmap for Local Governments.pdf
(Build It Green, June 2011, 70 pages, searchable)

The GreenPoint Rated Climate Calculator

This document provides background and analysis of data compiled from the GreenPoint Rated Climate Calculator.

Link: Beyond_T24-GPR_Climate_Calculator_Report.pdf
(Build It Green, March 2009, 36 pages, searchable)

Examples in Practice

Marin Communities Proposed Multi-jurisdictional Building Code

A multi-jurisdictional approach to develop a new comprehensive local green building code was undertaken by all 12 local governments in Marin County in 2009. The City of San Rafael spearheaded a collaborative effort that involved representatives from the County and each city, and a broad based technical advisory committee of builders, building officials, realtors and other industry professionals, with the goal of developing a uniform local code all the jurisdictions could adopt. What emerged is a proposal for one of the most rigorous energy efficiency and green building codes to date that combines all the mechanisms described in this section as well as solar and EV ready requirements. The proposal provides uniform requirements across 12 jurisdictions, which simplifies compliance for the building industry. It also permits jurisdictions to modify thresholds for compliance, building types, and provides for other exceptions that better reflect local conditions and priorities. A single application for approval to the CEC for all 12 jurisdictions was prepared. Development of the proposed local standards was completed near the end of 2009 and was brought before the city councils and county beginning in January 2010. The only cities that have attained CEC and council approval are the City of San Rafael and the City of Tiburon. The City of San Rafael received CEC approval in May 2010, and the City of Tiburon received CEC approval in July 2011. Marin County received CEC approval in May 2010. The Town of San Anselmo adopted the green building ordinance in August 2010, and the City of Novato implemented their green building requirements in January 2011.

The draft ordinance, resolution, staff report and cost-effectiveness study for the City of San Rafael are provided here.

Link: Beyond_T24-Marin_Co_Compilation_for_2008_Standards.pdf
(City of San Rafael, January 2010, 62 pages, searchable)

Link: Beyond_T24-Marin_Co-Report-Cost-Effectiveness_for_2008_Standards.pdf
(Michael Gabel, December 2009, 39 pages, searchable)

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City of Santa Barbara Innovative Building Review Program

The Innovative Building Review Program (IBRP) is a *free* program that advises developers on how to make their developments more energy-efficient. The IBRP provides a number of incentives to participants that reach one of the program's three target levels. One of the most well-liked incentives is an expedited review of the plan check through the Building & Safety Division. Another is a 50% reduction on the energy plan-check fee. Other incentives are available depending on the target level reached.

To reach a target, a development must exceed Title 24 (California Energy Efficiency Standards) by a certain percentage and include additional energy-efficient features outside the purview of Title 24 (e.g., recycled building materials, drought-tolerant or native plants, alternative energy systems). The Energy-Efficient Menu lists a number of energy-efficient features that the applicant can choose from. Each feature is assigned a point(s). The point total and the percentage improvement upon Title 24 are used to determine the target achieved. The Energy-Efficient Menu also lists the three target levels and the associated incentives.

Link: Beyond_T24-Santa_Barbara_Energy-Efficient_Menu.pdf
(City of Santa Barbara, November 2009, 5 pages, searchable)

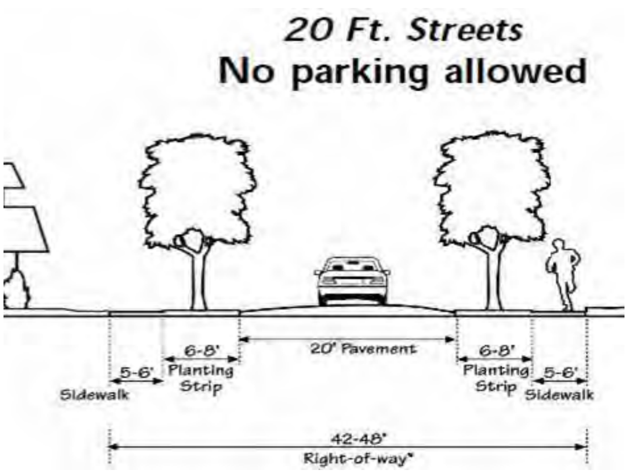
Measure 2:

Energy-efficient Street Design

Energy-efficient street design reduces the amount of heat absorbed by streets, which translates into cooler neighborhoods and less air conditioning use in buildings. Energy-efficient streets are often oriented to protect and enable solar access, and are narrower, better shaded, and constructed with cool paving materials.

What the Measure Does

Energy-efficient street design provides both a foundation for optimizing and protecting solar access and reduces a significant source of summertime heat contributing to the urban heat island effect[10] in communities. Energy-efficient street design is a subset of a much larger movement for "complete streets" that are safer, multi-modal and generally create healthier and more attractive communities. The focus in this Handbook is on how to improve those elements that affect energy use in buildings: width, shading, paving materials, and orientation.



Width: Narrower neighborhood streets both reduce the amount of paved surface absorbing heat and make it easier to shade with street trees. The reduction of paved surfaces in a development results in the mitigation of the heat island effect. The heat island effect occurs as new developments replace once vegetated spaces with impermeable surfaces that absorb the heat of the sun, thus causing an "island" of increased temperatures over the paved areas. Air temperatures in cities, particularly after sunset, can be as much as 22°F (12°C) warmer than in neighboring, less developed regions. Exacerbated during the summertime, the heat island effect elevates temperatures in cities, which increases the energy demand for cooling. Research shows that electricity demand for cooling increases 1.5–2.0% for every 1°F (0.6°C) increase in air temperatures, starting from 68 to 77°F (20 to 25°C), suggesting that as much as five to ten percent of community-wide demand for electricity is used to compensate for the heat island effect at certain times[11].

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[10] The heat island effect occurs in urban areas where absorption of sunlight on paved surfaces and buildings causes the ambient air temperature to be higher than in rural (less paved) areas. The heat island effect increases with the size of the urban area.

[11] Akbari, H. 2005. Energy Saving Potentials and Air Quality Benefits of Urban Heat Island Mitigation, Lawrence Berkeley National Laboratory

The advantages of narrower streets are much broader, however. As summed up in one reference, "Skinny streets calm traffic, maintain a comfortable human scale for pedestrians, cut the cost of development, make more land available for public and private spaces, and minimize the negative environmental impacts of all that asphalt, such as runoff and reflective heat.[12]"

Transportation safety studies have found that narrower streets are safer as well. Added roadway connections and shorter blocks in a new development help to distribute traffic evenly throughout a community making narrower streets more feasible, and they can increase pedestrian access to residences and open spaces areas.

Shading: Shading streets and other paved surfaces will minimize the exposure of the pavement to the sun reducing ambient neighborhood temperatures by as much as 10°F. This in turn reduces the cooling loads in buildings. Trees mitigate the urban heat island effect directly through shading the pavement and also through evapotranspiration.[13] In addition to the temperature reducing benefit of street tress, shaded streets are also considered more walkable and less prone to degradation from thermal expansion, which can reduce maintenance costs and increase the useful life[14].

Cool Pavements: Cool pavements include a range of established and emerging technologies that communities are exploring as part of their heat island reduction efforts. The term currently refers to paving materials that reflect more solar energy, enhance water evaporation or percolation, or have been otherwise modified to remain cooler than conventional pavements. Conventional paving materials can reach peak summertime temperatures of 120–150°F (48–67°C), transferring excess heat to the air above them.

Cool pavements can be created with existing paving materials (such as asphalt and concrete) as well as newer approaches such as the use of coatings or open-cell grass paving. Cool pavement technologies are not as advanced as other heat island mitigation strategies, and there is no official standard or labeling program to designate cool paving materials. However, many communities have conducted pilot projects. More information is included in the *Next Steps* section.

Orientation: Street orientation impacts the ability to protect solar access and the future use of solar, and the ability to reduce the impact of the local climate on buildings. For example, subdivision streets oriented east/west may enable better lot and building orientation for passive and active solar access when a planned subdivision generally has the long axis and roof line of the house parallel to the street. Under this scenario, east/west streets result in better south-facing exposure for both the roof and the long wall that often has the most windows.

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[12] See "Skinny Streets and Fire Trucks," *Urban Land,* August 2007 in *Next Steps* below.

[13] Evapotranspiration refers to the combination of water transpired from the plants leaves and evaporated from the soil and plant surfaces. Evapotranspiration, alone or in combination with shading, can help reduce peak summer air temperatures.

[14] This photo of Village Homes subdivision in Davis, CA shows a well shaded narrow residential street. Walking paths and parking bays that provide the same amount of space as on-street parking made narrower streets practical. Photo: Wayne Senville, Planning Commissioners Journal, www.plannersweb.com

Best Practice:

Village Homes, developed in the mid 1970's in Davis, CA, has well-planned streets, lots and homes, narrow street widths, vegetation that shades streets, foot/bike paths, common open space, natural drainage swales and some commercial mixed-use.

Bad Practice:

Another common design creates small roof planes with no dominant orientation, leaving little room for solar panels facing south.

Bad Practice:

In this development, east-west streets don't help protect solar access because the lots and homes are laid out with the roof ridge running north-south. Solar panels placed on these roofs would face east or west rather than optimally south.

North/South streets are better for row houses and other building types that have narrow lots. A north/south street orientation allows the long axis of the row houses to face south. This not only promotes solar access but also allows for more north-facing windows that maximizes on even, indirect daylighting, which reduces energy usage. Proper orientation of streets facilitates the ability to design passive solar homes, which will be discussed further in Measure 5- Solar Access Protection. Buildings with flat roofs and parapets, more typical in commercial construction, are not dependent on street orientation.

Topography and many other factors can affect the choice of street, lot and building orientations, so it is always important to look at the actual building designs proposed in the context of the streets and lots. In the examples above as in many new subdivisions and community plans, the topography is flat and there were no other factors that would have restricted better street orientation, lot and home design.

Why this Measure is Important

Street design has long-term impacts on energy efficiency that are locked in for decades once streets are constructed. In addition to the energy and GHG benefits, attention to energy-efficient streets today can lower initial development costs and will lower the long term maintenance costs for the community.

Street orientation can be a controlling factor for the protection of solar access and enabling onsite use of solar and climatically appropriate design whether initially or in the future. **Shade trees** require about 15 years to reach their full canopy providing the full benefits of pavement shading and heat reduction. The capital savings from constructing **narrower streets** provides an offset to the cost of planting trees and possibly other energy efficiency measures.

Benefits and Costs

The City of Visalia estimated that reducing street widths by 20% could save about 16% of construction costs and 12% of maintenance costs.

Energy-efficient street design can lower ambient air temperatures and, in turn, building cooling loads, which would lower actual GHG emissions and the direct cost of operating the buildings. Reduced cooling loads also reduces the size and cost of an onsite PV system that can contribute to achieving zero net energy in buildings.

Healthy urban trees also sequester CO2. However, street trees may be an additional capital cost for developers if not already required or if more are required than would normally be.

Narrower streets reduce the initial development costs and make more land available for other uses such as additional lots or open space. Having less impervious surface reduces storm water runoff and the capacity required for the storm water system. Narrow streets, combined with shading, reduces the long term maintenance costs for which the community is responsible.

Initial capital savings can be estimated by simply calculating the reduction in paving required. The initial savings will accrue to the developer and a future savings in maintenance and repaving will benefit the community. Money saved by developers on construction of streets that are narrower can then be spent elsewhere in the development such as for other measures that could further reduce the energy requirements of buildings.

It is hard to estimate the net costs or benefits of cool pavements based on temperature reduction alone. The greatest overall value may result when multiple benefits, such as improved storm water management and water quality, are factored into the evaluation of a paving approach. Comparing the costs of cool pavements with those of conventional paving materials is difficult. The cost of any pavement application varies by region, the contractor, the time of year, materials chosen, accessibility of the site, local availability of materials, underlying soils, size of the project, expected traffic and the desired life of the pavement.

How to Implement - Legal Authority

The California Fire Code requires minimum street widths and gives local fire code officials the authority to require greater widths than the minimums. The Fire Code requires 20 feet of unobstructed width and gives authority to the local fire code official to require greater width[15]. While narrow streets have been an issue of much debate between planners and fire departments, many cities and their fire departments have been able to allow narrower streets. For a good discussion of this issue, see the article "Skinny Streets and Fire Trucks" in the Resource Folder.

The Complete Streets Act of 2008 (AB 1358): AB 1358 requires that local governments, upon any substantive revision of the circulation element of the General Plan, modify the element to plan for a balanced, multimodal transportation network that meets the needs of all users of streets to include motorists, pedestrians, bicyclists, children, persons with disabilities, seniors, movers of commercial goods, and users of public transportation. In December 2010, guidelines were developed by the Office of Planning and Research, which are included in the following section. This law will compel all communities to rethink how they design their streets. Narrower tree shaded streets are consistent with this new law. (See link under *Next Steps* below.)

San Francisco, Santa Clara, and San Jose have undertaken complete streets makeovers, including measures to slow down traffic, increase bike lanes, and dedicate lanes for future bus or light rail lines.

How to Implement - Next Steps

Most local governments have local policies, guidelines or ordinances governing the design of streets and street trees that can be revised for improved energy efficiency in neighborhood buildings. The documents listed here and included in the Resource Library folder provide examples of what other communities have done and other information to help you get started.

There are four basic concepts promoted in this section related to energy and GHG reduction: narrower streets, tree-shaded streets, permeable or cool pavements, and street orientation for solar access. Much more information is available on narrower streets because this is a subset of a larger movement for "complete streets" and "traffic calming" to promote multi-modal transportation, greater accessibility and safety. These topics are likely more familiar to local traffic

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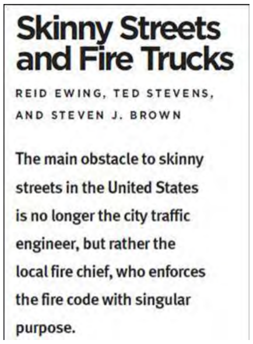
[15] 8.20.050 Section 503.2.1 of the 2010 California Fire Code amended—Dimensions.

Section 503.2.1 of the 2010 California Fire Code is amended to read as follows: Fire apparatus access roads shall have an unobstructed width of not less than 20 feet (6,096 mm), exclusive of shoulders, except for approved security gates in accordance with Section 503.6, and an unobstructed vertical clearance of not less than 13 feet, 6 inches (4,115 mm). Vertical clearances or widths shall be increased when, in the opinion of the fire code official, vertical clearances or widths are not adequate to provide fire apparatus access.

engineers as well. The value of tree shading, cool pavements, and street orientation may be less familiar. For this reason, more information is provided on these topics here than on "complete streets."

Skinny Streets and Fire Trucks


Skinny Streets and Fire Trucks

REID EWING, TED STEVENS, AND STEVEN J. BROWN

The main obstacle to skinny streets in the United States is no longer the city traffic engineer, but rather the local fire chief, who enforces the fire code with singular purpose.

This article provides an excellent and concise discussion of the conflicts between narrower streets and fire department concerns, and the solutions that were worked out in many jurisdictions.

Link: Street_Design-Article-Skinny_Streets_and_Fire_Trucks_Urban_Land-2007.pdf
(Urban Land, Reid Ewing, Ted Stevens and Steven J. Brown, August 2007, 3 pages, searchable)

Neighborhood Street Design Guidelines: An Oregon Guide for Reducing Street Widths

This 2008 handbook was developed to help local governments consider and select neighborhood street standards appropriate for their communities. It was developed through a consensus process involving all the key stakeholders to resolve the contentious issues that historically arise when addressing standards for local streets, especially width. It directly deals with the issues of livability and access for emergency vehicles. It recommends a community process for developing neighborhood street width standards.

Link: Street_Design-Guidelines-Oregon_Neighborhood_Street_Design_Guidelines-2000.pdf
(Prepared by the Neighborhood Streets Project Stakeholders, November 2000, 30 pages, searchable)

Why Shade Streets? The Unexpected Benefit

This is an excellent informational pamphlet on the cost savings from reduced street maintenance resulting from street shading. It also provides information on detailed research and guides to assist in the choice of street trees.

Link: Street_Design-Paper-Why_Shade_Streets-CUFR.pdf
(Center for Urban Forest Research, 2006, 4 pages, searchable)

Reducing Urban Heat Islands: Compendium of strategies: Cool Pavements

This document provides an introduction to cool pavement technology and practice. It explains cool pavement terminology, how it works, types of materials, and costs and benefits. It is one in a series of informational documents on Heat Island impacts and solutions developed by the Climate Protection Partnership Division in the U.S. EPA's Office of Atmospheric Programs.

Link: Street_Design-Report-Reducing_Urban_Heat_Islands_Strategies_Cool_Pavements_EPA-2008.pdf
(Climate Protection Partnership Division in the U.S. Environmental Protection Agency's Office of Atmospheric Programs, December 2008, 39 pages, searchable)

Street Design: Impervious Surface Reduction

This is a short excerpt from the Minnesota Urban Small Sites Best Management Practices Manual that is focused on siting, width and drainage design for reducing storm water runoff.

Link: Street_Design-Fact_Sheet-Minn_Best_Practices_Impervious_Surface_Reduction_Street_Design-2000.pdf
(Minnesota Metropolitan Council, 2000, 4 pages, searchable)

Permeable Pavement

Fact sheet provided by USGBC's Green Resource Center in support of LEED credits including reducing the "heat island effect" and reducing stormwater runoff. It also provides a list of manufacturers and contractors, several of which are located in Northern California. It is not intended to be comprehensive but provides a good starting point on the topic.

Link: Street_Design-Fact_Sheet-Permeable_Pavement_USGBC-2004.pdf
(Green Resource Center, July 2004, 5 pages, searchable)

Cool Pavement Report, EPA Cool Pavements Study - Task 5

This report provides in depth information on cool pavement technology and options for implementation. It describes the types of pavements now in use throughout the United States, the candidates for cool pavements within this context, and some of the elements that go into decisions on pavement selection at the state and local levels. It was prepared for the Heat Island Reduction Initiative of the U.S. EPA.

Link: Street_Design-Report-Cool_Pavement_Study_EPA-2005.pdf
(Cambridge Systematics, Inc., June 2005, 72 pages, searchable)

The following resources provide information on "complete streets" that generally address the issues and practices of designing narrower streets:

Update to the General Plan Guidelines: Complete Streets and the Circulation Element

This update to the circulation element section of the 2003 General Plan Guidelines meets the requirements of Assembly Bill 1358, The California Complete Streets Act. Starting January 2011, all cities and counties, upon the next update of their circulation element, must plan for the development of multimodal transportation networks. To support cities and counties in meeting the requirements and objectives of AB 1358, this update provides guidance on General Plan circulation element goals, policies, data collection techniques, and implementation measures related to multimodal transportation networks.

Link: Street_Design-Update_to_the_General_Plan-Complete_Streets-Circulation_Element-2010.pdf
(Governor's Office of Planning and Research, December 2010, 53 pages, searchable)

Local Government Commission Fact Sheet on Community Street Design

This fact sheet provides a short overview and a list of resources on "complete streets" that generally address the issues and practices of designing narrower streets.

Link: Street_Design-Fact_Sheet-LGC_Community_Design_Street_Design.pdf
(Local Government Coalition, 4 pages, searchable)

Complete Streets, PAS QuickNotes No. 5

This fact sheet from APA provides a quick overview of the "complete streets" concept.

Link: Street_Design-Fact_Sheet-Complete_Streets_APA-2006.pdf
(American Planning Association's Planning Advisory Service, 2006, 2 pages, searchable)

Complete Streets Act of 2008, AB 1358

Starting on January 1, 2011, this law requires local governments, upon any substantive revision of the circulation element of the General Plan, to plan for a balanced, multimodal transportation network that meets the needs of all users of streets in a manner that is suitable to the rural, suburban, or urban context of the General Plan. Users include motorists, pedestrians, bicyclists, children, persons with disabilities, seniors, movers of commercial goods, and users of public transportation.

Link: Street_Design-Law-Calif_Complete_Streets_Act_of_2008_AB_1358-2008.pdf
(California Assembly Bill, 2008, 9 pages, searchable)

Street Design Guidelines for Healthy Neighborhoods

This paper is excerpted from and provides a good overview of the research and findings in Street Design Guidelines for Healthy Neighborhoods published in January 1999 by the Local Government Commission's Center for Livable Communities. It provides a short history of how we arrived at our current wider street designs, and research and development of the "healthier streets" guidelines. The guidelines were initially prepared for communities in the San Joaquin Valley to identify ways to design new neighborhoods that will be more "interactive, walkable, enjoyable and livable." The full handbook is only available in printed form from the Local Government Commission.

Link: Street_Design-Guidelines-Street_Design_Guidelines_for_Healthy_Neigborhoods_Dan_Burden-1999.pdf
(Dan Burden Walkable Communities Inc, 1999, 15 pages, searchable)

Examples in Practice

Assessment of Energy Efficiency Alternatives: Stetson Hills, City of Indio

This report published in 2000 from the Local Government Commission provides an analysis and recommendations for multiple energy efficiency measures for a 496 unit planned residential community in Indio, California. It specifically examines orientation of streets to optimize solar access and passive solar utilization, changes to street designs and reduction of street widths to reduce paved surfaces, street shading, and street light modifications. It recommends revisions to the original proposed plan and quantifies the costs and savings, which provides a good example of how you can conduct or require similar analysis of options for proposed subdivisions.

Link: Street_Design-Pamphlet-Assessment_of_Energy_Efficiency_Alternatives_Stetson_Hills-2000.pdf
(Local Government Commission, July 2000, 40 pages, searchable)

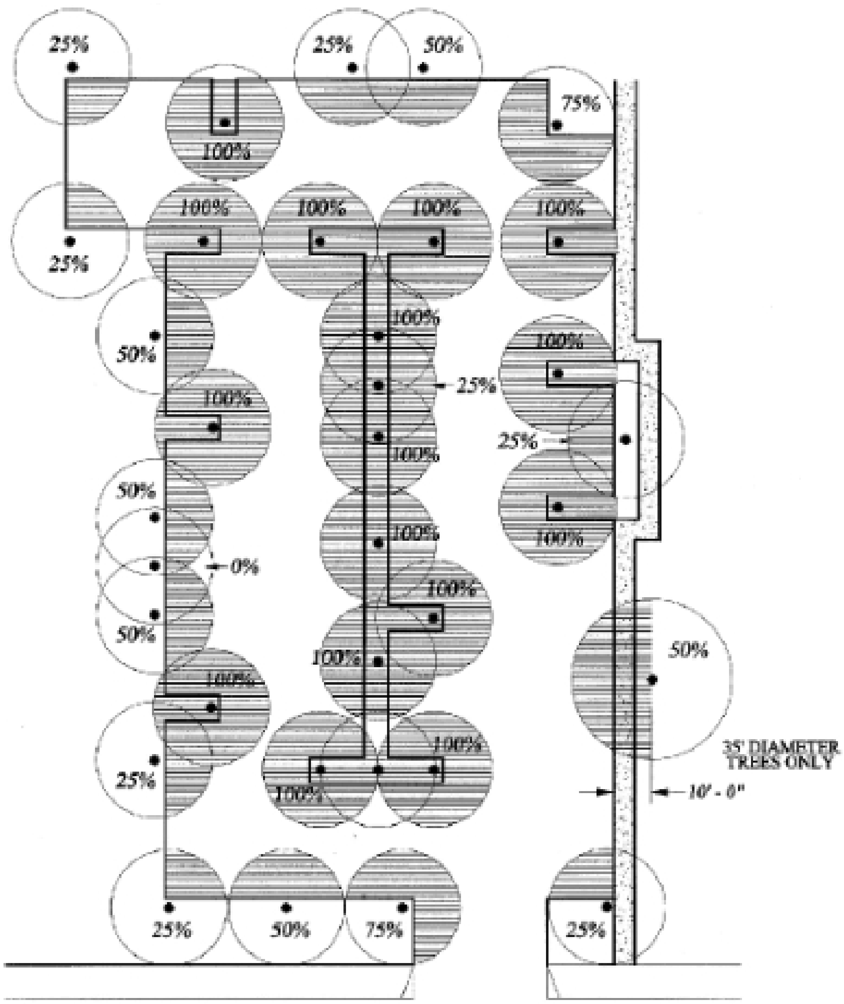
Measure 3:
Energy-efficient Parking Lots

Parking lots occupy about ten percent of the landscape in many California urban communities. Requiring shading of parking lots in new development reduces the heat absorbed by the pavement, which lowers the ambient air temperature and reduces the cooling load in surrounding buildings. Cool paving materials also help lower heat absorption and can allow rainwater percolation to reduce storm water runoff.

What the Measure Does

The heat impacts from parking lots can be reduced by shading with trees, carports, and other shade structures, by reducing the exposed area using underground parking and parking structures, and by using cool pavements.

Even before employing these techniques, sizing parking lots appropriately is the first step to consider. Keeping parking lots to a minimum, enough to meet local parking requirements, reduces the amount of exposed area and minimizes paving and materials cost. Reducing parking area also has co-benefits in reducing vehicle miles travelled and associated GHG emissions.



TREE SHADING FOR PARKING LOTS

Trees provide shade and evapotranspiration, lowering surrounding temperatures and decreasing the heat island effect. For example, trees in the City of Davis parking lots have been found to reduce the surface temperatures of asphalt by as much as 36°F, cabin temperatures of vehicles by over 47°F, and fuel-tank temperatures by nearly 7°F[16]. Cooler ambient temperatures reduce building cooling loads. Parking areas abutting commercial and multifamily buildings can cause a significant increase in a building's cooling load.

Carports and other shade structures can be used but should employ cool roofs so as not to contribute to ambient temperatures as well. Shade structures that support solar PV panels can provide power to adjacent buildings and recharge electric vehicles. These are especially appropriate for commercial applications where insufficient roof space is available for solar to serve an adjacent building's energy needs.

Cool Pavements: Cool pavements include a range of established and emerging technologies that communities are exploring as part of their heat island reduction efforts. Many communities are using pervious paving materials that both reduce heat and reduce storm water runoff. See Street Design for more discussion.

Why it is Important

It is less expensive to design and build energy-efficient parking lots from the start than to retrofit them later. There are also more options to create multiple benefits such as reducing storm water runoff and expanding the potential for onsite generation that will save initial capital and ongoing maintenance costs. Shade trees require about 15 years to reach their full canopy that will provide the full benefits of reducing the ambient temperatures and related building cooling loads.

Reducing cooling loads leverages a greater reduction in GHG because it directly offsets natural gas generation used to meet summertime peak demand. Summertime peak electric power is also the most expensive. Efficient parking lots will reduce cooling costs for businesses and homes, keeping more dollars in the community.

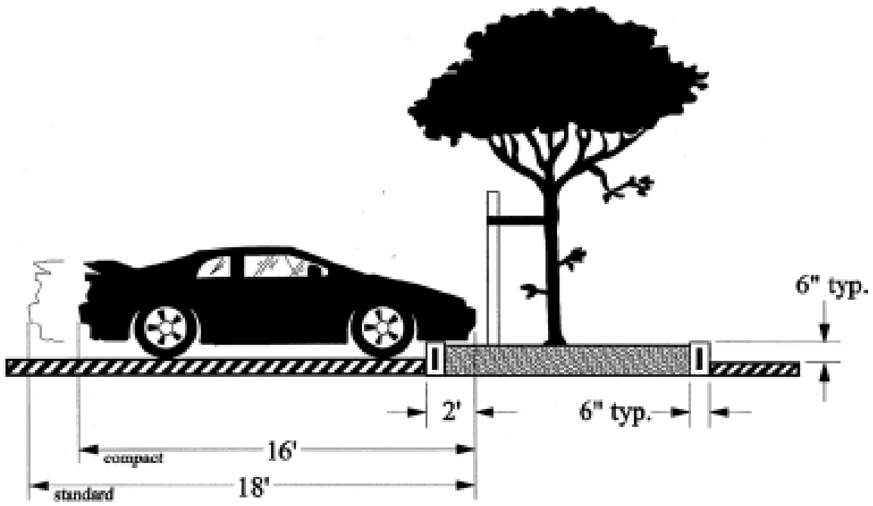
Benefits and Costs

The heat island reduction benefits associated with energy-efficient parking lots will generally accrue to the surrounding buildings in the form of reduced cooling loads. In Sacramento, where a shade tree ordinance exists, annual benefits provided by current parking lot trees (8.1% shade) were valued at approximately $700,000 for improved air quality. By increasing shade to 50% in all parking lots in Sacramento, the annual benefits will increase to $4 million[17].

[16] Center for Urban Forest Research, see citation in *Next Steps* section.
[17] Center for Urban Forest Research, see citation in *Next Steps* section.

Other Benefits and Drawbacks

Shading parking lots can keep automobiles cooler, reducing air conditioning use and lowering the rate of evaporation from gas tanks and hoses, which adds to smog levels. Aestheticallly, trees can relieve the barrenness of parking areas, and soften the look of large buildings, making communities look more friendly and inviting.



Northern California Coast Community Tree Guide: Benefits, Costs, and Strategic Planting

This report quantifies benefits and costs for small, medium, and large broadleaf trees and a coniferous tree in the Northern California Coast region.

Link: Parking_Lots-Northern_California_Coast_Community_Tree_Guide-2010.pdf
(E. Gregory McPherson et al, USDA Forest Service Western Center for Urban Forest Research and Education Pacific Southwest Research Station, April 2010, 132 pages, searchable)

Making Parking Lots More Tree Friendly

This fact sheet from the Center for Urban Forest Research provides an overview of the site planning, design and maintenance issues to consider when planting (or requiring the planting) of trees in parking lots.

Link: Parking_Lots-Fact_Sheet-Making_Parking_Lots_More_Tree_Friendly-2002.pdf
(Center for Urban Forest Research, January 2002, 2 pages, searchable)

Where are all the Cool Parking Lots?

This pamphlet from the Center for Urban Forest Research provides an overview of the site planning, design and maintenance issues to consider when planting (or requiring the planting) of trees in parking lots.

Link: Parking_Lots-Pamphlet-Cool_Parking_Lots-CURF.pdf
(Center for Urban Forest Research, August 2002, 4 pages, searchable)

Examples in Practice

The parking lot shading requirements and supporting documents for the cities of Davis, Sacramento and Fresno are provided here. All three cities adopted a 50% shading within 15 years requirement.

Parking lot shading requirements and guidelines for the City of Davis

This document provides the code language for the City of Davis that requires 50% shading within 15 years, and the guidelines for complying with the requirement.

Link: Parking_Lots-Guidelines-Davis_Ci-Parking_Lot_Shading_and_Tree_Guidelines.pdf
(City of Davis, 2006, 12 pages, searchable)

Sacramento's Parking Lot Shading Ordinance: Environmental and Economic Costs of Compliance

This report provides an analysis of the City of Sacramento's parking lot ordinance and points out both the value of a good parking lot ordinance and the importance of following through with good enforcement.

Link: Parking_Lots-Analysis-Sacramento's_Parking_Lot_Shading_Ordinance-2001.pdf
(E. Gregory McPherson, USDA Forest Service Western Center for Urban Forest Research and Education Pacific Southwest Research Station c/o Department of Environmental Horticulture, September 2001, 19 pages, searchable)

Municipal code for parking lot shading requirements for the City of Sacramento

This document provides the municipal code language for the City of Sacramento's requirement of 50% shading within 15 years.

Link: Parking_Lots-Municipal_Code-Sacramento_Ci-Parking_Lot_Tree_Shading.pdf
(City of Sacramento, 2003, 2 pages, searchable)

Parking lot shading guidelines for the City of Sacramento

This document provides specific compliance information for Sacramento's parking lot shading ordinance.

Link: Parking_Lots-Guidlines-Sacramento_Ci-Parking_Lot_Tree_Shading.pdf
(City of Sacramento, June 2003, 24 pages, searchable)

Parking lot shading requirements and supporting documents for the City of Fresno

This document provides the performance standards for the City of Fresno's parking lot shading ordinance that requires 50% shading within 15 years.

Link: Parking_Lots-Guidelines-Fresno_Ci-Parking_Lot_Shading_Standards-2006.pdf
(City of Fresno Planning and Development Department, February 2006, 4 pages, searchable)

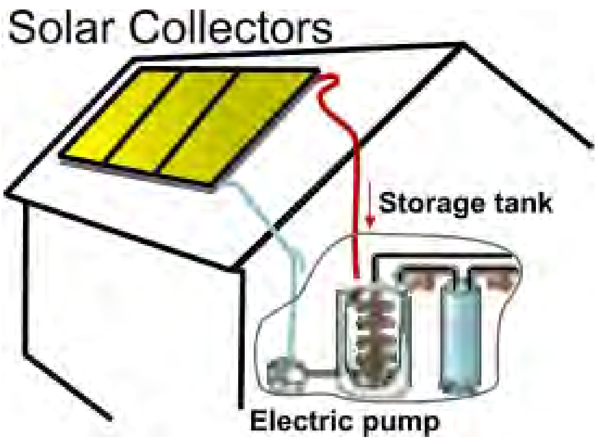
Measure 4:
Solar Water Heating

Solar water heating (SWH) systems convert sunlight into thermal energy to heat water used in homes and businesses. Considered an energy efficiency measure, typical solar water heating systems can offset up to 80% of the energy used to heat water in single and multifamily homes and can provide a substantial portion of hot water needs in many commercial applications[18]. Solar water heating (SWH) systems represent what is likely the largest untapped potential for natural gas savings in California.

What the Measure Does

Solar water heating (SWH) systems use the sun to heat water. An SWH system typically consists of a roof-mounted solar collector to heat the water, a storage tank and, depending on the system, a small electric pump to circulate the water between the collector and storage tank. Most SWH systems augment rather than replace the conventional water heating system. A typical residential SWH system reduces the need for conventional water heating by 50 to 80 percent depending on climate and technology used.

Source: Scurfield Solar



The typical flat plate solar water heating system for a single family home typically requires 40 to 80 square feet of collector, oriented within 22.5 degrees of south and installed flush to a pitched roof. Solar panels require unobstructed access to the sun's path in all four seasons. Sufficient roof or ground space must be available for the area needed by collector panels. A typical system also requires a storage tank adjacent to the normal water heater.

SWH technology is in widespread use today in Israel, Japan, China, and Europe, and the United States has a small but growing

[18] www.gosolarcalifornia.org/solarwater/nshp/index.php

manufacturing industry. The non-profit Solar Rating and Certification Corporation (SRCC) was established in 1980 and continues to provide testing, certification and rating of solar collectors and systems for domestic water, pool and space heating (see www.solar-rating.org). The State of Hawaii passed a law requiring SWH as a condition for issuing building permits for single family homes starting in 2010.

Measure Options

Local governments can encourage SWH through a range of approaches – from protecting the potential for solar water heating in the future to requiring solar water heating as a condition of approval now. At a minimum, the goal is to ensure that the potential to cost effectively use solar domestic water heating is protected for the individual and the GHG reduction impact is possible for the community. The option chosen will likely depend on the local political climate and the supporting impact analysis.

Option	Description	Impact
Protect solar access	Legal protections and design considerations to protect against shading for systems installed now or in the future. See Measure 5 - Solar Access	Protects potential for future SWH, GHG reduction and cost savings. Unlikely to create direct costs.
Require buildings to be solar-ready	Require roof space/orientation, plumbing, electrical, & equipment space to ensure the practical and least cost future installation of SWH.	Ensures potential for future SWH, GHG reduction and cost savings. Reduces future installation costs. Increases initial cost of construction by a small amount.
Require SWH as an option	Require builders to offer SWH as an option	Actual energy/GHG reduction. Immediate cost savings if financed through mortgage. Likely initial capital cost savings over retrofit.
Require SWH	Require SWH as condition of approval or by ordinance.	Actual energy/GHG reduction. Immediate cost savings if financed through mortgage. Likely initial capital cost savings over retrofit.

Why it is Important

As described in the AB 32 Scoping Plan, "Solar water heating (SWH) systems represent what is likely the largest untapped potential for natural gas savings in California. California residences and commercial buildings consume at least 2.5 billion therms of natural gas annually to heat water. With statewide implementation of solar water heating, a significant portion of this could be saved."

Solar water heating is an enabling technology for zero net energy buildings[19], and successful implementation of the zero net energy targets will require that new buildings include SWH systems or have the potential to add SHW in the future.

In the January 2011 update to the California Energy Efficiency Strategic Plan, the CPUC addresses solar water heating as a measure in their integrated demand-side management strategy. Listed as mid-term goal for implementation, it would be offered with other technologies or systems in a pilot program for residential and commercial customers[20].

In the California residential sector, water heating accounts for 38% of natural gas and 6% of electricity use. Eighty-nine percent of homes in California and 94 percent of homes in the PG&E service territory heat water using natural gas[21]. Unlike electricity that can be generated from many renewable technologies, the options for displacing natural gas are more dependent on demand-side solutions. After water conservation measures, SWH provides one of the best solutions to reducing natural gas consumption. Through the local planning process, local governments can ensure that the potential for SWH can be realized now or in the future. In the absence of a statewide mandate, local action is critical to protect the individual's and community's option for SWH.

Unlike electricity, options for displacing natural gas are more dependent on demand-side solutions. SWH provides one of the best solutions to reducing natural gas consumption.

Benefits and Costs

The benefits and costs will vary depending on the SWH policy option pursued. The CPUC authorized the California Center for Sustainable Energy in San Diego to conduct a multiyear SWH pilot program to inform state policy and implement AB1740 that authorizes $250 million in incentives over a ten year period. A Final Evaluation Report (included under Next Steps below) was released in March of 2011 that provides useful data to support a local benefit-cost analysis[22].

According to a study by the University of Wisconsin-Madison, equipping 75% of U.S. buildings and homes with solar thermal technologies by 2015 would cut more than 300 million tons of CO2 pollution each year and at some of the lowest costs[23]. To put this number in context, it is roughly twice the annual global warming pollution reductions to be achieved by AB 32 (which only applies to California). For a rough GHG calculation, a typical system can provide 130 therms annually for a single family home, which would save about 0.76 metric tons of CO2. If your community has a potential build-out of 1,000 homes, the potential savings from SWH would be about 762 metric tons annually.

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[19] A "zero net energy" building must produce enough electricity to offset both the electrical and natural gas use of the building on an annual basis. The State has set a 2020 target for zero net homes and 2030 for zero net commercial buildings.

[20] Page 69, California Energy Efficiency Strategic Plan, January 2011, California Public Utilities Commission.

[21] Table 2-22, California Statewide Residential *Appliance Saturation Study*, Vol 2, Study Results, Final Report, June 2004, California Energy Commission Consultant Report (300-00-004)

[22] The report provides more sophisticated data and calculations for examining the system wide benefits and more variables than are necessary to support local decision-making but can be referred to for a detailed understanding of the wider range of societal costs and benefits.

[23] Lenius, J. M., Klein, S. A., and Beckman, W.A. "Utilizing Solar Energy in Mitigating CO2 Emissions", Solar Energy Laboratory, University of Wisconsin-Madison. In this study, solar hot water is compared with improving average fuel economy for cars and trucks and cutting CO2 pollution from the industrial sector by 50%

Section 73 of the California Revenue and Taxation Code allows a property tax exclusion for certain types of solar energy systems installed between January 1, 1999, and December 31, 2016. Qualifying active solar energy systems are defined as those that "are thermally isolated from living space or any other area where the energy is used, to provide for the collection, storage, or distribution of solar energy." These include solar space conditioning systems, solar water heating systems, active solar energy systems, solar process heating systems, photovoltaic (PV) systems, and solar thermal electric systems, and solar mechanical energy. Solar pool heating systems and solar hot-tub-heating systems are not eligible[24].

Potential financial enablers: AB 1470, the Solar Hot Water and Efficiency Act of 2007 (SHWEA) authorized the CPUC to undertake a ten year, $250-million incentive program for solar water heaters with a goal of promoting the installation of 200,000 solar water systems in California by 2017. The CPUC ran a pilot program in San Diego from 2007 to 2009 to evaluate the potential impacts on equipment prices, demand, and overall cost effectiveness of a SWH incentive program. The results showed that single-family homes that installed solar water heating experienced an average monthly utility bill savings of $11.29 for displacing natural gas water heating and a savings of $41.08 when displacing electric water heating[25].

On January 21, 2010, the CPUC created the California Solar Initiative (CSI)-Thermal Program, a cash rebate program for solar water heating systems on single-family, multifamily, and commercial properties funded by ratepayers of PG&E, SCE, SoCalGas, and SDG&E. With $350.8 million dedicated to this program, rebates of up to $1,875 are available for single-family dwellings while multifamily and commercial buildings can receive a maximum rebate of $500,000. Similarly, a low income CSI-Thermal Program was approved on October 6, 2011 for qualifying low-income single-family and multi-family residences in PG&E, SoCalGas, and SDG&E territories. CPUC has allocated $25 million to this program.

How to Implement – Legal Authority

SWH is currently not a requirement under the Title-24 building code but is an option for the performance-based compliance alternative. Similarly, SWH is not a mandatory measure for CALGreen but is listed as a voluntary measure to help achieve Tier 1 or Tier 2. Under the California Solar Initiative, the California Energy Commission (CEC) oversees the New Solar Homes Partnership (NSHP), which provides financial incentives to home builders who construct energy-efficient solar homes. Though the New Solar Homes Partnership provides incentives for solar electric systems only, the installation of a SWH system serves as an option for complying with the Building Energy Efficiency Standards, which meet the energy efficiency requirements for program participation. (SWH is classified as an energy efficiency measure under California program rules. Unlike grid-connected solar electric systems that provide power to the grid part of the time, SWH can only store hot water to reduce a customer's onsite demand.) SWH is also called out as an important measure in the CARB AB 32 Scoping Plan.

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[24] DSIRE:Database of State Incentives for Renewable & Efficiency. 2011. North Carolina Solar Center and Interstate Renewable Energy Council. 06 Nov 2011 <http://www.dsire.org>

[25] California Center for Sustainable Energy,, *Solar Water Heating Pilot Program*, Study Results, Final Evaluation Report, Page 13, March 2011.

Local governments have authority to place conditions for approval on new development or to adopt ordinances. While conditions for approval may work for new subdivisions, an ordinance may be needed to capture buildings requiring only a building permit.

How to Implement - Next Steps

The resources here are specific to to two policy approaches: requiring SWH as an option or simply requiring SWH. Even if a community has adopted a green building code more stringent than CALGreen or a stricter local energy building code than Title-24, specifically requiring SWH or the option for SWH is worth considering. It is a mature technology and a cost-effective way to reduce natural gas consumption, especially when installed in new construction.

Solar water heating systems can be claimed as credit toward compliance with the Title 24 Building Energy Efficiency Standards.

Requiring SWH as an Option: Requiring SWH as an option is simply a requirement that the builder must offer the option to the prospective buyer. The builder can offer SWH directly or through referral to local solar contractors, but the builder remains responsible for providing the solar ready components. For subdivisions, solar as an option could be made a condition of approval, while for individual new homes an ordinance would likely be needed.

State of Colorado Solar Ready Law

The State of Colorado adopted a state law in May 2009 that requires builders to make all single family homes solar ready and offer to install both SWH and PV as an option.

Link: Solar_Water_Heating-Law-Colorado-Solar_Ready.pdf
(Colorado House Bill, 2009, 4 pages, searchable)

California Solar Initiative Law, SB 1

The California Solar Initiative law (SB1, 2006) includes a requirement starting in 2011 that developers of new production homes with 50 or more homes offer solar PV but not SWH. At this writing, there is no California state law that would require the SWH option.

Link: Solar_Water_Heating-Law-California-Solar_Initiative_Law_SB1.pdf
(Senate Bill, August 2006, 20 pages, searchable)

Requiring SWH on New Homes: Requiring SWH on new construction is the only way to immediately realize broad GHG reduction impacts through the technology. This approaoch would also likely meet with more resistance from developers than SWH as an option, because of the initial cost. However, requiring SWH does have historical precedent in California. In 1979, SWH was considered so commercially available and sufficiently cost effective that the County of San Diego and a few other jurisdictions in the state adopted ordinances requiring SWH on homes in new subdivisions. The elimination of state and federal incentives and stabilizing natural gas prices in the early to mid-1980s changed the economics and adversely affected the SWH industry. Municipalities rescinded these laws as a result, but today both the technology and policy landscapes are changing again. AB 1470 rebates for SWH systems, volatility in the cost of natural gas, and mandates for climate action and zero net energy homes once again establish the need and means for local action.

County of San Diego Solar Water Heating Ordinance

The County of San Diego SWH requirement for new subdivisions originally adopted in 1979 provides a sample ordinance that could be adapted for use today as conditions for approval or as an ordinance. The ordinance had to be rescinded in the early 1980's when tax credits for solar water heating were eliminated, natural gas prices stabilized, and too many solar contractors went out of business.

Link: Solar_Water_Heating-Municipal_Code-San_Diego.pdf
(San Diego, 1979, 3 pages, image)

State of Hawaii Solar Water Heating Law, Act 204

The State of Hawaii adopted a new state law in 2008 that requires SWH for all new single family homes starting in 2010. Hawaii's high cost to import fossil fuel makes this statewide law practical. For specific code language:

Link: Solar_Water_Heating-Code_Section-Hawaii-2008-Act_204.pdf
(Hawaii, 2008, 1 page, searchable)

State of Hawaii Energy Resources Law, AB 1464

In 2009 Hawaii's legislature passed an omnibus energy bill that, in part, reinforced the state's commitment to the solar water heating requirement. While it may not be entirely adaptable to California communities, it provides a good example of the analysis and key arguments you used to evaluate a SWH requirement. SWH is addressed in Section 14 of the legislation.

Link: Solar_Water_Heating-Law-Hawaii-Renewable_Energy-2009-HB1464.pdf
(Hawaii House Bill, 2009, 17 pages, searchable)

California Center for Sustainable Energy Solar Water Heating Pilot Program: Final Evaluation Report

This report provides the final cost and savings information for SWH from the San Diego area pilot program set up to inform the statewide implementation of AB 1470 establishing rebates for SWH.

Link: Solar_Water_Heating-Report-Solar_Water_Heating_Pilot_Program_Final_Evaluation_CCSE-2011.pdf
(Itron, Inc., March 2011, 221 pages, searchable)

The Value Proposition of Solar Water Heating in California

The California Solar Energy Industries Association (CALSEIA) commissioned this study to analyze and quantify the value of Solar Water Heating.

Link: Solar_Water_Heating-Report-Value_Proposition_of_SWH_in_California_CALSEIA-2009.pdf
(CALSEIA, January 2009, 20 pages, searchable)

Measure 5:
Solar Access Protection

Solar access addresses the need to protect solar energy systems from the effects of shading by buildings and vegetation on neighboring properties. Solar access can be protected legally under existing law and practically by employing simple design principals in planning new development. Current California law does not guarantee solar access without local action.

What the Measure Does

Solar access protection ensures that property owners can protect existing and future investments in onsite solar energy to the greatest extent feasible. Solar systems include both passive solar design elements, such as a thermal collection wall built into the south facing façade of a building, and active solar water heating and solar electric systems generally placed on the roof of buildings. Such systems might also be ground-mounted on the site. More detailed information on solar access can be found in two guidebooks developed by the CEC in the late 1970's that are included in the Resource Library and discussed in the Next Steps section. See also Measure 2 – Energy-efficient Street Design for more discussion of the impact of street layout in protecting solar access.

Protecting solar access is a critical local government function to ensure the maximum feasible reduction in energy use for buildings. While a local government may not require onsite generation or passive solar design elements as GHG mitigations today, it can protect the right and ability to add them in the future.

California has two laws --The Solar Shade Control Act of 1978 and the Solar Rights Act of 1978 -- that in theory protect solar access. However, poor subdivision design, insufficient local controls on landscaping, and lack of enforcement can negate the protections provided under the laws. While many local governments added the Solar Rights Act language to their General Plans and municipal codes many years ago, far fewer developed the standards and programs to implement them, since the Act established no means to enforce its provisions and no accountability.

Why it is Important

The failure to protect solar access will reduce the individual's and community's options to lower energy use and GHG in the future.. The properties affected may be more expensive to maintain, less competitive against newer buildings and more dollars will leave the local economy to pay for increasing energy costs.

Benefits and Costs

The City of San Jose adopted solar access guidelines in 1991 after finding it would save nearly 24 million kWh, reducing home energy bills $2.8 million (in 2009 dollars) and eliminate nearly 5500 tons of CO2 emissions within 10 years

Protecting solar access does not create any direct benefits or costs but ensures the benefits of active and passive solar systems can be realized over the lifetime of the buildings. Not protecting solar access can result in significantly higher operating costs for building owners by limiting the options for onsite renewable energy production. Moreover, properties with protected solar access rights are likely to retain or increase in market value over unprotected properties as renewable energy gains recognition as a cost-saving building feature.

Other Benefits and Drawbacks

While protecting solar access might appear to limit options for layout and orientation of buildings, planning for solar access can actually improve subdivision design by focusing more attention on the value of passive and active solar integration into building design. Solar access protections also can increase the potential for daylighting in buildings and winter light for gardens.

Marin County authorizes planners to require solar easements for properties that cannot be protected by good subdivision design

How to Implement - Legal Authority

Two state laws – The Solar Rights Act of 1978 and the Solar Shade Control Act of 1978 – provide the legal basis for requiring protection of solar access as a condition of approval for new development. The laws are described here, and additional resources to assist with implementation are provided in the Resource Library folder.

The Solar Rights Act of 1978 requires that the design of a subdivision shall provide, to the extent feasible, for future passive or natural heating or cooling opportunities in the subdivision (Government Code section 66473.1.) This law is focused on ensuring that streets, lots and building placement in new subdivisions are optimized for unrestricted southerly exposure of homes. While this does not provide legal protection for solar access for residents, it gives local governments the authority to require developers to design subdivisions to maximize the opportunity for solar. The Solar Rights Act also authorizes local governments to require that the solar rights are protected through specifying the location and dimensions on each parcel that are protected from neighboring buildings or landscaping, as a condition of approval of subdivisions. This provision can and by law should be enforced by planners now.

The Solar Shade Control Act of 1978 prohibits homeowners and residents from allowing "a tree or shrub to be placed, or if placed, to grow on such property, subsequent to the installation of a solar collector on the property of another so as to cast a shadow greater than 10 percent of the collector absorption area ... between the hours of 10 a.m. and 2 p.m." Unless a local jurisdiction adopted a specific ordinance protecting solar access (as some local governments did in the early 1980's), this state law provides the primary legal authority to do so. The law relates only to vegetation that may cause shading, not buildings.

Amendments to the Solar Shade Control Act in August 2008 (AB 1399) dramatically weakened solar access protection by limiting solar access rights to solar systems that were installed prior to the planting of neighboring vegetation. Under the original law, a neighbor would be required to trim vegetation that shades a solar system as long as the system was installed before the area was shaded. Under the amended law, a neighbor might plant a tree that will eventually grow to shade the southern exposure of your home. If the solar system had not been planned and the neighbor notified before the tree was planted, there would be no legal recourse to keep the tree from eventually shading the solar system. AB 1399 also changed enforcement from a public nuisance prosecuted by the local government to a civil action requiring neighbors to sue neighbors. The amendments to the Shade Control Act could severely reduce the individual's and community's ability to use onsite solar in the future. Local governments do have the authority to adopt stricter local rules for solar shade control by ordinance.

How to Implement - Next Steps

If you have no current program for implementing the provisions of the Solar Rights Act in your planning process, you may first want to check your municipal code or General Plan to see if any policy was adopted, which often happened in the late 1970s or early 1980s. Examples from local governments that did adopt language are provided below.

Your community and/or water district may already have requirements for native or drought tolerant landscaping to mitigate water demand. Most communities or water districts have permitted or recommended tree lists. Such lists and current landscaping requirements can be reviewed and amended to consider solar access protections as well. New rules would govern the distance trees could be planted from the neighbor's southerly walls.

The following documents included in the Resource Library folder will provide more background on solar access law, solar access design guidelines, implementation options, and examples from local governments who have implemented the described solar access protections.

The subdivision on the left has good orientation but some roof areas have been shaded by trees. The subdivision on the right also has good orientation but designed the lots and placed the homes to better protect the south walls and roofs from shading.

California Solar Rights Act: A Review of the Statute and Relevant Cases

This review of the Solar Rights Act by the Energy Policy Initiatives Center (EPIC) published in 2010 provides a good overview of the law, its amendments, and relevant case law since it was enacted. It was written to provide a better understanding and analysis of the law in the context of current State policy supporting solar energy systems and the rapid growth of the solar market. It also contains the California code sections amended by the law.

Link: Solar_Access-Handbook-SRA_Review_of_the_Statute_and_Relevant_Cases_EPIC-2010.pdf
(Energy Policy Initiatives Center University of San Diego School of Law, April 2010, 36 pages, searchable)

California Solar Shade Control Act: A Review of the Statutes and Relevant Cases

This review of the Solar Shade Control Act by the Energy Policy Initiatives Center (EPIC) published in 2010 provides a good overview of the law and case law since it was enacted. It also contains the California code sections amended by the law.

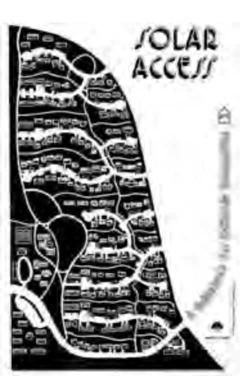
Link: Solar_Access-Handbook-Solar_Shade_Control_Act_Review_of_the_Statute_EPIC-2010.pdf
(Energy Policy Initiatives Center University of San Diego School of Law, 2010, 24 pages, searchable)

Solar Access: A Local Responsibility

This is one of the first handbooks (1978) published by the California Energy Commission to introduce the concept of solar access to developers and local government officials.

Link: Solar_Access-Handbook-Solar_Access_A_Local_Responsibility_CEC-1978.pdf
(CEC, December 1978, 41 pages, image)

Protecting Solar Access: A Guidebook for California Communities



This is an early handbook (1980) published by the California Energy Commission for land use planners on how to use conventional land use controls to protect solar access in new residential development for space heating and cooling, and domestic water heating. It provides detailed information on solar easements and other legal mechanisms. The appendix includes various local model ordinances that were proposed or adopted at the time.

Link: Solar_Access-Guidebook-Protecting_Solar_Access -CEC-1980.pdf
(CEC, March 1980, 183 pages, image)

Link: Solar Access-Appendix to Guidebook-Protecting_Solar_Access-CEC-1980.pdf
(CEC, March 1980, 81 pages, image)

A Comprehensive Review of Solar Access Law in the United States: Suggested Standards for a Model Statute and Ordinance

This is a 2008 report that reviews the ability of existing law and regulation to protect solar access and recommends specific measures to improve solar access. It provides a good history of solar access law, explains the legal mechanisms, examines several exemplary state and local codes, and provides a model state law and local code. Note: California's laws are not discussed or presented as models to follow.

Link: Solar_Access-Report-Review_of_Solar_Access_Laws_in_the_US-2008.pdf
(Solar America Board for Codes and Standards Prepared by Colleen McCann Kettles Florida Solar Energy Research and Education Foundation, October 2008, 44 pages, searchable)

Tomorrow's Energy Today for Cities and Counties: Solar Access: A Winning Strategy

This is a short tract published by the Department of Energy that discusses the importance of solar access protection and cites research in San Jose on the value of protecting solar access that led to adopting local solar access guidelines for subdivisions. See also "San Jose – Solar access residential design guidelines."

Link: Solar_Access-Pamphlet-Tomorrow's_Energy_Today_for_Cities_and_Counties-DOE-1993.pdf
(DOE, December 1993, 5 pages, searchable)

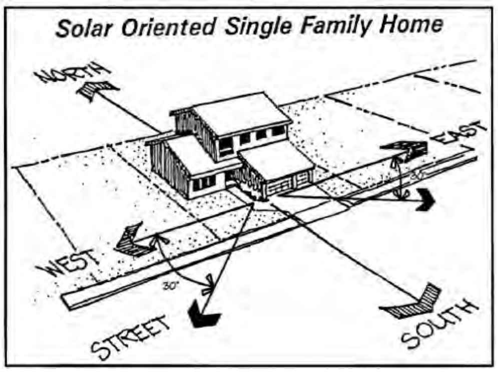
Examples in Practice

Marin County Solar Access Municipal Code Excerpts

Marin County and many other local governments passed ordinances in the early 1980's adding solar access protection as allowed under the state laws. Most adopted the language from the state law specifically allowing solar easements to be required as a condition of approval of new subdivisions. Marin County's code states "Where neither lot size, lot configuration or applicable zoning is sufficient to reasonably protect solar access to parcels in a new subdivision, the planning director or planning commission may require the preparation and dedication of solar access easements or restrictive covenants."

Link: Solar Access-Code-Marin County- Solar_Access_Code_Excerpts-1982.pdf
(Marin County, 1982, 6 pages, searchable)

San Jose Solar Access, Residential Design Guidelines (Chapter 14)



The City of San Jose adopted solar access guidelines as part of its Residential Design Guidelines in the early 1990s. The guidelines provide general rules for protecting passive solar heating and reducing cooling loads through shading. The rules also preserve future options for solar electric and solar thermal technologies.

Link: Solar_Access-Guidelines-San_Jose-Residential-1999.pdf
(Dept. of Planning, City of San Jose, 1999, 4 pages excerpt, searchable)

General References

AB 1358 (2008), Complete Streets Act

Starting January 1, 2011, this law requires local governments to plan for a balanced, multimodal transportation network that meets the needs of all users of streets. Users include motorists, pedestrians, bicyclists, children, persons with disabilities, seniors, movers of commercial goods, and users of public transportation.

Link: Street_Design-Law-Calif_Complete_Streets_Act_of_2008_AB_1358-2008.pdf
(California Assembly Bill, 2008, 9 pages, searchable)

AB 1470 (2007), Solar Hot Water and Efficiency Act, SHWEA

SHWEA authorized the CPUC to undertake a ten year, $250-million incentive program for solar water heaters that offset natural gas use with a goal of promoting the installation of 200,000 solar water systems in California by 2017. Eighty-nine percent of single-family households in California use natural gas to heat their water and would be eligible for a rebate through this program. As of December 2009, the CPUC funded a pilot project and evaluation in San Diego but has not authorized rebates statewide. See the report titled "California Center for Sustainable Energy Solar Water Heating Pilot Program: Interim Evaluation Report Final" in this bibliography for detailed information on the pilot project.

Link: Solar_Water_Heating-Law-California-AB1470_2007.pdf
(California Assembly Bill, 2007, 9 pages, searchable)

AB 32 (2006), Global Warming Solutions Act

This bill requires the State Air Resources board to adopt a statewide greenhouse gas emissions limit equivalent to the statewide greenhouse gas emissions levels in 1990 to be achieved by 2020, and to adopt regulations to require the reporting and verification of statewide greenhouse gas emissions and to monitor and enforce compliance with this law. The bill would require the state board to adopt rules and regulations in an open public process to achieve the maximum technologically feasible and cost-effective greenhouse gas emission reductions specified.

Link: General_Documents-Calif_Law-AB_32_bill_2006_chaptered.pdf
(Assembly Bill, 2006, 13 pages, searchable)

California Climate Change Final Scoping Plan

This plan required by AB 32 outlines the State's strategy to achieve the 2020 greenhouse gas emissions limit. Adopted by the Air Resources Board in December of 2008, the plan proposes "a comprehensive set of actions designed to reduce overall greenhouse gas emissions in California, improve our environment, reduce our dependence on oil, diversify our energy sources, save energy, create new jobs, and enhance public health." The measures proposed in the Scoping Plan are required to be developed and in place by 2012.

Link: General_Documents-Climate_Change_Scoping_Plan-2008.pdf
(California Air Resources Board, December 2008, 152 pages, searchable)

California Energy Efficiency Strategic Plan

Developed through a collaborative process involving the CPUC's regulated utilities, the Plan sets forth a roadmap for energy efficiency in California through the year 2020 and beyond. It articulates a long-term vision and goals for each economic sector and identifies specific near-term, mid-term and long-term strategies to assist in achieving those goals.

Link: General_Documents-CA_Energy_Efficiency_Strategic_Plan_CPUC-2011.pdf
(CPUC, January 2011, 130 pages, searchable)

California Governor's Executive Order S-3-05

Executive Order signed June 1, 2005 by Governor Arnold Schwarzenegger establishing the following greenhouse gas emission reduction targets for California: by 2010, reduce GHG emissions to 2000 levels; by 2020, reduce GHG emissions to 1990 levels; by 2050, reduce GHG emissions to 80 percent below 1990 levels. AB 32, the Global Warming Solutions Act passed by the state legislature in 2006 put the 2020 target formally into state law.

Link: General_Documents-Calif_Executive_Order-S-3-05-2005.pdf
(Office of the Governor, 2005, 1 page, searchable)

California Statewide Residential Appliance Saturation Study, Vol 2, Study Results, Final Report

This 2004 report provides data on energy end use and type for residential appliances in California, including breakdowns by utility territory and climate zone as applicable. Table 2-22 is cited in the Handbook for the following statistics: In the California residential sector, water heating accounts for 38% of natural gas and 6% of electricity use. Eighty-nine percent of homes in California and 94 percent of homes in the PG&E service territory heat water using natural gas

Link: Solar_Water_Heating-Report-California_Statewide_Residential_Appliance_Saturation_Study-2004.pdf
(CEC Prepared by: KEMA-XENERGY, Itron, RoperASW, June 2004, 30 pages, searchable)

CEQA & Climate Change, Evaluating and Addressing Greenhouse Gas Emissions from Projects Subject to the California Environmental Quality Act

This paper was prepared by the California Air Pollution Control Officers Association published in January 2008 to serve as a resource for public agencies as they establish agency procedures for reviewing GHG emissions from projects under CEQA. It considers the application of thresholds and offers three alternative programmatic approaches toward determining whether GHG emissions are significant. The paper also evaluates tools and methodologies for estimating impacts, and summarizes mitigation measures.

Link: General_Documents-Report-CEQA_and_Climate_Change_CAPCOA-2008.pdf
(CAPCOA, January 2008, 156 pages, searchable)

Model Policies for Greenhouse Gases in General Plans: A Resource for Local Government to Incorporate General Plan Policies to Reduce Greenhouse Gas Emissions

This document, published by California Air Pollution Control Officers Association in June 2009, provides local governments with relevant information for considering climate change and GHG reductions in General Plans. It is intended as a resource document and contains background information on relevant state laws and policy, model local policies, and other information to assist local decision makers and planners.
Link: General_Documents-Report-Model_Policies_for_Greenhouse_Gases_in_General_Plans-2009.pdf
(CAPCOA, June 2009, 250 pages, searchable)

New Solar Homes Partnership Guidebook, Revised Second Edition

The New Solar Homes Partnership (NSHP) established by the California Solar Initiative (SB 1, 2006) provides financial incentives and other support for installing eligible PV systems on new residential buildings that receive electricity from PG&E and other investor-owned utilities. This Guidebook describes the requirements developed by the CEC to receive incentives for constructing energy-efficient, solar homes under the NSHP.

Link: Solar_Water_Heating-Guidebook-CEC_New_Solar_Home_Guidebook-2008.pdf
(CEC, August 2008, 80 pages, searchable)

San Bernardino and Attorney General of California 2007 Settlement Regarding Analysis and Mitigation of GHG Impacts of the General Plan Update

This document is the settlement agreement in the lawsuit filed under CEQA by the California Attorney General against the County of San Bernardino that alleged the County did not adequately analyze the adverse effects or adopt feasible mitigations for the adverse effect of implementation of the General Plan on air quality and climate change.

Link: General_Documents-San_Bernardino_Settlement_Agreement-2007.pdf
(Superior Court of the State of California, 2007, 11 pages, searchable)

SB 1 (2006), California Solar Initiative Law

The California Solar Initiative law revised and set new targets, requirements and incentives for promoting customer-installed solar electric systems for the state. The goals include:

- Install 3,000 megawatts (MW) of distributed solar PV capacity in California by the end of 2016
- Establish a self-sufficient solar industry in which solar energy systems are an available mainstream option in 10 years
- Place solar energy systems on 50 percent of new homes in 13 years.

It also requires developers of new production homes with 50 or more homes to offer solar PV starting in 2011.

Link: Solar_Water_Heating-Law-California-Solar_Initiative_Law_SB1.pdf
(Senate Bill, August 2006, 20 pages, searchable)

SB 375 (2008), Transportation Planning, Sustainable Communities Strategy

This law addresses controlling GHG emissions from vehicles by curbing urban sprawl. It directs the ARB to set GHG reduction targets for regions of the state and builds on the existing regional transportation planning process overseen by local elected officials to connect the reduction of GHG emissions from cars and light trucks to local and regional land use and transportation policy. The first document is the original adopted legislation. The second is a short fact sheet from the Institute for Local Government.

Link: General_Documents-Calif_Law-SB_375_bill_2008_enrolled.pdf
(Senate Bill, 2008, 64 pages, searchable)

Link: General_Documents-Fact_Sheet-Basics_of_SB_375-ILG.pdf
(Institute for Local Government, 2 pages, searchable)

SB 97 (2007), CEQA, Greenhouse Gas Emissions

The bill requires the State Office of Planning and Research (OPR) to develop guidelines for the feasible mitigation of greenhouse gas emissions as required by CEQA, including, but not limited to, effects associated with transportation or energy consumption. The Resources Agency adopted these guidelines on December 30, 2009. The OPR is required to periodically update the guidelines to incorporate new information or criteria established by the State Air Resources Board pursuant to the California Global Warming Solutions Act of 2006.

Link: General_Documents-Calif_Law-SB_97_bill_2007_chaptered.pdf
(Senate Bill, August 2007, 2 pages, searchable)

Solar Rights Act Amendment, AB 1407 (2003)

This bill amended the Solar Rights Act in 2003 to require that public entities do not place unreasonable restrictions on the procurement of solar energy systems when funded by state-sponsored grants and loans. AB 1407 also prohibits local governments from unreasonable restrictions on solar systems and from exempting residents from these rules.

Link: Solar_Access-Calif_Law-AB_1407_bill_20030904_chaptered.pdf
(Assembly Bill, 2003, 2 pages, searchable)

Solar Rights Act Amendment, AB 2473 (2004)

This bill amended the Solar Rights Act in 2004 to prohibit local governments from restricting the installation of a solar energy system based on aesthetics or placing other requirements that would "significantly" impair use of solar systems. It also defines "significantly" for solar water or pool heating systems as greater than a 20 percent increase in cost or reduction in performance, and for solar photovoltaic systems as an amount not to exceed $2,000 in system cost or greater than a 20 percent reduction in performance, as originally specified and proposed.

Link: Solar_Access-Calif_Law-AB_2473_bill_20040925_chaptered.pdf
(Assembly Bill, 2004, 8 pages, searchable)

Solar Shade Control Act Amendment, AB 1399 (2008)

This law amended the Solar Shade Control Act of 1978 limiting solar access rights to solar systems that were installed prior to the planting of the tree(s) on a neighboring property. Prior to this amendment, a tree planted prior to the installation of a solar system on a neighboring property but not yet shading the solar system could not be allowed to shade the solar system in the future. In other words, a homeowner could install a solar system unaware that a neighbor might have planted a redwood sapling on the other side of a fence to the south. Under the change in the law, the homeowner has no recourse to prevent the eventual shading the solar system. It also changed the violation of the law from a public nuisance to a private nuisance that would require a civil action by the affected party to enforce.

Link: Solar_Access-Calif_Law-SB_1399_bill_20080707_enrolled.pdf
(Assembly Bill, August 2008, 8 pages, searchable)

Net Metering Application Procedures for Liberty Utilities

1. If you plan to install a renewable energy system, please contact the Net Metering Administrator either by phone or mail (see below) and ask to participate in the Net Metering program. We will then either email, fax, or mail an Application Packet to you within 5 business days.

   For more information about the program or to answer your questions at any time during the application, construction or final inspection process, please contact:

Liberty Utilities

Net Metering Administrator

933 Eloise Avenue

South Lake Tahoe, CA 96150

Phone: (530) 543-5216

Fax: (530) 544-4811

2. The Application Packet includes:

   - **Net Metering Application** – This is the starting point to help you understand the process, and for us to learn about your installation to make the process run smoothly. Your contractor will be able to help you with information about your system, but if you have any questions, please contact us. If you are doing the installation yourself, please also contact your local building department to find out their requirements.

- **Net Metering Systems Standards** – This information is a guide for meeting utility codes so that the renewable energy is used in a way that is safe for you and utility employees. It includes important information to help make the installation safe.

  The following are the minimum requirements to participate in net metering:

  a. You must be connected to the utility grid.

  b. You must be located on your premises.

  c. The renewable energy system must be used primarily to offset all or part of the electricity you receive from Liberty Utilities.

  d. The renewable energy system must be 1,000 kilowatts or less in generating capacity.

  e. The renewable energy system must be constructed to comply with utility standards that are listed on the utility's website, Libertyutilities.com

- **Net Metering Rider** – This is the new rate schedule that will apply to you once you complete your installation. In simple terms, your meter will run backwards if you are producing more electricity than you are using, banking the electricity for you. It will run forward as it normally does when you are using more electricity than you are producing. More information can be found in the How to Read Your Net Metering Power Bill brochure, which is included in this packet.

- **Standard Net Metering Agreement** – A copy of the standard agreement will be provided with the blank application form so you can look it over and see if you have any questions. Once your system nears completion, we will fill out the agreement and send it to you for your signature.

- **How to Read Your Net Metering Power Bill** brochure – This brochure explains how Net Metering works, how your power bill will look, and what your new meter will look like.

3. You will hear back from us within 10 business days once we receive the completed application from you. If we have any questions about your application, we will contact you for additional information. Otherwise you are ready to proceed with your installation.

4. When the application nears completion, we will prepare the Net Metering Agreement and send it to you. Please review and sign the agreement, and return it to us in the envelope provided. If the envelope is missing, please send it to the Net Metering Administrator at the address listed above.

5. Prior to any construction, you or your contractor should apply for a building permit, if required. (A building permit is required in most jurisdictions.) The building permit needs to be signed off on by the city or county building officials before a meter can be set and you can operate your new renewable energy system.

6. When the project is completed and you have the sign-off from the building inspector on your permit, please email, fax, or mail a copy of the signed-off building permit to the Net Metering Administrator at the address above.

7. Following receipt of your signed-off building permit a utility representative will contact you to schedule a system inspection. By regulation we are required to perform this inspection no later than 10 business days after we receive your signed-off building permit.

8. After the system passes inspection, your existing meter will be placed with a bi-directional meter. The bi-directional meter runs both forwards and backwards, depending on whether the system is generating more or less energy than your household is using. This keeps a record of the net energy, or how much you are sending to us and how much your household is using.

9. You are encouraged to review your first Net Metering bill, using the **How to Read Your Net Metering Power Bill** brochure included in your Application Packet as a guide, and contact us if you have any questions regarding your bill.

News List

City of Lancaster's Residential Solar Ordinance Approved by California Energy Commission

Post Date: 12/26/2013 1:00 AM

The California Energy Commission (CEC) has approved the City of Lancaster's locally adopted energy standards which will require single family residential units built within Lancaster on or after January 1, 2014 to provide an average of 1 kilowatt (kW) of solar-generated electricity per housing unit. Having now been given the authority to enforce the ordinance, Lancaster is the first city in the nation to make residential solar mandatory. The new ordinance, adopted by the Lancaster City Council on March 26, 2013, was approved by the CEC on December 11, 2013.

"We continue to aggressively pursue net-zero status, and this approval by the CEC proves we are indeed on the right path," said Lancaster Mayor R. Rex Parris. "We are strongly committed to reducing our carbon footprint, while advancing green energy alternatives to traditional power resources. Requiring solar power assets for new residential construction in the coming years will bring Lancaster one huge step closer to becoming the Alternative Energy Capital of the World, while providing new homeowners with earth-friendly and cost-effective benefits."

Lancaster's Residential Zoning Ordinance was comprehensively revised to require new home builders to meet the aggregate energy generation requirement within a production subdivision, though solar energy systems do not have to be on every home.

"I've had the opportunity to visit the City of Lancaster and meet the Mayor and some of the senior City staff," commented CEC Commissioner Karen Douglas. "I just want to say that they are taking some very impressive leadership in the area of clean energy, and I'm pleased to see them arrive at this point… I'm looking forward to continued leadership from the City of Lancaster and continued partnership moving forward."

Shortly after the adoption of the General Plan Update in 2009, City staff began initial research on the Residential Zones update. An administrative draft was released in June 2011, followed by a public draft in January 2012. Following several outreach efforts and a series of public hearings, the Planning Commission adopted Resolution No. 13-01 on January 28, 2013, recommending to the City Council approval of the City's Residential Zoning Ordinance. Other zoning code amendments for implementation of specific actions from the City's Housing Element were also included in the resolution.

"The City of Lancaster remains at the forefront of innovative and progressive design and technologies because we realize these are crucial components of any thriving cutting-edge city," added Mayor Parris. "Our Architectural and Design Commission conducted a comprehensive revision of the City's previous design guidelines, creating yet another pathway for Lancaster's future as a thriving community."

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lancaster ca
it's positively clear

R. Rex Parris Mayor
Marvin E. Crist Vice Mayor
Ronald D. Smith Council Member
Ken Mann Council Member
Sandra Johnson Council Member
Mark V. Bozigian City Manager

October 23, 2013

Mr. Robert Oglesby
California Energy Commission
1516 Ninth Street, MS 39
Sacramento, CA 95814-5514

RE: LOCAL ENERGY ORDINANCE FOR IMPLEMENTATION OF SOLAR PV SYSTEMS

Dear Mr. Oglesby,

Per the request of Commission Staff, the City of Lancaster would like to express to you our firm commitment to enforce the 2013 Title 24, Part 6 Building Energy Efficiency Standards of the California Building Code as part of the implementation of our local energy ordinance. As the Chief Building Official, I will work with my staff to provide training on enforcement of the energy standards and the new requirements for developers to install solar energy systems for new dwelling units as contained in Ordinance No. 994.

On October 22, 2013, I presented to the Lancaster City Council, Ordinance No. 994 including the requirement for implementation of solar energy systems. The City Council recognized the reports, resolution and ordinance at the public hearing and approved Ordinance No. 994 on the same date, with the finding that the requirement is cost-effective.

Per the request of Commission Staff, the ordinance for implementation of solar energy systems was amended to reflect Commission Staff comments to require the demonstration of compliance with the Building Energy Efficiency Standards. The City of Lancaster is committed to enforcing these standards, with the ultimate goal of being the first net-zero city in state of California.

Commission Staff has requested that we summarize our California Environmental Quality Act (CEQA) procedure and findings. The City Council approved a resolution on October 22, 2013 determining that the proposed ordinance is intended to preserve and enhance the environment of the City of Lancaster and is not subject to the CEQA pursuant to Section 15061(b)(3) of the CEQA Guidelines, because there is no possibility that the ordinance may have a significant negative impact on the environment. In addition, it was determined that the ordinance is exempt from the requirements of CEQA pursuant to Section 15308 of the CEQA Guidelines, which exempts actions taken by regulatory agencies for the enhancement and protection of the environment. The City of Lancaster is filing a notice of exemption with Los Angeles County Clerk's office.

Sincerely,

Robert C. Neal

Robert Neal, CBO
Public Works Director

RN/cn

October 31, 2013

Application for:

City of Lancaster Locally Adopted Energy Standards

From:
Robert Neal, Public Works Director CBO
City of Lancaster
44933 Fern Avenue
Lancaster, CA 93534
(661) 723-6040

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RESOLUTION NO. 13-61

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF LANCASTER, CALIFORNIA, PRESENTING FINDINGS FOR MODIFYING THE 2013 CALIFORNIA BUILDING, RESIDENTIAL, ELECTRICAL, AND ENERGY CODES WHICH ARE REASONABLY NECESSARY DUE TO LOCAL CLIMATIC, GEOLOGICAL, OR TOPOGRAPHICAL CONDITIONS.

WHEREAS, the State of California Building Standards Commission is mandated by Sections 18928 and 18929 of the Health and Safety Code to adopt, by reference, the most recent edition of the International Building Code of the International Conference Council; the International Residential Code of the International Conference Council; the National Electrical Code of the National Fire Protection Association; and the California Energy Code, hereafter collectively referred to as "Codes"; and

WHEREAS, permission is granted to Cities or Counties to make changes or modifications in requirements contained in the provisions published in the California Building Standards Code pursuant to Sections 17958 and 17958.5 of the Health and Safety Code; and

WHEREAS, Health and Safety Code Section 17958.7 provides that, before making any modifications or changes to the California Building Standards Code, the governing body of the City or County shall make an express finding that such changes or modifications are reasonably necessary because of local climatic, geological, or topographical conditions; and

WHEREAS, permission is granted to Cities or Counties to make changes or modifications in requirements contained in the provisions published in the California Energy Code pursuant to Section 25402.1(h)2 of the Public Resources Code; and

WHEREAS, Public Resources Code Section 25402.1(h)2 provides that, before making any modifications or changes to the California Building Standards Code, the governing body of the City or County shall make an express finding that such changes or modifications are cost effective and will require buildings to be designed to consume no more energy than permitted by Title 24, Part 6; and

WHEREAS, the City Engineering Division of the City of Lancaster has recommended that changes and modifications to the Codes be made, such changes and modifications being necessary due to local conditions, and further recommend other changes and modifications which are of an administrative, definitional, and/or procedural nature and not deemed to be Building Standards.

NOW, THEREFORE, BE IT RESOLVED AND ORDERED BY THE CITY COUNCIL OF THE CITY OF LANCASTER, STATE OF CALIFORNIA, THAT:

Section 1. Sections 15.08.020 and 15.08.030 of the Lancaster Municipal Code change, add and/or modify Sections 903.2, 1505.6, 1505.7, 1507.8, 1507.9, 3425 and Tables 1507.8, 1507.8.5, 1507.8.7, 1507.9.6 and 1507.9.8, of the 2013 California Building Code, Title 24, Part 2 of the California Code of Regulations. Section 15.09.020 of the Lancaster Municipal Code change, add and/or modify Sections R905.7, R905.8 and Tables R905. 7.4, R905.7.5, R905.8.5 and R905.8.6, of the 2013 California Residential Code, Title 24, Part 2.5 of the California Code of Regulations. Section 15.12.040 of the Lancaster Municipal Code changes, adds and/or modifies Article 690.15 of the 2013 California Electrical Code, Title 24, Part 3 of the California Code of Regulations. All the above are incorporated by reference as if fully set forth herein and are hereby found to be reasonably necessary due to the following local conditions:

Local Climatic Conditions:
The City of Lancaster is located in the western portion of the southeast desert air basin. The seasonal temperatures vary greatly. Summer is relatively hot with temperatures as high as 117° F with very little precipitation. In winter it is very frigid with temperatures as low as 2° F. Lancaster experiences high winds and a significant portion of the prevailing winds are due to the desert heat low pressure systems and the phenomena known as the "orographic effect" (the air is forced over the mountain range and loses moisture as it rises, when it descends, it also compresses and heats up).

With these conditions, Lancaster is a prime locality to experience snow, flooding, heat wave, drought and devastating fires. Therefore, to further reduce the likelihood of loss of human life, and property damage from a catastrophe which would extremely tax the resources of the City thereby making less resources available for other concurrent incidences, to further preserve the natural environment in sensitive areas of the City, to conserve water for use in irrigation systems, and to provide for adequate ventilation and rest areas, it is therefore reasonably necessary because of the above mentioned climatic conditions to adopt, change, add and/or modify the above mentioned Sections and Chapters of Title 24 of the California Code of Regulations.

Section 2. Section 15.28.020 of the Lancaster Municipal Code adds Section 110.11 to the 2013 California Energy Code. This Section is incorporated by reference as if fully set forth herein and has been found to be cost effective and will require buildings to be designed to consume no more energy than permitted by Title 24, Part 6. The proposed Ordinance is intended to preserve and enhance the environment of the City of Lancaster and is not subject to the California Environmental Quality Act pursuant to Section 15061(b)(3) of the CEQA Guidelines, because there is no possibility that the ordinance may have a significant negative impact on the environment and is exempt from the requirements of CEQA pursuant to Section 15308 of the CEQA Guidelines, which exempts actions taken by regulatory agencies for the enhancement and protection of the environment. In addition, this Section places Ordinance 989, approved by the City Council in April 2013, requiring the implementation of solar energy systems in new residential construction, within the Lancaster Energy Code.

PASSED, APPROVED and ADOPTED this 22nd day of October, 2013, by the following vote:

AYES: **Council Members: Johnson, Mann, Smith, Vice Mayor Crist, Mayor Parris**

NOES: **None**

ABSTAIN: **None**

ABSENT: **None**

ATTEST:

Geri K Bryan

GERI K. BRYAN, CMC
City Clerk
City of Lancaster

APPROVED:

R. REX PARRIS
Mayor
City of Lancaster

STATE OF CALIFORNIA }
COUNTY OF LOS ANGELES }ss
CITY OF LANCASTER }

CERTIFICATION OF RESOLUTION
CITY COUNCIL

I, ______________________________, ______________________________ City of Lancaster, California, do hereby certify that this is a true and correct copy of the original Resolution No. 13-61, for which the original is on file in my office.

WITNESS MY HAND AND THE SEAL OF THE CITY OF LANCASTER, on this ____ ____ day of _______________, _______.

(seal)

____

ORDINANCE NO. 994

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF LANCASTER, CALIFORNIA AMENDING TITLE 15 OF THE LANCASTER MUNICIPAL CODE BY REPEALING ORDINANCE NUMBER 958, AND ADOPTING BY REFERENCE THE 2013 EDITION OF THE CALIFORNIA BUILDING CODE AS AMENDED HEREIN; ADOPTING BY REFERENCE THE 2013 EDITION OF THE CALIFORNIA RESIDENTIAL CODE AS AMENDED HEREIN; ADOPTING THE LANCASTER STRAW-BALE CONSTRUCTION STANDARDS AS CONTAINED HEREIN; ADOPTING BY REFERENCE THE 2013 EDITION OF THE CALIFORNIA ELECTRICAL CODE AS AMENDED HEREIN; ADOPTING BY REFERENCE THE 2013 EDITION OF THE CALIFORNIA MECHANICAL CODE; ADOPTING BY REFERENCE THE 2013 EDITION OF THE CALIFORNIA PLUMBING CODE AS AMENDED HEREIN; ADOPTING THE LANCASTER SECURITY CODE AS CONTAINED HEREIN; ADOPTING BY REFERENCE THE 2012 EDITION OF THE INTERNATIONAL PROPERTY MAINTENANCE CODE AS AMENDED HEREIN; ADOPTING BY REFERENCE THE 1997 EDITION OF THE UNIFORM CODE FOR THE ABATEMENT OF DANGEROUS BUILDINGS AS AMENDED HEREIN; ADOPTING BY REFERENCE THE 2013 EDITION OF THE CALIFORNIA ENERGY CODE AS AMENDED HEREIN; ADOPTING BY REFERENCE THE 2013 EDITION OF THE CALIFORNIA HISTORICAL BUILDING CODE; ADOPTING BY REFERENCE THE 2014 EDITION OF THE LOS ANGELES COUNTY FIRE CODE; AND ADOPTING BY REFERENCE THE 2013 EDITION OF THE CALIFORNIA GREEN BUILDING STANDARDS CODE, AS THE LANCASTER CODES FOR BUILDINGS AND CONSTRUCTION

THE CITY COUNCIL OF THE CITY OF LANCASTER, CALIFORNIA, DOES HEREBY ORDAIN AS FOLLOWS:

Section 1. Chapter 15.04 of the Lancaster Municipal Code is hereby amended by rewriting the Chapter in its entirety to read as follows:

CHAPTER 15.04
ADMINISTRATIVE CODE

15.04.010 California Building Code Chapter 1, Division II Adopted by Reference.

A. That certain Building Code known as the 2013 California Building Code, Chapter 1, Division II, incorporating by adoption the 2012 edition of the International Building Code with necessary California amendments, all published by the International Conference of Building Officials, and as herein amended, is hereby adopted by reference, and such code shall be and become the Lancaster Administrative Code for Buildings and Construction, to serve as the administrative, organizational and enforcement rules and regulations for the technical codes which regulate the site preparation and construction, alteration, moving, demolition, repair, use, occupancy and maintenance of buildings, structures and building service equipment.

B. One (1) copy of said California Building Code 2013 Edition has been deposited in the Office of the City Clerk of the City of Lancaster, and shall be at all times maintained by said Clerk for use and examination by the public.

15.04.020 Definitions.

Section 101.4.7 of the California Building Code, Chapter 1, Division II, is hereby added to read as follows:

101.4.7 Definitions. Whenever any of the names or terms defined in this section are used in this Code, each such name or term shall be deemed and construed to have the meaning ascribed to be in this section as follows:

"Building Code" shall mean chapter 15.08 of the Lancaster Municipal Code.

"Building Official" shall mean the Building and Safety Official of the City of Lancaster.

"Code Enforcement Agency" or "Local Building Department" shall mean the Building and Safety Division of the Department of Public Works of the City of Lancaster.

"Electrical Code" shall mean Chapter 15.12 of the Lancaster Municipal Code.

"Elevator Code" shall mean the 2013 California Elevator Safety Construction Code.

"Energy Code" shall mean Chapter 15.28 of the Lancaster Municipal Code.

"Fire Code" shall mean Chapter 15.32 of the Lancaster Municipal Code.

"Green Building Standards Code" shall mean Chapter 15.34 of the Lancaster Municipal Code.

"Historical Building Code" shall mean Chapter 15.30 of the Lancaster Municipal Code.

"Jurisdiction" shall mean the City of Lancaster.

"Mechanical Code" shall mean Chapter 15.16 of the Lancaster Municipal Code.

"Plumbing Code" shall mean Chapter 15.20 of the Lancaster Municipal Code.

"Property Maintenance Code" shall mean Chapter 15.24 of the Lancaster Municipal Code.

"Residential Code" shall mean Chapter 15.09 of the Lancaster Municipal Code.

"Technical Codes" shall mean Chapters 15.08, 15.09, 15.10, 15.12, 15.16, 15.20, 15.22, 15.24, 15.28, 15.30, 15.32 and 15.34 of the Lancaster Municipal Code.

15.04.030 Duties and Powers of the Building Official.

Section 104 of the California Building Code, Chapter 1, Division II, is hereby amended by adding subsection 104.12, as follows:

104.12 Regulations. The building official is authorized to promulgate rules and regulations to implement the provisions of this code.

15.04.040 Permit Exempt.
Section 105.2 of the California Building Code, Chapter 1, Division II, is hereby amended by adding the following:

"14. Minor repairs to roof covering which cumulatively totals 100 square feet or 10% of the roof area of any structure regulated by the technical codes, whichever is the least, in any 12 month period. The exemption of a permit shall not be construed to mean that the repairs shall not comply with Chapter 15 of the Building Code."

15.04.050 <u>Permits – Expiration.</u>
Section 105.5 of the California Building Code, Chapter 1, Division II, is hereby amended to read as follows:

105.5 Expiration. Except as set forth in subsection 105.5.1, every permit issued for property within the city of Lancaster shall expire by limitation and become null and void as follows:
(i) If work authorized by such permit is not commenced within 180 days from the issuance date of the permit.

(ii) If work authorized by such permit is commenced within 180 days from the issuance date of the permit, such permit shall expire by limitation and become null and void if the work authorized by such permit is suspended or abandoned. For purposes of this subsection, "suspended or abandoned" shall mean that the permittee has, for a period of 180 days or longer after commencing the work authorized by such permit, failed to make substantial progress toward completion of the work, as determined by the building official. Failure to schedule, undergo and/or pass a requisite interim or final inspection for a period of 180 days or longer since the issuance date of the permit or since the most recent interim inspection may be deemed to constitute a failure to make substantial progress toward completion of the work. The building official may, in his/her sole discretion, grant, in writing, one or more extensions of time, for periods not more than 180 days each. The extension shall be requested in writing and justifiable cause demonstrated.

(iii) In the event of permit expiration, before work authorized pursuant to the expired permit can be commenced or recommenced, a new permit shall first be obtained (hereafter, a "renewal permit"). To obtain a renewal permit, the applicant may be required to resubmit plans and specifications, if deemed necessary by the building official and/or the city's planning director. The applicant must pay all applicable fees, including but not limited to a plan check fee and building permit fees, in the amount then established by resolution of the City Council. If renewal permits are applied for, a mandatory site inspection shall be performed by the Building and Safety Division to determine that existing conditions and materials comport with this code. All work to be performed under a renewal permit must be performed in accordance with all applicable technical codes, regulations, laws and ordinances in effect on the date of issuance of the renewal permit. Renewal permits are subject to expiration as set forth in (ii), above.

(iv) In the event of permit expiration, any work performed under that permit is "unpermitted" as defined in Section 114.1 of this chapter, and is subject to the legalization provisions of section 114.5 of this chapter.

105.5.1 Expiration – Unpermitted structures or grading. Notwithstanding any provision of section 105.5, if a building permit was issued in order to bring an unpermitted structure, unpermitted grading, or other unlawful, substandard or hazardous condition into compliance with any applicable law, ordinance, rule or regulation, such permit shall expire by limitation and become null and void sixty (60) days after the issuance date of such permit, if the permittee has failed to make substantial progress toward completion of the work as determined by the building official. Failure to schedule, undergo and/or pass a requisite interim or final inspection for a period of 60 days since the issuance date of the permit or since the most recent interim inspection may be deemed to constitute a failure to make substantial progress toward completion of the work. The building official may, in his/her sole discretion, grant, in writing, one or more extensions of time, for periods not more than 60 days each. The extension shall be requested in writing and justifiable cause demonstrated.

15.04.060 Standard Plans.
Section 107 of the California Building Code, Chapter 1, Division II, is hereby amended by adding the following:

107.6 Standard Plans. The Building Official may approve a set of plans for a building or structure as a "standard plan," provided that the applicant has made proper application, submitted complete sets of plans as required by this section, and paid the plan review fees required.

Plans shall reflect laws and ordinances in effect at the time a permit is issued except as provided herein. Nothing in this section shall prohibit modifying the permit set of plans to reflect changes in laws and ordinances, which have become effective since the approval of the standard plan. The standard plan shall become null and void where the work required by such changes exceeds ten percent (10%) of the value of the building or structure. When it is desired to use an approved "standard plan" for an identical structure, the Building Official may require two plot plans and two duplicate plans to be submitted. Such duplicate plans shall be compared and stamped prior to permit issuance. All fees in effect at the time of permit issuance shall be paid prior to permit issuance.
Standard plans shall be valid for a period of one year from the date of approval. The Building Official may extend this period when no changes in codes or ordinances have occurred.

15.04.070 Fees.
Section 109.2 of the California Building Code, Chapter 1, Division II, is hereby amended to read as following:

109.2 Schedule of Permit fees. "On buildings, structures, electrical, gas, mechanical and plumbing systems or alterations requiring a permit, a fee for each permit shall be paid as required, in accordance with the schedule *as adopted by resolution of the City Council of the City of Lancaster.*"

15.04.080 Use or Occupancy.
Section 111.1 of the California Building Code, Chapter 1, Division II, is hereby amended to read as following:

111.1 Use and Occupancy. No building or structure, *regardless of occupancy classification,* shall be used or occupied, and no change in the existing *business* or occupancy classification of a building or structure or portion thereof shall be made until the building official has issued a certificate of occupancy therefore as provided herein. Issuance of a certificate of occupancy shall not be construed as an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction.

Exception: Certificates of occupancy are not required for work exempt from permits under Section 105.2.

111.1.1 "No building shall be occupied for any purpose until all permanent utilities have been installed and are fully functional. There shall be no exceptions without the express written consent of the building official."

15.04.090 Board of Appeals.
Section 113 of the California Building Code, Chapter 1, Division II, is hereby deleted in its entirety and replaced with the following:

113 Appeals. Appeals of orders, decisions or determinations of the building official are limited to those enumerated in this section, and shall be filed, scheduled and conducted in accordance with this section.

113.1 Scope.
A. Notwithstanding the provisions of the Technical Codes or the State Housing Law (commencing with Section 17910 of Chapter 1 of Division 13 of the Calif. Health and Safety Code), an appeal is limited to the following orders, decisions or determinations of the building official:

(1) Denials of the proposed use of alternative materials, design or method of construction, installation and/or equipment;

(2) Orders to Vacate and/or Not Enter a building, structure or premises; however, such order shall not be stayed during the pendency of the appeal;

(3) Orders to Demolish a building or structure; however, an order to vacate that may be issued in conjunction with an Order to Demolish shall not be stayed during the pendency of the appeal;

B. The right of appeal shall not exist for determinations of the building official, or a designee thereof, that a violation of any provision of the Technical Codes exists in a building or structure, or portion thereof, or on any premises.

113.2 Appeal Procedure.
A. Any person who is aggrieved by an order, decision or determination of the building official as provided in subsection 113.1 may contest said order, decision or determination by filing an appeal, in writing on a city approved form, with the City Clerk within ten (10) business days from the date of service of the order, decision or determination being appealed. The appeal must specify the basis for the appeal in detail, provide a mailing address and telephone number for the appellant, and include the applicable fee. If a timely appeal is not received by the City Clerk, the right to appeal is waived and the order, decision or determination of the building official is deemed final and binding.

B Appeals shall be heard before an impartial hearing officer, designated by the city manager or his/her designee. Only those matters or issues specifically raised in the written appeal shall be considered in the hearing.

C If the appellant fails to appear, the hearing officer shall cancel the hearing and send a notice thereof to the appellant by first class mail to the address stated on the appeal form. A cancellation of a hearing due to non-appearance of the appellant shall constitute the appellant's waiver of the right to appeal. In such instances, the order, decision or determination of the building official is final and binding.

D Appeal hearings are informal, and formal rules of evidence and discovery do not apply. The order, decision or determination of the building official shall be prima facie evidence of the violation. The appellant, and the building official or his/her designee shall have the opportunity to present evidence and to cross-examine witnesses. The appellant may represent himself/herself or be represented by anyone of his/her choice. The appellant may bring an interpreter to the hearing at his/her sole expense.

E Within thirty calendar days following the appeal hearing, the hearing officer shall affirm, modify or rescind the order, decision or determination of the building official. A written decision shall be served on the appellant by first class mail to the address stated on the appeal form. Failure of an appellant to receive a properly addressed decision shall not invalidate any action or proceeding by the city.

F Any person who is aggrieved by the decision of the hearing officer may appeal said decision to the Board of Appeals, which shall be comprised of members of the City Council and the building official, who shall be an ex officio member. An appeal shall be in writing, must be filed in the same manner, within the same time period, and contain the same information, as an appeal to hearing officer, as provided in Subsection A of this Section. A second appeal fee must accompany the written appeal. If a timely appeal is not received by the City Clerk, the decision of the hearing officer is deemed final and binding. Failure to appeal a decision to the Board of Appeals shall constitute a failure to exhaust the aggrieved person's administrative remedy.

G Appeals before the Board of Appeals shall be conducted in the manner set forth in Chapter 2.44 of the Lancaster Municipal Code.

113.3 Limitation on Authority of Board of Appeals. The Board of Appeals shall have no authority to waive the technical requirements of the Building Code or other technical codes adopted in Title 15 of the Lancaster Municipal Code.

113.4 Appeals of Actions Related to Access to Public Accommodation by Physically Handicapped Persons. The City Council shall have the authority to review decisions by the building official in enforcement of the requirements of the California Health & Safety Code, sections 19955 through 19959, related to access to public accommodation by physically handicapped persons. Appeals of such decisions shall be filed, scheduled and conducted in the manner set forth in Chapter 2.44 of the Lancaster Municipal Code.

15.04.100 Violations – Unlawful Acts
Subsection 114.1 of the California Building Code, Chapter 1, Division II, is hereby amended to read as follows:

114.1 Unlawful acts. It shall be unlawful for any person firm, or corporation to erect, construct, alter, extend, repair, move, remove, demolish, occupy or maintain any building, structure, equipment, installation or land regulated by the Technical Codes, or cause or permit the same to be done, in conflict with or in violation of any of the provisions of the Technical Codes.

114.1.1 Unpermitted structures. No person shall own, use, occupy or maintain an unpermitted structure. For purposes of this section, "unpermitted structure" shall be defined as any building or structure, or portion thereof, or any electrical, plumbing, mechanical or other installation or fixture, that was erected, constructed, enlarged, altered, repaired, moved, improved, removed, connected, installed, converted, demolished or equipped, at any point in time by any person, without the required permit(s) having first been obtained from the building official or with a valid permit as issued by the building official which subsequently expired and became null and void.

114.1.2 Unpermitted grading. No person shall own, use, occupy or maintain unpermitted grading. For purposes of this section, "unpermitted grading" shall be defined as any land which has been excavated, cut, filled, graded, compacted or terraced, at any point in time by any person, without the required permit(s) having first been obtained from the building official or with a valid permit as issued by the building which subsequently expired and became null and void.

15.04.110 Violations – Violation Penalties
Subsection 114.4 of the California Building Code, Chapter 1, Division II, is hereby amended to read as follows:

114.4 Violation Penalties. Any person, firm or corporation who violates any provision of the Technical codes, or fails to comply with any of the requirements thereof, or who erects, constructs, alters, repairs or maintains a building, structure, installation or equipment, or excavates, cuts, fills, grades, compacts or maintains land in violation of approved construction documents or directive of the building official, or of a permit or certificate issued under the provisions of the Technical Codes, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be subject to the punishments set forth in Chapter 1.12 of the Lancaster Municipal Code.

15.04.120 Violations – Legalizing Procedures
Subsection 114 of the California Building Code, Chapter 1, Division II, is hereby amended by adding thereto Subsection 114.5, Procedure for Legalizing Unpermitted Structures or Grading, to read as follows:

114.5 Procedure for legalizing unpermitted structures or grading. The procedures specified within subsections 114.5.1 through 114.5.6 shall be followed whenever an attempt is made to legalize an unpermitted structure or unpermitted grading.

114.5.1 Permits. Any person who wishes to legalize an unpermitted structure or unpermitted grading, as defined in Subsections 114.1.1 and 114.1.2, shall obtain all applicable permits. Unpermitted structures and grading shall comply with all current Technical Code requirements and other required approvals pursuant to the Lancaster Municipal Code in order to be legalized. Permits obtained to legalize unpermitted structures or grading shall expire as set forth in Section 105.5.1 of this code.

114.5.2 Plans. Prior to the issuance or granting of any permit to legalize an unpermitted structure, plans showing the plot plan, exterior elevations, existing structures, proposed structures and proposed finish materials shall be submitted to the building official and planning director, or their designees, for review and approval.

114.5.3 Grading. Prior to the issuance or granting of any permit to legalize unpermitted grading, a grading and drainage plan showing the original grade and existing unpermitted grade on the premises the existing grade on adjoining properties, and a soils report shall be submitted to the building official for review and approval.

114.5.4 Inspections. Unpermitted structures or unpermitted grading for which a permit has subsequently been obtained shall be subject to inspection by the building official in accordance with, and in the manner prescribed in, the Technical Codes. The building official may require the removal of finish materials in order to expose framing elements, electrical components, plumbing fixtures or mechanical systems, or may require the removal of fill, to verity that installation, construction or grading was performed in conformance with the Technical Codes.

114.5.5 Investigation. Whenever any work for which a permit is required by this code has commenced on land or in connection with any type of structure without first obtaining said permit a special investigation shall be made before a permit may be issued for such work. For purposes of this section, "special investigation" shall include, but is not limited to, inspecting premises and structures, reviewing permit, license and other records of the City or other agencies, reviewing plans, taking photographs, engaging in conferences and communications with other officials of the City or other agencies, and engaging in conferences and communications with owners or other responsible persons concerning the unpermitted structure or grading.

114.5.5.1 Fee. A special investigation fee shall be paid prior to the issuance of a permit for an unpermitted structure or unpermitted grading. The fee shall be equal to the amount of time expended by city officials in undertaking the special investigation, as defined in Section 114.5.5, charged at the hourly rate that has been established by resolution of the City Council for recovery of code enforcement reinspection fees. The payment of such investigation fee shall not exempt any person from compliance with all other provisions of this code nor from any penalty prescribed by law.

114.5.6 Unpermitted structures or grading which cannot be legalized. If the planning director determines that the City's zoning regulations prohibit legalization of any unpermitted structure, the structure shall be demolished or, if previously permitted, restored to its original approved condition, with all requisite permits, inspections and approvals.

If the building official determines that an unpermitted structure cannot be made to conform to the current applicable Technical Code requirements, the structure shall be demolished or, if previously permitted, restored to its original approved condition, with all requisite permits, inspections and approvals.

If the building official determines that unpermitted grading and/or lot drainage cannot be made to conform with current applicable Technical Code requirements, the land shall be fully restored to the condition that preceded the unpermitted grading, with all requisite permits, inspections and approvals.

Section 2. Chapter 15.08 of the Lancaster Municipal Code is hereby amended by rewriting the Chapter in its entirety to read as follows:

CHAPTER 15.08
BUILDING CODE

15.08.010 California Building Code Provisions Adopted by Reference.

A. That certain Building Code known and designated as volumes 1 and 2 of the 2013 California Building Code, including Appendix C; Appendix F; Appendix G; Appendix H; Appendix I; and Appendix J; incorporating by adoption the 2012 edition of the International Building Code with necessary California amendments, all published by the International Conference of Building Officials, and as herein amended, are hereby adopted by reference, and such codes shall be and become the Lancaster Building Code, regulating the erection, construction, enlargement, alteration, repair, moving, removal, demolition, conversion, occupancy, use, height, area and maintenance of all structures and certain equipment therein, and the grading of premises, and providing penalties for violation of such codes.

B. One (1) copy of said 2013 California Building Code has been deposited in the office of the City Clerk of the City of Lancaster and shall be at all times maintained by said Clerk for use and examination by the public.

15.08.020 Fire Sprinkler System.

Section 903.2 of the 2013 California Building Code is hereby amended to read as follows:

903.2 Where Required. Approved automatic sprinkler systems shall be provided in all buildings and structures, regardless of occupancy group, with a total floor area of 10,000 square feet or more without regard to fire walls of less than four (4) hour fire resistive construction; in existing buildings, other than single family residences, where additions are constructed which increase the total floor area to 10,000 square feet or more; and in the locations described in Sections 903.2.1 through 903.2.12.

15.08.030 Roof Covering - Wood Shakes and Wood Shingles.
Sections 1505.6, 1505.7, 1507.8, 1507.9 and Tables 1507.8,1507.8.5, 1507.8.7, 1507.9.6 and 1507.9.8 of the 2013 California Building Code and all references in any of the technical or administrative codes to said sections or to wood shakes and/or wood shingles, whether or not fire-rated, fire treated, or fire-retardant-treated or any similar terminology, are hereby deleted.

15.08.040 Existing Structures.
Chapter 34 of the 2013 California Building Code is hereby amended by adding section 3425 to read as follows:

**SECTION 3425
REPAIRS TO BUILDINGS AND STRUCTURES DAMAGED
BY THE OCCURRENCE OF A NATURAL DISASTER OR FIRE**

3425.1 Purpose. The purpose of this section is to provide a defined level of repair for buildings damaged by a natural disaster in the City of Lancaster when a formal state of emergency has been proclaimed. This section shall also apply when an individual building has been damaged by fire or other disaster.

3425.2 General. Required repair levels shall be based on the ratio of the estimated value of the repairs required to restore the structural members to their pre-event condition to the estimated replacement value of the building or structure.

3425.2 Structural Repairs. When the damage ratio does not exceed 0.10 (10 percent), buildings and structures, except essential service facilities, shall at a minimum be restored to their pre-event condition.

When the damage ratio is greater than 0.10 (10 percent) but less than 0.5 (50 percent), buildings and structures, except essential service facilities, shall have the damaged structural members including all critical ties and connections associated with the damaged structural members, all structural members supported by the damaged member, and all structural members supporting the damaged members repaired and strengthened to bring them into compliance with the force levels and connection requirements of the Building Code. These criteria shall apply to essential service facilities when the damage ratio is less than 0.30 (30 percent).

EXCEPTION: For buildings with rigid diaphragms where the above-required repair and strengthening increases the rigidity of the resisting members, the entire lateral-force-resisting system of the building shall be investigated. When, in the opinion of the building official, an unsafe or adverse condition has been created as a result of the increase in rigidity, the condition shall be corrected.

When the damage ratio is greater than 0.5 (50 percent), buildings and structures, except essential service facilities, shall at a minimum have the entire building or structure strengthened to comply with the force levels and connection requirements of the Building Code. This criteria shall apply to essential service facilities when the damage ratio is greater or equal to 0.3 (30 percent).

3425.4 Nonstructural Repairs to Light Fixtures and Suspended Ceilings. Under all damage ratios, when light fixtures and the suspension system of suspended ceilings are damaged, the damaged light fixtures and ceiling suspension systems shall be repaired to fully comply with the requirements of this code. In buildings and structures where suspended ceiling systems are present, undamaged light fixtures and ceiling suspension systems shall have the additional support and bracing, provided that is required in this code.

Section 3. Chapter 15.09 of the Lancaster Municipal Code is hereby created by adding the Chapter in its entirety to read as follows:

CHAPTER 15.09
RESIDENTIAL CODE

15.09.010 California Residential Code Provisions Adopted by Reference.

A. That certain Residential Code known and designated as the 2013 California Residential Code, including Appendix H, Appendix J, and Appendix K, incorporating by adoption the 2012 edition of the International Residential Code with necessary California amendments, all published by the International Conference of Building Officials, and as herein amended, are hereby adopted by reference, and such codes shall be and become the Lancaster Residential Code for Buildings and Construction regulating the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal and demolition of every detached one-and two-family dwelling, townhouse and certain equipment therein, and the grading of premises, and providing penalties for violation of such codes.

B. One (1) copy of said 2013 California Residential Code has been deposited in the Office of the City Clerk of the City of Lancaster, and shall be at all times maintained by said Clerk for use and examination by the public.

15.09.020 Roof Covering - Wood Shakes and Wood Shingles.

Sections R905.7, R905.8, and Tables R905.7.4, R905.7.5, R905.8.5, and R905.8.6 of the 2013 California Residential Code and all references in any of the technical or administrative codes to said sections or to wood shakes and/or wood shingles, whether or not fire-rated, fire treated, or fire-retardant-treated or any similar terminology, are hereby deleted.

Section 4. Chapter 15.10 of the Lancaster Municipal Code is hereby amended by rewriting the Chapter in its entirety to read as follows:

CHAPTER 15.10
STRAW-BALE CONSTRUCTION

15.10.010 Scope.
Straw-bale construction shall be limited to building of one story in height. This chapter shall establish minimum standards for straw-bale construction. Nothing in this chapter shall be construed as increasing or decreasing the authority of the Building Official to approve or disapprove of alternative construction methods pursuant to the State Housing Law, Part 1.5 (commencing with Section 17910) or the California Building Standards Code, Title 24 of the California Code of Regulations.

15.10.020 Fee Schedule incorporated by reference.
The fees charged for the construction of any straw-bale building shall be as adopted by resolution of the City Council for non-straw-bale construction of the same occupancy.

15.10.030 Architect or Engineer required.
Nothing in this chapter shall be construed as an exemption from Chapter 3 (commencing with Section 5500), or Chapter 7 (commencing with Section 6700) of Division 3 of the Business and Professions Code relative to preparation of plans, drawings, specifications, or calculations under the direct supervision of a licensed architect or civil engineer, for the construction of structures that deviate from the conventional framing requirements for wood frame construction.

15.10.040 Definitions.
For the purpose of this chapter, the following terms are defined as follows:

"Bales" means rectangular compressed blocks of straw, bound by strings or wire.

"Flakes" means slabs of straw removed from an untied bale.

"Laid flat" refers to stacking bales so that the sides with the largest cross-sectional area are horizontal and the longest dimension of this area is parallel with the wall plane.

"Laid on edge" refers to stacking bales so that the sides with the largest cross-sectional area are vertical and the longest dimension of this area is horizontal and parallel with the wall plane.

"Loadbearing" refers to plastered straw-bale walls that bear the dead and live loads of the roof.

"Non-loadbearing" refers to plastered straw-bale walls that bear only their own weight, such as infill panels within some type of post and beam structure.

"Plaster" means lime, gypsum, lime cement, or cement plasters, as defined by the California Building Standards Code, or earthen plaster with fiber reinforcing.

"Straw" means the dry stems of cereal grains left after the seed heads have been substantially removed.

15.10.050 Guidelines for Materials.
The following shall be the guidelines for all bales used in the construction of a straw-bale building.

A. Bales shall be rectangular in shape.

B. Bales used within a continuous wall shall be of consistent height and width to ensure even distribution of loads within wall systems.

C. Bales shall be bound with ties of either polypropylene string or baling wire. Bales with broken or loose ties shall not be used unless the broken or loose ties are replaced with ties which restore the original degree of compaction of the bales.

D. The moisture content of bales, at the time of installation, shall not exceed 20 percent of the total weight of the bale. Moisture content of bales shall be determined through the use of a suitable moisture meter, designed for use with baled rice straw or hay, equipped with a probe of sufficient length to reach the center of the bale, and used to determine the average moisture content of five bales randomly selected from the bales to be used.

E. Bales in loadbearing walls shall have a minimum calculated dry density of 7.0 pounds per cubic foot. The calculated dry density shall be determined after reducing the actual bale weight by the weight of the moisture content.

F. Where custom-made partial bales are used, they shall be of the same density, same string or wire tension, and, where possible, use the same number of ties as the standard size bales.

G. Bales of various types of straw, including wheat, rice, rye, barley, oats, and similar plants, shall be acceptable if they meet the minimum requirements of this chapter for density, shape, moisture content, and ties.

15.10.060 Construction Guidelines.
The following shall be the minimum construction guidelines for all straw-bale buildings.

A. Straw-bale walls, when covered with plaster, drywall, or stucco, shall be deemed to have the equivalent fire resistive rating as wood-frame construction with the same wall-finishing system.

B. Minimum bale wall thickness shall be 13 inches.

C. Buildings with loadbearing bale walls shall not exceed one story in height, and the bale portion of the loadbearing walls shall not exceed a height-to-width ratio of 5.6:1 (for example, the maximum height for a wall that is 23 inches thick would be 10 feet 8 inches).

D. The ratio of unsupported wall length to thickness, for loadbearing walls, shall not exceed 15.7:1 (for example, for a wall that is 23 inches thick, the maximum unsupported length allowed is 30 feet).

E. The allowable vertical load (live and dead load) on top of loadbearing bale walls plastered with cement or lime cement plaster on both sides shall not exceed 800 pounds per linear foot, and the resultant load shall act at the center of the wall. Straw-bale structures shall be designed to withstand all vertical and horizontal loads, and the resulting overturning and base shear, as specified in the latest edition of the California Building Standards Code. Straw-bale walls plastered with cement or lime cement plaster on both sides shall be capable of resisting in-plane lateral forces from wind or earthquake of 360 pounds per linear foot.

F. Foundations shall be designed in accordance with the California Building Standards Code to accommodate the load created by the bale wall plus superimposed live and dead loads. Supports for bale walls shall extend to an elevation of at least six inches above adjacent ground at all points, and at least one inch above floor surfaces.

G. 1. Bale walls shall be anchored to supports to resist lateral forces, as approved by the civil engineer or architect. This may be accomplished with one-half inch reinforcing bars embedded in the foundation and penetrating the bales by at least 12 inches, located along the center line of the bale wall, spaced not more than two feet apart. Other methods as determined by the engineer or architect may also be used.

2. Non-bale walls abutting bale walls shall be attached by means of one or more of the following methods or by means of an acceptable equivalent:

a. Wooden dowels of 5/8 inch minimum diameter and of sufficient length to provide 12 inches of penetration into the bale, driven through holes bored in the abutting wall stud, and spaced to provide one dowel connection per bale.

b. Pointed wooden stakes, a minimum of 12 inches in length and 1 ½ inches by 3 ½ inches at the exposed end, fully driven into each course of bales, as anchorage points.

c. Bolted or threaded rod connection of the abutting wall, through the bale wall, to a steel nut and steel or plywood plate washer, a minimum of 6 inches square and a minimum thickness of 3/16 of an inch for steel and ½ inch for plywood, in a minimum of three locations.

3. a. Bale walls and roof bearing assemblies shall be anchored to the foundation where necessary, as determined by the civil engineer or architect, by means of methods that are adequate to resist uplift forces resulting from the design wind load. There shall be a minimum of two points of anchorage per wall, spaced not more than 6 feet apart, with one located within 36 inches of each end of each wall.

b. With loadbearing bale walls, the dead load of the roof and ceiling systems will produce vertical compression of the walls. Regardless of the anchoring system used to attach the roof bearing assembly to the foundation, prior to installation of wall finish materials, the nuts, straps, or cables shall be retightened to compensate for this compression.

H. 1. A moisture barrier shall be used between the top of the foundation and the bottom of the bale wall to prevent moisture from migrating through the foundation so as to come into contact with the bottom course of bales. This barrier shall consist of one of the following:

a. Cementitious waterproof coating.

b. Type 30 asphalt felt over an asphalt emulsion.

c. Sheet metal flashing, sealed at joints.

d. Another building moisture barrier, as approved by the building official.

2. All penetrations through the moisture barrier, as well as all joints in the barrier, shall be sealed with asphalt, caulking, or an approved sealant.

3. There shall also be a drainage plane between the straw and the top of the foundation, such as a one inch layer of pea gravel.

I. 1. For non-loadbearing walls, bales may be laid either flat or on edge. Bales in loadbearing bale walls shall be laid flat and be stacked in a running bond, where possible, with each bale overlapping the two bales beneath it. Overlaps shall be a minimum of 12 inches. Gaps between the ends of bales which are less than 6 inches in width may be filled by an untied flake inserted snugly into the gap.

2. Bale wall assemblies shall be held securely together by rebar pins driven through bale centers as described in this chapter, or equivalent methods as approved by the civil engineer or architect.

3. The first course of bales shall be laid by impaling the bales on the rebar verticals and threaded rods, if any, extending from the foundation. When the fourth course has been laid, vertical #4 rebar pins, or an acceptable equivalent long enough to extend through all four courses, shall be driven down through the bales, two in each bale, located so that they do not pass through the space between the ends of any two bales, the layout of these rebar pins shall approximate the layout of the rebar pins extending from the foundation. As each subsequent course is laid, two pins, long enough to extend through that course and the three courses immediately below it, shall be driven down through each bale. This pinning method shall be continued to the top of the wall. In walls seven or eight courses high, pinning at the fifth course may be eliminated.

4. Alternative pinning method to the method described in paragraph 3: when the third course has been laid, vertical #4 rebar pins, or an acceptable equivalent, long enough to

extend through all three courses, shall be driven down through the bales, tow in each bale, located so that they do not pass through the space between the ends of any two bales. The layout of these rebar pins shall approximate the layout of the rebar pins extending from the foundation. As each subsequent course is laid, two pins, long enough to extend through that course and the two courses immediately below it, shall be driven down through each bale. This pinning method shall be continued to the top of the wall.

5. Only full-length bales shall be used at corners of loadbearing bale walls.

6. Vertical #4 rebar pins, or an acceptable alternative, shall be located within one foot of all corners or door openings.

7. Staples, made of #3 or larger rebar formed into a "U" shape, a minimum of 18 inches long with two 6-inch legs, shall be used at all corners of every course, driven with one leg into the top of each abutting corner bale.

J. 1. All loadbearing bale walls shall have a roof bearing assembly at the top of the walls to bear the roof load and to provide the means of connecting the roof structure to the foundation. The roof bearing assembly shall be continuous along the tops of loadbearing bale walls.

2. An acceptable roof bearing assembly option shall consist of two double 2-inch by 6-inch, or larger, horizontal top plates, one located at the inner edge of the wall and the other at the outer edge. Connecting the two doubled top plates, and located horizontally and perpendicular to the length of the wall, shall be 2-inch by 6-inch cross members, spaced no more than 72 inches center to center, and as required to align with the threaded rods extending from the anchor bolts in the foundation. The double 2-inch by 6-inch top plates shall be face-nailed with 16d nails staggered at 16-inch o.c., with laps and intersections face-nailed with four 16d nails. The crossmembers shall be face-nailed to the top plates with four 16d nails at each end. Corner connections shall include overlaps nailed as above or an acceptable equivalent, such as plywood gussets or metal plates. Alternatives to this roof bearing assembly option shall provide equal or greater vertical rigidity and provide horizontal rigidity equivalent to a continuous double 2 by 4 top plate.

3. The connection of roof framing members to the roof plate shall comply with the appropriate sections of the California Building Standards Code.

K. All openings in loadbearing bale walls shall be a minimum of one full bale length from any outside corner, unless exceptions are approved by an engineer or architect licensed by the state to practice. Wall or roof load present above any openings shall be carried, or transferred, to the bales below by one of the following:

1. A frame, such as a structural window or door frame.

2. A lintel, such as an angle-iron cradle, wooden beam, or wooden box beam. Lintels shall be at least twice as long as the opening is wide and extend a minimum of 24 inches beyond either side of the opening. Lintels shall be centered over openings.

3. A roof bearing assembly designed to act as a rigid beam over the opening.

L. 1. All weather–exposed bale walls shall be protected from water damage. No vapor impermeable barrier may be used on bale walls, and the civil engineer or architect may design the bale walls without any membrane barriers between straw and plaster, except as specified in this section, in order to allow natural transpiration of moisture from the bales and to secure a structural bond between plaster and straw.

2. Bale walls shall have special moisture protection provided at all horizontal surfaces exposed to the weather. This moisture protection shall be installed in a manner that will prevent water from entering the wall system.

M. 1. Interior and exterior surfaces of bale walls shall be protected from mechanical damage, flame, animals, and prolonged exposure to water. Bale walls adjacent to bath and shower enclosures shall be protected by a moisture barrier.

2. Cement stucco shall be reinforced with galvanized woven wire stucco netting or an equivalent, as approved by the building official. The reinforcement shall be secured by attachment through the wall at a maximum spacing of 24 inches horizontally and 16 inches vertically, unless substantiated otherwise by a civil engineer or architect.

3. Where bales abut other materials, the plaster or stucco shall be reinforced with galvanized expanded metal lath, or an acceptable equivalent, extending a minimum of 6 inches into the bales.

4. Earthen and lime-based plasters may be applied directly onto bale walls without reinforcement, except where applied over materials other than straw.

N. 1. All wiring within or on bale walls shall meet all the provisions of the California Electrical Code. Type "NM" or "UF" cable may be used, or wiring may be run in metallic or nonmetallic conduit systems.

2. Electrical boxes shall be securely attached to wooden stakes driven a minimum of 12 inches into the bales, or an acceptable equivalent.

O. Water or gas pipes within bale walls shall be encased in a continuous pipe sleeve to prevent leakage within the wall. Where pipes are mounted on bale walls, they shall be isolated from the bales by a moisture barrier.

P. Bales shall be protected from rain and other moisture infiltration at all times until protected by the roof of the structure.

15.10.070 To the extent this chapter does not address certain phases of construction, the applicable provisions of this Title shall govern.

Section 5. Chapter 15.12 of the Lancaster Municipal Code is hereby amended by rewriting the Chapter in its entirety to read as follows:

CHAPTER 15.12
ELECTRICAL CODE

15.12.010 California Electrical Code Adopted by Reference.

A. That certain Electrical Code known and designated as the 2013 California Electrical Code, incorporating by adoption the National Electrical Code, 2011 Edition, by the National Fire Protection Association, with necessary California amendments, all published by BNi Publications, inc., and as herein amended, is hereby adopted by reference, and such code shall be and become the Lancaster Electrical Code, regulating the installation, arrangement, alteration, repair, maintenance, use and operation of electrical wiring, connections, fixtures, equipment and other electrical appliances.

B. One (1) copy of said 2013 California Electrical Code has been deposited in the Office of the City Clerk of the City of Lancaster and shall be at all times maintained by said Clerk for use and examination by the public.

15.12.020 Registered Maintenance Electricians.

A. In lieu of an individual permit for each installation or alteration, an annual permit may be issued to any person, firm or corporation regularly employing one or more registered maintenance electricians for the installation and maintenance of electrical wiring, devices, appliances, apparatus, or equipment or premises owned or occupied by the applicant for thc permit. The application for such annual permit shall be made in writing to the Building Official and shall contain a description of the premises upon which work is to be done under the permit. Within not more than fifteen (15) days following the end of each calendar month, the person, firm or corporation to which an annual permit is issued shall transmit to the Building Official a report of all electrical work which has been done under the annual permit during the preceding month. A fee specified in the Fee Schedule shall be paid for each annual registered maintenance electrician's permit at the time such permit is issued. In addition, fees shall be paid for all work installed under such a permit, in accordance with the fee schedule, at the time the work is inspected.

B. "Registered Maintenance Electrician" shall mean a person holding a valid Certificate of Registration as Maintenance Electrician issued by the County of Los Angeles.

15.12.030 Dangerous Electrical Equipment.
For the purpose of this chapter, any electrical equipment existing in any type of occupancy which has any or all of the conditions or defects described as follows shall be deemed dangerous, and such equipment shall be replaced, repaired, reinstalled, reconstructed or removed:

A. The service panel(s) or sub-panel(s) show visual evidence of an overload.

B. The working space in front of any service panel or sub-panel as outlined in table 110.26(A)(1) is not properly maintained.

C. Live front panels are being maintained or used.

D. The fuses or circuit breakers are rated higher than those permitted by the Electrical Code.

E. The electrical conductor is in an unapproved raceway.

F. The electrical conductors from different classes of service are in a common raceway.

G. Drop cords greater than six (6) feet in length are used to connect electrical appliances.

H. The electrical equipment is not properly grounded for the protection of the electrical equipment as determined by the use being made thereof.

I. The electrical equipment is broken, cracked, or not properly maintained to meet the standards existing at the time the equipment was approved.

J. The electrical equipment is unsafe for the use intended.

15.12.040 Solar Photovoltaic Systems.
Article 690 of the 2013 California Electrical Code is hereby amended by adding the following:

690.15.1 Disconnecting Means for Multiple Arrays
Where more than one array is combined to form a single output rated more than 50 volts and/or 10 amperes, a disconnecting means rated for the output shall be installed immediately adjacent to the combiner box on the output side.

Exception: *If the combiner box is located adjacent to the inverter(s), the disconnecting means as stated above shall not be required.*

Section 6. Chapter 15.16 of the Lancaster Municipal Code is hereby amended by rewriting the Chapter in its entirety to read as follows:

CHAPTER 15.16
MECHANICAL CODE

15.16.010 California Mechanical Code Adopted by Reference.
A. That certain Mechanical Code known and designated as the 2013 California Mechanical Code, incorporating by adoption the Uniform Mechanical Code, 2012 Edition, published by the International Association of Plumbing and Mechanical Officials, with necessary California amendments, is hereby adopted by reference, and shall be and become the Lancaster Mechanical Code regulating the design, construction, quality of materials, erection, installation, alteration, repair, location, relocation, replacement, addition to, use and maintenance of heating, ventilating, cooling, refrigeration systems, incinerators, and other miscellaneous heating ventilating, and air conditioning appliances on premises within the City of Lancaster.

B. One (1) copy of said 2013 California Mechanical Code has been deposited in the Office of the City Clerk of the City of Lancaster and shall be at all times maintained by said Clerk for use and examination by the public.

Section 7. Chapter 15.12 of the Lancaster Municipal Code is hereby amended by rewriting the Chapter in its entirety to read as follows:

CHAPTER 15.20
PLUMBING CODE

15.20.010 California Plumbing Code Adopted by Reference.
A. That certain Plumbing Code known and designated as the 2013 California Plumbing Code, incorporating by adoption the Uniform Plumbing Code, 2012 Edition, published by the International Association of Plumbing and Mechanical Officials, including appendices A, B, D, G, I, K and L with necessary California amendments, and as herein amended, is hereby adopted by reference, and such code shall be and become the Lancaster Plumbing Code regulating plumbing, drainage, building sewers, and private sewage disposal systems and prescribing conditions under which such work may be carried on within the City of Lancaster and providing for the issuance of permits.

B. One (1) copy of said 2013 California Plumbing Code has been deposited in the office of the City Clerk of the City of Lancaster and shall be at all times maintained by said Clerk for use and examination by the public.

15.20.020 Minimum Number of Required Fixtures.
Section 412.1 of the 2013 California Plumbing Code is hereby amended to read as follows:

412.1 Fixture Count. Plumbing fixtures shall be provided for the type of building occupancy and in the minimum number shown in Table 4-1 or *Table 2902.1 of the 2012 International Building Code.*

15.20.030 Gray Water Systems.

State Chapter Appendix G Section G 3, Permit, is hereby amended by deleting the paragraph and substituting the following:

G 3 Permit

It shall be unlawful for any person to construct, install or alter, or cause to be constructed, installed or altered any gray water system in a building or on a premises without first obtaining a permit to do such work from the *Division of Building and Safety. The cost of such permit shall be equal to that required for private sewage disposal system as provided by resolution of the City Council. A plan check fee shall also be required for each application for a permit. The plan check fee shall be equal to the permit fee.*

15.20.040 General Registration Requirements.

A. Except as provided in Section 15.20.060 no person shall direct or perform any plumbing or gas fitting work unless, either he or she is a registered plumbing or gas fitting contractor or registered journeyman plumber or gas fitter registered by the County of Los Angeles.

B. There shall be no more than two (2) apprentices per journeyman plumber or gas fitter on a project at any time. There shall be no limit on the number of laborers per journeyman plumber or gas fitter on any project.

15.20.050 Issuance of Permits.

A. No permit shall be issued to any person to do or cause to be done any plumbing work regulated by this code unless such person is a duly licensed contractor as required by Chapter 9, Division 3 commencing with Section 7000 of the Business and Professions Code of the State of California except as otherwise provided herein.

B. Any permit required by this code may be issued to a person to do any plumbing work regulated by this code in a single-family dwelling used exclusively for living purposes, including common accessory and minor poultry or agricultural buildings in the event that such person is the bona fide owner of such dwelling and accessory buildings and that the same are occupied and used exclusively by or are designated to be occupied and used exclusively by said owner. An owner may be issued a permit for, or perform any plumbing work covered by this code on a duplex (Max. two units) where one unit is used and occupied exclusively by the bona fide owner. An owner or property manager shall not be issued a permit for, or perform any plumbing work regulated by this code on any rental or lease property except for a duplex (Max. two units) where one unit is exclusively used and occupied by the bona fide owner.

Section 8. Chapter 15.22 of the Lancaster Municipal Code is hereby amended by rewriting the Chapter in its entirety to read as follows:

CHAPTER 15.22
SECURITY CODE

15.22.010 **Purpose**
The purpose of this chapter is to set forth minimum standards of construction for resistance to unlawful entry.

15.22.020 **Scope**
The provisions of this chapter shall apply to enclosed Groups B, F, M, R and S occupancies and enclosed private garages.

15.22.030 **Limitations**
No provisions of this chapter shall require or be construed to require devices on exit doors or on sleeping room emergency exits contrary to the requirements specified in Chapter 10 and Section 310.4 of the California Building Code.

15.22.040 **Alternate Security Provisions**
The provisions of this chapter are not intended to prevent the use of any device or method of construction not specifically prescribed by this code when such alternate provides equivalent security based on a recommendation of the county sheriff or the City Public Safety Office.

15.22.050 **Definitions**
For the purpose of this chapter, certain terms are defined as follows:

"Cylinder Guard" is a protective metal device of hardened steel, or with a hardened steel insert, that covers or surrounds the exposed portion of the lock cylinder for the purpose of protecting the cylinder from wrenching, prying, cutting, driving through or pulling out by attack tools.

"Deadbolt" is a bolt which has no automatic spring action and which is operated by a key cylinder, thumb-turn or lever, and is positively held fast when in the projected position.

"Deadlocking Latch" is a latch in which the latch bolt is positively held in the projected position by a guard bolt, plunger or auxiliary mechanism.

"Latch" is a device for automatically retaining the door in a closed position upon its closing.

15.22.060 **Tests: Sliding Glass Doors**
Panels shall be closed and locked. Tests shall be performed in the following order:

15.22.061 **Test A.** With the panels in the normal position, a concentrated load of 300 pounds shall be applied separately to each vertical pull stile incorporating a locking device, at a point or the stile within 6 inches (152.4 mm) of the locking device, in the direction parallel to the plane of glass that would tend to open the door.

15.22.062 **Test B.** Repeat Test A while simultaneously adding a concentrated load of 150 pound to the same area of the same stile in a direction perpendicular to the plane of glass toward the interior side of the door.

15.22.063 **Test** C. Repeat Test B with the 150-pound (667.2 N) force in the reversed direction toward the exterior side of the door.

15.22.064 **Tests D, E and F.** Repeat Tests A, B and C with the movable panel lifted upwards to its full limit within the confines of the door frame.

15.22.065 **Identification** Sliding glass door assemblages subject to the provisions of this section shall bear a label or other approved means of identification indicating compliance with these tests. The label shall be a type authorized through a recognized testing agency which provides periodic follow-up inspection service.

15.22.070 **Tests: Sliding Glass Windows**
Sash shall be closed and locked. Tests shall be performed in the following order:

15.22.071 **Test A.** With the sliding sash in the normal position, a concentrated load of 150 pounds shall be applied separately to each sash member incorporating a locking device, at a point on the sash member within 6 inches (152.4 mm) of the locking device, in the direction parallel to the plane of glass that would tend to open the window.

15.22.072 **Test B**. Repeat Test A while simultaneously adding a concentrated load of 75 pounds to the same area of the same sash member in the direction perpendicular to the plane of glass toward the interior side of the window.

15.22.073 **Test C.** Repeat Test B with the 75 pounds of force in the reversed direction toward the exterior side of the window.

15.22.074 **Tests D, E and R** Repeat Tests A, B and C with the movable sash lifted upwards to its full limit within the confines of the window frame.

15.22.075 **Identification.** Sliding glass window assemblages subject to the provisions of this section shall bear a label or other approved means of identification indicating compliance with these tests. The label shall be a type authorized through a recognized testing agency which provides periodic follow up inspection service.

15.22.080 **Doors: General**
A door forming a part of the enclosure of a dwelling unit or of an area occupied by one tenant of a building shall be constructed, installed, and secured as set forth in Sections 15.22.090, 15.22.110 and 15.22.120, when such door is directly reachable or capable of being reached from a street, highway, yard, court, passageway, corridor, balcony, patio, breezeway, private garage, portion of the building which is available for use by the public or other tenants, or similar area. A

door enclosing a private garage with an interior opening leading directly to a dwelling unit shall also comply with said Sections 15.22.090, 15.22.100, 15.22.110 and 15.22.120.

15.22.090 **Doors: Swinging Doors**

15.22.091 Swinging wooden doors which are operable from the inside without the use of a key shall be of one of the following constructions or shall be of a construction having equivalent forced entry resistance:

15.22.091.1 Solid core doors not less than 1 3/8 inches (35 mm) in thickness.

15.22.091.2 Wood panel type doors with panels fabricated of lumber not less than 1 3/8 inches (34.9mm) thick, provided shaped portions of the panels are not less than 1/4 inch (6.4 mm) thick. Individual panels shall not exceed 300 square inches (0.19 m^2) in area. Stiles and rails shall be of solid umber with overall dimensions of not less than 1 3/8 inches (35 mm) in thickness and 3 inches (76mm) in width. Mullions shall be considered a part of adjacent panels unless sized as required here in for stiles and rails, except mullions not over 18 inches (457 mm) long may have an overall width of not less than 2 inches (51 mm). Carved areas shall have a thickness of not less than 3/8inch (9.5 mm). Dimensional tolerances published in recognized industry standards may be utilized.

15.22.091.3 Hollow core doors or doors less than 1 3/8 inches (35 mm) in thickness, either of which are covered on the inside face with 16-gauge sheet metal attached with screws at 6 inches (152mm) maximum centers around the perimeter. Lights in doors shall be as set forth in Sections 15.22.140 and 15.22.150.

15.22.092 A single swinging door, the active leaf of a pair of doors, and the bottom leaf of dutch doors shall be equipped with a deadbolt and a latch. A dead latch shall be used if a key locking feature is incorporated in the latching mechanism. The deadbolt and latch may be activated by one lock or by individual locks. Deadbolts shall contain hardened inserts, or the equivalent, so as to repel cutting tool attack. The deadbolt lock or locks shall be key operated from the exterior side of the door and engaged or disengaged from the interior side of the door by a device not requiring a key, tool or excessive force.

EXCEPTIONS:

1. The latch may be omitted from doors in Group B occupancies.
2. In other than residential occupancies, locks maybe key operated, or otherwise operated from the inside when not prohibited by Chapter 10 of the California Building Code or other laws and regulations.
3. A swinging door of greater than 5 feet (1524 mm) width may be secured as set forth in Section 15.22.110.
4. In residential occupancies, doors not required by Section 310.4 or 1004.1 of the California Building Code may be equipped with security type hardware which requires a key to release from the interior side of the door if the sleeping rooms are protected with a fire warning system as set forth in Section 310.9 of the California Building Code.

A straight deadbolt shall have a minimum throw of 1 inch (25.4 mm) and the embedment shall not be less than 5/8 inch (15.9 mm) into the holding device receiving the projected bolt. A hook shape or expanding lug deadbolt shall have a minimum throw of 3/4 inch (19 mm) All deadbolts of locks which automatically activate two or more deadbolts shall embed at least 1/2 inch (12.7 mm), but need not exceed 3/4 inch (19 mm), into the holding devices receiving the projected bolts.

15.22.093 The inactive leaf of a pair of doors and the upper leaf of Dutch doors shall be equipped with a deadbolt or deadbolts as set forth in Section 6709.2.

EXCEPTIONS:

1. The bolt or bolts need not be key operated, but shall not be otherwise activated, from the exterior side of the door.
2. The bolt or bolts may be engaged or disengaged automatically with the deadbolt or by another device on the active leaf or lower leaf.
3. Manually operated hardened bolts that are at the top and bottom of the leaf and which embed a minimum of 1/2 inch (12.7 mm) into the device receiving the projected bolt may be used when not prohibited by Chapter10 or other laws and regulations.

15.22.094 Doorstops on wooden jambs for in swinging doors shall be of one-piece construction with the jamb or joined by a rabbet.

15.22.095 Non removable pins shall be used in pin type hinges which are accessible from the outside when the door is closed.

15.22.096 Cylinder guards shall be installed on cylinder locks for deadbolts whenever the cylinder projects beyond the outside face of the door or is otherwise accessible to attack tools.

15.22.100 **Doors: Sliding Glass Doors**

Sliding glass doors shall be equipped with locking devices and shall be so installed that, when subjected to tests specified in Section 15.22.060, they remain intact and engaged. Movable panels shall not be rendered easily openable or removable from the frame during or after the tests. Cylinder guards shall be installed on all mortise or rim type cylinder locks installed in hollow metal doors whenever the cylinder projects beyond the face of the door or is otherwise accessible to gripping tools. Locking devices installed on sliding glass doors providing the exit required by Section 1003 or providing for the emergency escape or rescue required by Section 310.4 shall be releasable from the inside without the use of a key, tool or excessive force.

15.22.110 **Doors: Overhead and Sliding Doors**

Metal or wooden overhead and sliding doors shall be secured with a deadbolt lock, padlock with a hardened steel shackle, or equivalent when not otherwise locked by electric power operation. Locking devices, when installed at the jamb of metal or wooden overhead doors, shall be installed on both jambs when such doors exceed 9 feet (2743 mm) in width. Metal or wooden sliding doors exceeding 9 feet (2743 mm) in width and provided with a jam blocking device shall have the door side opposite the lock restrained by a guide or retainer. Cylinder guards shall be installed on all mortise or rim type cylinder locks installed in hollow metal doors whenever the cylinder projects beyond the face of the door or is otherwise accessible to gripping tools.

15.22.120 **Doors: Metal Accordion Grate or Grille-Type Doors**
Metal accordion grate or grille type doors shall be equipped with metal guides at top and bottom, and a cylinder lock or padlock and hardened steel shackle shall be provided. Cylinder guards shall be installed on all mortise or rim type cylinder locks installed in hollow metal doors whenever the cylinder projects beyond the face of the door or is otherwise accessible to gripping tools.

15.22.130 **Lights: General**
A window, skylight or other light forming a part of the enclosure of a dwelling unit or of an area occupied by one tenant of a building shall be constructed, installed and secured as set forth in Sections 15.22.140 and 15.22.150, when the bottom of such window, skylight or light is not more than 16 feet (4877 mm) above the grade of a street, highway, yard, court, passageway, corridor, balcony, patio, breezeway private garage, portion of the building which is available for use by the public or other tenants, or similar area. A window enclosing a private garage with an interior opening leading directly to a dwelling unit shall also comply with Sections 15.22.140 and 15.22.150.

15.22.140 **Lights: Material**
Lights within 40 inches (1016 mm) of a required locking device on a door when in the closed and locked position and openable from the inside without the use of a key, and lights with a least dimension greater than 6 inches (152 mm) but less than 48 inches (1219 mm) in Groups B, F, M and S occupancies, shall be fully tempered glass, laminated glass of at least 1/4 inch (6.4 mm) thickness, approved burglary resistant material, or guarded by metal bars, screens or grilles in an approved manner.

15.22.150 **Lights: Locking Devices**

15.22.151 Locking devices installed on windows providing the emergency egress required by Section 310.4 shall be releasable from the inside without use of a key, tool or excessive force.

15.22.152 Sliding glass windows shall be provided with locking devices that, when subject to the tests specified in Section 15.22.070, remain intact and engaged. Movable panels shall not be rendered easily openable or removable from the frame during or after the tests.

15.22.153 Other openable windows shall be provided with substantial locking devices which render the building as secure as the devices required by this section. In Groups B, F, M and S occupancies, such devices shall be a glide bar, bolt, cross bar, and/or padlock with hardened steel shackle.

15.22.154 Special. Louvered windows, except those above the first story in Group R occupancies which cannot be reached without a ladder, shall be of material or guarded as specified in Section 15.22.140, and individual panes shall be securely fastened by mechanical fasteners that require a tool for removal and are not accessible on the outside when the window is in the closed position.

15.22.160 **Other Openings: General**
Openings, other than doors or lights, which form a part of the enclosure, or portion thereof, housing a single occupant, and the bottom of which is not more than 16 feet (4877 mm) above the grade of a street, highway, yard, court, passageway, corridor, balcony, patio, breezeway or similar area, or from a private garage, or from a portion of the building which is occupied, used or available for use by the public or other tenants, or an opening enclosing a private garage attached to a dwelling unit with openings therein, shall be constructed, installed and secured as set forth in Section 15.22.170.

15.22.170 **Hatchways, Scuttles and Similar Openings**

15.22.171 Wooden hatchways of less than 1 3/4-inch-thick (44 mm) solid wood shall be covered on the inside with 16-gage sheet metal attached with screws at 6-inch-maximum (152 mm) centers around perimeter.

15.22.172 The hatchway shall be secured from the inside with a slide bar, slide bolt, and/or padlock with a hardened steel shackle.

15.22.173 Outside pin type hinges shall be provided with non removable pins or a means by which the door cannot be opened through removal of hinge pins while the door is in the closed position.

15.22.174 **Other** openings exceeding 96 square inches (0.062 m^2) with a least dimension exceeding 8 inches (203 mm) shall be secured by metal bars, screens or grilles in an approved manner.

Section 9. Chapter 15.24 of the Lancaster Municipal Code is hereby amended by rewriting the Chapter in its entirety to read as follows:

CHAPTER 15.24
PROPERTY MAINTENANCE CODE

15.24.010 International Property Maintenance Code Provisions Adopted by Reference.
A. That certain Property Maintenance Code known and designated as of the 2012 International Property Maintenance Code, including Appendix A, published by the International Conference of Building Officials, as herein amended, is hereby adopted by reference, and such codes shall be and become the International Property Maintenance Code of Lancaster, regulating the use and maintenance of all existing structures, premises and certain equipment therein, and providing penalties for violation of such codes.

B. One (1) copy of said 2012 Property Maintenance Code has been deposited in the office of the City Clerk of the City of Lancaster and shall be at all times maintained by said Clerk for use and examination by the public.

15.24.020 Title
Section 101.1 of the International Property Maintenance Code is hereby amended to read as follows:

101.1 Title. These regulations shall be known as the *International Property Maintenance Code of Lancaster*, hereinafter referred to as "this code."

15.24.030 Application of Other Codes
Section 102.3 of the International Property Maintenance Code is hereby amended to read as follows:

102.3 Application of other codes. Repairs, additions or alterations of a structure, or changes of occupancy, shall be done in accordance with the procedures and provisions of the *Lancaster Building Code, Lancaster Energy Code, Lancaster Fire Code, Lancaster Zoning Code, Lancaster Plumbing Code, Lancaster Mechanical Code and Lancaster Electrical Code.*

15.24.040 Fees.
Section 103.5 of the International Property Maintenance Code is hereby amended to read as follows:

103.5 Fees. The fees for activities and services performed by the department in carrying out its responsibilities under this code shall be paid as required, in accordance with the schedule as adopted by resolution of the City Council of the City of Lancaster.

15.24.050 Duties and Powers of the Code Official.
Section 104 of the International Property Maintenance Code is hereby amended by adding subsection 104.7, to read as follows:

104.7 Regulations. The code official is authorized to promulgate rules and regulations to implement the provisions of this code.

15.24.060 Violations.
Section 106 of the International Property Maintenance Code is hereby deleted in its entirety and replaced with the following:

106 Violations. It is unlawful for any person to violate any provision or to fail to comply with any requirement of this code. Any person violating this code is subject to the penalty, administrative and abatement provisions set forth in Chapters 1.12, 1.16 and 8.28 of the Lancaster Municipal Code.

15.24.070 Notices and Orders

Section 107 of the International Property Maintenance Code is hereby deleted in its entirety and replaced with the following:

107 Notices and orders. Whenever the code official determines that there has been a violation of this code or has grounds to believe that a violation has occurred, he/she may give notice in a manner that comports with the Lancaster Administrative Code, Lancaster Dangerous Buildings Code, other applicable provisions of the Lancaster Municipal Code, and/or the State Housing Law (commencing with Section 17910 of the California Health & Safety Code).

15.24.080 Terms Defined in Other Codes.
Section 201.3 of the International Property Maintenance Code is hereby amended to read as follows:

201.3 Terms defined in other codes. Where terms are not defined in this code and are defined in the *Lancaster Building Code, Lancaster Fire Code, Lancaster Zoning Code, Lancaster Plumbing Code, Lancaster Mechanical Code or Lancaster Electrical Code,* such terms shall have the meanings ascribed to them as stated in those codes.

15.24.090 Definitions.
Section 201.6 of the International Property Maintenance Code is hereby added to read as follows:

201.6 Definitions. Whenever any of the names or terms defined in this section is used in this Code, each such name or term shall be deemed and construed to have the meaning ascribed to be in this section as follows:

"Building Code" shall mean chapter 15.08 of the Lancaster Municipal Code.

"Code Official" shall mean the Building and Safety Official of the City of Lancaster.

"Electrical Code" shall mean Chapter 15.12 of the Lancaster Municipal Code.

“Elevator Code” shall mean the 2013 California Elevator Safety Construction Code.

"Energy Code" shall mean Chapter 15.28 of the Lancaster Municipal Code.

“Fire Code” shall mean Chapter 15.32 of the Lancaster Municipal Code.

“Green Building Standards Code” shall mean Chapter 15.34 of the Lancaster Municipal Code.

“Historical Building Code” shall mean Chapter 15.30 of the Lancaster Municipal Code.

"Jurisdiction" shall mean the City of Lancaster.

"Mechanical Code" shall mean Chapter 15.16 of the Lancaster Municipal Code.

"Plumbing Code" shall mean Chapter 15.20 of the Lancaster Municipal Code.

"Property Maintenance Code" shall mean Chapter 15.24 of the Lancaster Municipal Code.

"Residential Code" shall mean Chapter 15.09 of the Lancaster Municipal Code.

"Technical Codes" shall mean Chapters 15.08, 15.09, 15.10, 15.12, 15.16, 15.20, 15.22, 15.24, 15.28, 15.30, 15.32 and 15.34 of the Lancaster Municipal Code.

15.24.100 General.
Section 202 of the International Property Maintenance Code is hereby amended by amending the definitions of "Owner" and "Person" and by adding the definition of "Responsible Person," as follows:

202 General definitions.
Owner. Any person having legal title to, or who leases, rents, occupies or has charge, control or possession of, any real property in the city, and/or the personal property thereon, including all persons shown as owners on the last equalized assessment roll of the Los Angeles County Assessor's Office. Owners include persons with powers of attorney, executors of estates, trustees, or who are court appointed administrators, conservators, guardians or receivers.

Person. Any individual, partnership of any kind, corporation, limited liability company, association, joint venture or other organization or entity, however formed, as well as trustees, heirs, executors, administrators or assigns, or any combination of such persons. "Person" also includes any public entity or agency that acts as an owner in the city.

Responsible Person. Any person, whether as an owner as defined herein, or otherwise, that allows, causes, creates, maintains or permits a violation of this code, by any act or the omission of any act or duty. The actions or inactions of a responsible person's agent, employee, representative or contractor may be attributed to that responsible person.

15.24.110 Weeds.
Section 302.4 of the International Property Maintenance Code is hereby amended to read as follows:

302.4 Weeds. All premises and exterior property shall be maintained free from weeds or plant growth in excess of six (6) inches. All noxious weeks shall be prohibited. Weeds shall be defined as all grasses, annual plans and vegetation, other than trees or shrubs; however, this term shall not include cultivated flowers, fruits and/or vegetables.

15.24.120 Insect Screens.
Section 304.14 of the International Property Maintenance Code is hereby amended to read as follows:

304.14 Insect screens. Every door, window and other outside opening required for ventilation of habitable rooms, food preparation areas, food service areas or any areas where products to be included or utilized in food for human consumption are processed, manufactured, packaged or stored shall be supplied with approved tightly fitting screens of minimum 16 mesh per inch (16 mesh per 25 mm), and every screen door used for insect control shall have a self-closing device in good working condition.

Exception: Screens shall not be required where other approved means, such as air curtains or insect repellent fans, are employed.

15.24.130 Heating and Air Conditioning Facilities.
Section 602 of the International Property Maintenance Code is hereby amended to read as follows:

602 Heating and Air Conditioning Facilities

15.24.140 Facilities Required.
Section 602.1 of the International Property Maintenance Code is hereby amended to read as follows:

602.1 Facilities required. Heating and air conditioning facilities shall be provided in structures as required by this section.

15.24.150 Residential Occupancies.
Section 602.2.1 of the International Property Maintenance Code is hereby added as follows:

602.2.1 Residential occupancies. Dwellings shall be provided with air conditioning facilities at all times, capable of maintaining a maximum room temperature of 80°F in all habitable rooms.

15.24.160 Heat and Air Conditioning Supply
Section 602.3 of the International Property Maintenance Code is hereby amended to read as follows:

602.3 Heat supply. Every owner and operator of any building who rents, leases or lets one or more dwelling units or sleeping units shall supply heat at all times to maintain a minimum temperature of 68° F (20° C) in all habitable rooms, bathrooms and toilet rooms.

15.24.170
Section 602.3.1 of the International Property Maintenance Code is hereby added as follows:

602.3.1 Air conditioning supply. Every owner and operator of any building who rents, leases or lets one or more dwelling units or sleeping units shall supply air conditioning at all times, to maintain a maximum temperature of 80° F in all habitable rooms,

15.24.180 Occupiable Work Spaces.

Section 602.4 of the International Property Maintenance Code is hereby amended to read as follows:

602.4 Occupiable work spaces. Indoor occupiable work spaces shall be supplied with heat at all times to maintain a minimum temperature of 65° F (18° C) during the period the spaces are occupied.

Exceptions:

1. Processing, storage and operation areas that require cooling or special temperature conditions.
2. Areas in which persons are primarily engaged in vigorous physical activities.

Section 15, 24.190 Mechanical Equipment
Section 603.1 of the International Property Maintenance Code is hereby amended to read as follows:

603.1 Mechanical appliances All mechanical appliances, fireplaces, evaporative coolers, solid fuel-burning appliances, cooking appliances and water heating appliances shall be properly installed and maintained in a safe working condition, and shall be capable of performing the intended function.

Section 10. Chapter 15.26 of the Lancaster Municipal Code is hereby amended by rewriting the Chapter in its entirety to read as follows:

CHAPTER 15.26
DANGEROUS BUILDINGS CODE

15.26.010 Abatement of Dangerous Buildings Adopted by Reference.
A. That certain Dangerous Buildings Code known and designated as the
Uniform Code for the Abatement of Dangerous Buildings, 1997 Edition,
published by the International Conference of Building Officials, as hcrcin amended, is hereby adopted by reference, and such code shall be and become the Lancaster Dangerous Buildings Code regulating the repair, vacation, or demolition of buildings or structures which from any cause endanger the life, limb, health, morals, property, safety or welfare of the general public or the occupants or such building or structure. Said code shall be cumulative with and in addition to any other remedy or provision of the Lancaster Municipal Code, and where any provisions of this code conflict with any other provision of the Lancaster Municipal Code, the most restrictive or the provision that provides greater safety shall apply.

B. One (1) copy of said Uniform Code for the Abatement of Dangerous Buildings 1997 Edition has been deposited in the Office of the City Clerk of the City of Lancaster and shall be at all times maintained by said Clerk for use and examination by the public.

15.26.020 Appeals.
Section 205 Board of Appeals, of the Uniform Code for the Abatement of Dangerous Buildings is hereby deleted in its entirety and replaced with the following:

205 Appeals. Appeals shall be filed, scheduled and conducted in the manner set forth in Chapter 15.04 of the Lancaster Municipal Code.

15.26.030 Definitions.
Section 301 of the Uniform Code for the Abatement of Dangerous Buildings is hereby deleted in its entirety and replaced with the following:

301-- General. Whenever any of the names or terms defined in this section is used in this Code, each such name or term shall be deemed and construed to have the meaning ascribed to be in this section as follows:

"Building Code" shall mean chapter 15.08 of the Lancaster Municipal Code.

"Building Official" shall mean the Building and Safety Official of the City of Lancaster.

"Code Enforcement Agency" or "Local Building Department" shall mean the Building and Safety Division of the Department of Public Works of the City of Lancaster.

"Electrical Code" shall mean Chapter 15.12 of the Lancaster Municipal Code.

"Elevator Code" shall mean the 2013 California Elevator Safety Construction Code.

"Energy Code" shall mean Chapter 15.28 of the Lancaster Municipal Code.

"Fire Code" shall mean Chapter 15.32 of the Lancaster Municipal Code.

"Green Building Standards Code" shall mean Chapter 15.34 of the Lancaster Municipal Code.

"Historical Building Code" shall mean Chapter 15.30 of the Lancaster Municipal Code.

"Jurisdiction" shall mean the City of Lancaster.

"Mechanical Code" shall mean Chapter 15.16 of the Lancaster Municipal Code.

"Plumbing Code" shall mean Chapter 15.20 of the Lancaster Municipal Code.

"Property Maintenance Code" shall mean Chapter 15.24 of the Lancaster Municipal Code.

"Residential Code" shall mean Chapter 15.09 of the Lancaster Municipal Code.

"Technical Codes" shall mean Chapters 15.08, 15.09, 15.10, 15.12, 15.16, 15.20, 15.22, 15.24, 15.28, 15.30, 15.32 and 15.34 of the Lancaster Municipal Code.

15.26.040 Terms Defined in Other Codes.
Section 301.1 of the Uniform Code for the Abatement of Dangerous Buildings is hereby added to read as follows:

301.1 Terms defined in other codes. Where terms are not defined in this code and are defined in the *Lancaster Building Code, Lancaster Fire Code, Lancaster Zoning Code, Lancaster Plumbing Code, Lancaster Mechanical Code or Lancaster Electrical Code,* such terms shall have the meanings ascribed to them as stated in those codes.

Section 11. Chapter 15.28 of the Lancaster Municipal Code is hereby amended by rewriting the Chapter in its entirety to read as follows:

CHAPTER 15.28
ENERGY CODE

15.28.010 California Energy Code Provisions Adopted by Reference.

A. That certain Energy Code known as the 2013 California Energy Code, including Appendix 1-A, published by the International Conference of Building Officials, is hereby adopted by reference, and such code shall be and become the Lancaster Energy Code, regulating the construction, enlargement, alteration, repair, moving, conversion, use, occupancy and maintenance of all structures and certain equipment therein and providing penalties for violation of such codes.

B. One (1) copy of said 2013 California Energy Code has been deposited in the office of the City Clerk of the City of Lancaster and shall be at all times maintained by said Clerk for use and examination by the public.

15.28.020 Implementation of Solar Energy Systems

Subchapter 2 of the California Energy Code is hereby amended by adding Section 110.11 to read as follows:

SECTION 110.11
MANDATORY REQUIREMENTS FOR THE IMPLEMENTATION OF SOLAR ENERGY SYSTEMS

(a) Purpose and intent. It is the purpose and intent of this section to provide standards and procedures for builders of new dwelling units to install solar energy systems in an effort to achieve energy savings and greater usage of alternative energy. It is intended that each dwelling unit owner or tenant shall be the beneficiary of achieved energy savings.

(b) Applicability. These specific standards are applicable for all new dwelling units with a building permit issuance date on or after January 1, 2014.

Exception: Accessory dwelling units.

(c) Provision of solar energy systems.

1. A builder shall provide solar energy systems for new homes in accordance with the energy generation requirements as listed in Section 17.08.060 of the Lancaster Municipal Code. It is intended that no individual installed system shall produce less than 1.0 kW.

2. Installation of solar energy systems is not required for all homes within a production subdivision; however, the builder shall meet the aggregate energy generation requirement within the subdivision (as calculated by the per-unit energy generation requirement multiplied by the number of homes in the subdivision). For example, an R-7000 subdivision with ten (10) homes that is required to provide 1.0 kW per unit would have an aggregate energy generation requirement of 10 kW for the subdivision. The 10 kW energy generation requirement can be met with two homes having solar energy systems generation 5 kW each, or with four homes having systems generating 2.5 kW each.

3. Homebuilders shall demonstrate through building plan check their intention to meet the solar energy generation requirement.

4. Homebuilders shall build solar energy systems on model homes, reflective of the products that will be offered to homebuyers.

5. If a tract is built in phases, the solar energy generation requirement shall be fulfilled for each phase, or release of homes.

6. Solar energy systems shall meet the development standards and guidelines as described in the Lancaster Zoning Code.

7. Solar energy systems for multi-family developments may be provided on rooftops, or on solar support/shade structures.

(d) Alternative methods of compliance. If site-specific situations make it impractical for a developer to meet the requirements of this section, the developer may propose an alternative method of compliance with the intent of this section. An alternative method of compliance shall be approved where the building official finds that the proposed alternative is satisfactory and complies with the intent of the provisions of this section.

Section 12. Chapter 15.30 of the Lancaster Municipal Code is hereby created by adding the Chapter in its entirety to read as follows:

CHAPTER 15.30
HISTORICAL BUILDING CODE

15.30.010 California Historical Building Code Provisions Adopted by Reference.
A. That certain Historical Building Code known and designated as the 2013 California Historical Building Code, published by the International Conference of Building Officials, is hereby adopted by reference, and such code shall be and become the Lancaster Historical Building Code, regulating the enlargement, alteration, repair, moving, removal, demolition, conversion, occupancy, use, height, area and maintenance of all qualified historical structures and certain equipment therein and providing penalties for violation of such codes.

B. One (1) copy of said California Historical Building Code 2013 Edition has been deposited in the Office of the City Clerk of the City of Lancaster, and shall be at all times maintained by said Clerk for use and examination by the public.

Section 13. Chapter 15.32 of the Lancaster Municipal Code is hereby amended by rewriting the Chapter in its entirety to read as follows:

CHAPTER 15.32
FIRE CODE

15.32.10 Los Angeles County Fire Code Adopted by Reference.
A. That certain Fire Code known and designated as the 2014 County of Los Angeles Fire Code, incorporating by adoption the 2013 California Building Code, including Appendix B of the California Fire Code, Appendix C of the California Fire Code, Appendix J of the 2013 California Fire Code, Appendix K, and Appendix L, all published by the International Conference of Building Officials, as herein amended, is hereby adopted by reference and such code shall be and become the Lancaster Fire Code which prescribes regulations governing conditions hazardous to life and property from fire or explosion within the City of Lancaster.

B. One (1) copy of said County of Los Angeles Fire Code 2014 Edition has been deposited in the Office of the City Clerk of the City of Lancaster, and shall be at all times maintained by said Clerk for use and examination by the public.

15.32.020 Board of Appeals
Section 103.1.4 of the Los Angeles County Fire Code, Appeals, is hereby deleted in its entirety and replaced with the following:

103.1.4 Appeals. Appeals shall be filed, scheduled and conducted in the manner set forth in Chapter 15.04 of the Lancaster Municipal Code.

15.32.030 Definitions and Abbreviations
Article 2 of the Los Angeles County Fire Code, Definitions and Abbreviations, is hereby added or amended to whenever any of the names or terms defined in this section are used in this Code, and each such name or term shall be deemed and construed to have the meaning ascribed to be in this section as follows:

"Building Code" shall mean chapter 15.08 of the Lancaster Municipal Code.

"Building Official" shall mean the Building and Safety Official of the City of Lancaster.

"Garage" is a building or portion thereof in which a motor vehicle containing flammable or combustible liquids or gas in its tank or an electric vehicle with a rechargeable storage battery, fuel cell, photovoltaic array, or other sources of electric current is stored, repaired, charged (electric vehicle only) or kept.

"Garage, Private" is a building or portion of a building not more than 1,000 square feet in area in which a motor vehicle containing flammable or combustible liquids or gas in its tank or an electric vehicle with a rechargeable storage battery, fuel cell, photovoltaic array, or other sources of electric current is stored, repaired, charged (electric vehicle only) or kept.

"Governing Body" shall mean Lancaster City Council.

"Jurisdiction" shall mean the City of Lancaster.

"Mechanical Code" shall mean chapter 15.16 of the Lancaster Municipal Code.

"Plumbing Code" shall mean chapter 15.20 of the Lancaster Municipal Code.

15.32.040 Obstruction of fire apparatus access roads.
Section 503.4 shall read as published in the 2013 California Fire Code without Los Angeles County amendments.

15.32.050 Traffic calming devices.
Section 503.4.1 shall be deleted in its entirety.

Section 14. Chapter 15.34 of the Lancaster Municipal Code is hereby created by adding the Chapter in its entirety to read as follows:

CHAPTER 15.34
GREEN BUILDING STANDARDS CODE

15.34.010 California Green Building Standards Code Provisions Adopted by Reference.
A. That certain Green Building Standards Code known and designated as the 2013 California Green Building Standards Code, published by the International Conference of Building Officials, is hereby adopted by reference, and such codes shall be and become the Lancaster Green Building Standards Code, regulating the erection, construction, enlargement, alteration, repair, moving, removal, demolition, conversion, occupancy, use, height, area and maintenance of all structures and certain equipment therein and providing penalties for violation of such codes.

B. One (1) copy of said California Green Building Standards Code 2013 Edition has been deposited in the Office of the City Clerk of the City of Lancaster, and shall be at all times maintained by said Clerk for use and examination by the public.

Section 15. Finding - Necessity. Findings made pursuant to Section 17958.7 of the State Health and Safety Codes are contained in Resolution No.13-XXX.

Section 16. Constitutionality. That if any section, subsection, sentence, clause or phrase of this ordinance is, for any reason, held to be unconstitutional, such decision shall not affect the validity of the remaining portions of this ordinance. The City Council hereby declares that it would have adopted this ordinance, and each section, subsection, clause or phrase thereof, irrespective of the fact that any one (1) or more sections, subsections, sentences, clauses and phrases be declared unconstitutional.

Section 17. Effective Date. This ordinance shall be in full force and effect on January 1, 2014.

Section 18. Posting. The City Clerk shall certify to the passage of this ordinance and shall cause it to be published according to legal requirements.

I, Geri K. Bryan, CMC, City Clerk of the City of Lancaster, do hereby certify that the foregoing ordinance was regularly introduced and placed upon its first reading on the _____day of __________, _______, and placed upon its second reading and adoption at a regular meeting of the City Council on the ______day of__________, _______ by the following vote:

AYES:

NOES:

ABSTAIN:

ABSENT:

ATTEST: APPROVED:

______________________________ ______________________________

GERI K. BRYAN, CMC
City Clerk
City of Lancaster

R. REX PARRIS
Mayor
City of Lancaster

STATE OF CALIFORNIA)
COUNTY OF LOS ANGELES) ss
CITY OF LANCASTER)

CERTIFICATION OF ORDINANCE
CITY COUNCIL

I, ________________________, __________________________ City of Lancaster, California, do hereby certify that this is a true and correct copy of the original Ordinance No. 994, for which the original is on file in my office.

WITNESS MY HAND AND THE SEAL OF THE CITY OF LANCASTER, on this ________ day of ________________, ___ ___ _.

____

(seal)

____

Selected pages from the zoning code showing required solar energy generation by zone

17.08.060 Development regulations by building types.

A. Single-family house on Rural Residential lot.

A single-family house on a rural residential lot is a residence for one household, with its primary entrance accessed through the front yard, on a lot ranging from 20,000 to 100,000 square feet or greater.

1. Development standards.

Rural Residential Development Standards			
	ZONES		
	RR-2.5	**RR-1**	**SRR**
Site specifications.			
Minimum lot size (sq. ft.).	100,000	40,000	20,000
Minimum width (feet).	165	110	85
Minimum depth (feet).	250	130	120
Building placement.			
Front yard (feet).	40	30	30
Garage location.	All garages shall be located at or behind the wall plane where the front entrance is located.		
Rear yard (feet).	30	25	20
Interior side yard: minimum (feet).	20	15	10
Interior side yard: total sum of two yards (feet).	40	30	25
Street side yard (feet).	40	30	20
Building size and massing.			
Lot coverage (percentage).	30%	40%	40%
Building height (feet).	40	40	35
Parking.			
Number of parking spaces.	2 spaces within an enclosed garage per Section 17.08.100		
Solar energy system provision.			
Minimum photo-voltaic kW per unit per Section 17.08.305.	1.5 kW	1.5 kW	1.5 kW

B. Single-family house on Residential lot.

1. Development standards.

Development Standards						
	ZONES / LOT TYPE					
	R-15,000	**R-10,000**	**R-7,000**	**Infill R-7,000 (with RPD)**	**Infill R-7,000 (alley access, with RPD)**	**SFR corner duplex**
Site specifications.						
Minimum lot size (sq. ft.).	15,000	10,000	7,000	5,000	3,500	10,000
Minimum width (ft.).	85	70	60	50	40	100
Min. width – corner lot (ft.).	100	85	75	60	50	
Minimum depth (ft.).	120	100	100	85	75	100
Building placement.						
Front plane build-to line (ft.).	20-32	16-28	14-26	12-20	10-18	16-28
Required minimum porch size (feet x feet).	6 x 12	6 x 12	6 x 12	6 x 10	6 x 8	6 x 12
	To the satisfaction of the Planning Director, an alternative frontage feature may be proposed in lieu of a porch if it achieves the same design intent and variation.					
Porch encroachment.	Up to additional 6' beyond front plane build-to line					
Garage location.	All garages shall be located at or behind the wall plane where the front entrance is located. A homebuilder with a subdivision with at least four floor plans may have one floor plan that has a garage located in front of the front entrance plane.					
Rear yard (ft.).	20	20	15	12	0	N/A
Interior side yard: min. (ft.).	5	5	5	5	0	10
Interior side yard: sum of two yards (ft.).	20	15	15	10	10	N/A
Street side yard (ft.).	15	15	10	10	10	N/A
Building size and massing.						
Lot coverage (percentage).	40%	40%	50%	55%	60%	45%
Building height (ft.).	35	35	35	35	35	35
Parking.						
Number of parking spaces.	2 spaces within an enclosed garage (Section 17.08.100)					
Solar provision.						
Minimum photo-voltaic kW per unit per Section 17.08.305.	1.50 kW	1.25 kW	1.0 kW	0.75 kW	0.50 kW	1.0 kW
a. A tandem garage parking arrangement may be considered if the applicant cannot meet the requirement to place a 2-car garage behind the plane of the house. b. Corner lots featuring side yard driveway access require a minimum 20-foot driveway and street side yard setback.						

C. Small apartment/condominium building/complex (2 to 15 units).

1. Development standards.

Development standards	
	MDR or HDR ZONE
Site specifications.	
Minimum lot size (sq. ft.)	6,000
Minimum width (feet).	60
Minimum width – corner lot (feet).	80
Minimum depth (feet).	100
Building placement.	
Front build-to line.	
Fronting local, collector, or other residential street with on-street parking (feet). Transitional infill design guidelines apply (Section 17.08.070.D).	0-12
Fronting local, collector, or other residential street with on-street parking and adjacent to single-family uses along the same street (feet).	8-20
Fronting arterial street with no on-street parking (feet).	20-32
Rear yard (feet).	15
Interior side yard (feet).	10
Street side yard (feet).	15
Building size and massing.	
Lot coverage (percentage).	50%
Building height within 100 feet of SFR zone (feet).	35
Maximum building height (feet).	55
Parking.	
Location of on-site parking.	Behind the front façade of the residential building
Number of parking spaces.	Per Section 17.08.100
Open space.	
Required usable open space/recreation area.	Minimum 8% of lot area, minimum 20' width and depth
Landscaping.	
Required landscaping (percentage).	Minimum 15% of lot area
Solar provision.	
Minimum photo-voltaic kW per unit per Section 17.08.305.	0.5 kW

a. On-site management shall be provide for apartments 4 units or greater.
b. A minimum 4' x 4' covered entryway shall be provided for each apartment or condominium unit. The entryway may be enlarged and designed as a porch.
c. Required amenities for units in a small apartment include in-unit laundry hook-ups.
d. Required amenities for units in a small condominium, beyond those required for apartments, include garage parking with storage shelves for each unit, and a minimum 4' x 8' porch, patio, or balcony area.
e. Other site amenities may include a barbeque area, pool, recreation courts, and shall be centrally located and easily accessible for residents.

D. Large apartment/condominium building/complex (16 or more units).

1. Development standards.

Development standards	
	MDR or HDR ZONE
Site specifications.	
Minimum lot size (sq. ft.)	6,000
Minimum width (feet).	60
Min. width – corner lot (feet).	75
Minimum depth (feet).	100
Building placement.	
Front build-to line.	
Fronting local, collector, or other residential street with on-street parking (feet). Transitional infill design guidelines apply (Section 17.08.070.D).	0-12
Fronting local, collector, or other residential street with on-street parking and adjacent to single-family uses along the same street (feet).	8-20
Fronting arterial street (feet).	20-32
Rear yard (feet).	15
Interior side yard (feet).	15
Street side yard (feet).	20
Building size and massing.	
Lot coverage (percentage).	50%
Building height within 100 feet of SFR zone (feet).	35
Maximum building height (feet).	72
Parking.	
Location of on-site parking.	40 ft. from front property line
Number of parking spaces.	Per Section 17.08.100
Open space.	
Required usable open space/recreation area.	Minimum 8% of lot area, minimum 50' width and depth
Landscaping.	
Required landscaping (percentage).	Minimum 15% of lot area
Solar provision.	
Minimum photo-voltaic kW per unit per Section 17.08.305.	0.5 kW

a. On-site management and security shall be provided for all large apartment complexes. Specific security provisions may include cameras, alarms, or active security guard surveillance, to the satisfaction of the Planning Director.
b. Required amenities for units in a large apartment include in-unit laundry hook-ups, and community pool and recreation room.
c. Required amenities for units in a large condominium, beyond those required for apartments, include garage parking with storage shelves for each unit, and a minimum 4' x 8' porch, patio, or balcony area.
d. Other amenities for units in a large multi-family complex may include courts for basketball, tennis or other sports, indoor gym, outdoor dog park, or daycare center.
e. All amenities shall be centrally located and easily accessible for residents.

Analysis on the cost-effectiveness of the "Implementation of Solar Energy Systems"

In 2013, the City of Lancaster revised its zoning and building codes to introduce a mandate to require solar energy systems, providing standards and procedures for builders of new homes to install photovoltaic (PV) solar energy systems. The standards are applicable to all new residential homes with a building permit issuance date on or after January 1, 2014.

The solar energy generation requirements are listed in Lancaster Municipal Code, Section 17.08.060. For the purpose of this analysis, it will be summarized as 1 kW of solar PV-generated energy per single-family home. The installation of PV solar energy systems is not required for all homes within a production subdivision; however, the builder shall meet the aggregate energy generation requirement within the subdivision (as calculated by the per-unit energy generation requirement multiplied by the number of homes in the subdivision). For example, an R-7000 subdivision with ten (10) homes that is required to provide 1.0 kW per unit would have an aggregate energy generation requirement of 10 kW for the subdivision. The 10-kW energy generation requirement can be met with two homes having solar energy systems generating 5 kW each, or with four homes having systems generating 2.5 kW each.

This analysis will reference heavily on the report prepared by Energy and Environmental Economics, Inc. ("E3") for the California Energy Commission, titled "Cost-Effectiveness of Rooftop Photovoltaic Systems for Consideration in California's Building Energy Efficiency Standards," dated May 2013. The authors measure photovoltaic's cost-effectiveness using two approaches: an average consumer savings analysis and a market-segmented savings analysis. An average consumer savings analysis evaluates whether PV is cost-effective to residential and commercial building owners on average. A market-segmented savings analysis evaluates whether PV is cost-effective to building owners based on their specific retail rate and annual electricity consumption.

E3's average consumer savings analysis determines cost-effectiveness using a benefit-cost ratio. The ratio is calculated by dividing the benefits (levelized bill savings) by the cost (levelized cost of solar electricity). A benefit-cost ratio greater than one is determined to be cost-effective. Figure 11 on Page 29 of E3's report shows that residential PV solar is cost-effective for year 2014, including the area of Climate Zone 14, identified as Palmdale, but representative for the Antelope Valley high desert, including Lancaster. PV is expected to be more cost-effective in the future as the installed capital costs of solar decreases, given advancements in technology development, and despite anticipated reductions in federal tax credits.

E3's market-segmented savings analysis evaluates benefits by including the avoided cost of retail electricity prices based on a customer's existing retail rate. Assumptions for this analysis vary, from the lifetime and cost of installation of solar PV systems, to the tiered retail rates that

Lancaster residents pay for electricity, as well as compensation parameters for an electricity company's Net Energy Metering program. Figure 14 on Page 33 of E3's report show that residential PV solar is cost-effective for year 2014 in the area of Climate Zone 14, including Lancaster. The cost-effectiveness increases with the size of the PV system.

In the past several years, KB Homes has been voluntarily installing solar PV systems on their new homes, with a 1.5 kW system as a standard feature, and upgrades up to a 3.8 kW system as options. KB has expressed that these features are a selling point and distinguishes their product from other homebuilders as well as resale homes. KB has not disclosed the exact costs for installation of the solar PV energy systems; however, E3's report provides additional details.

Table 2 on Page 9 of E3's report shows the cost in dollar/watt for installed PV systems, which for year 2012, averaged $5.38 per watt. Thus, for the minimum average of 1 kW, as required by the new solar requirement, the installation cost would be $5,380. However, E3's report notes that rack-mounted solar PV systems installed in newly constructed homes cost $0.80-$1.20/watt less than those installed as a retrofit on an existing home, likely due to built-in labor costs during construction of the home. Figure 1 on Page 11 of E3's report shows a reduction in installed costs for PV systems into the future, from a range of $4 to $5 per watt in 2014 to a range of $3 to $4 per watt by year 2020, thus reducing the installation cost for the minimum average of 1 kW to $3,000 to $4,000. Given a 3 kW solar PV system, typical for new construction, this calculates to cost of about $12,000 to $15,000 in year 2014 and $9,000 to $12,000 by year 2020. Anecdotally, city staff is aware that the installation costs may be even lower than what is reported in E3's study, given the rapidly declining costs of inverters and PV panels.

For new home construction, the added cost of solar PV systems is usually wrapped into the mortgage for the new house. The addition of a $12,000 to $15,000 solar PV system would result in an increase of the mortgage payment by about $75 to $100, given typical lending assumptions. This added cost is outweighed by the savings achieved by having a solar PV system that would reduce a household's utility bill by keeping the usage within the lower-rate pricing tiers.

Page 41 of E3's report summarizes the results of their cost-effectiveness analysis for rooftop PV solar. The average consumer and market-segmented savings results show that solar PV systems are largely cost-effective, especially for less expensive systems. More so, given the Antelope Valley's high desert location of ample sunshine, solar PV systems are cost-effective now and into the future as installation costs decline.

CONSULTANT REPORT

COST-EFFECTIVENESS OF ROOFTOP PHOTOVOLTAIC SYSTEMS FOR CONSIDERATION IN CALIFORNIA'S BUILDING ENERGY EFFICIENCY STANDARDS

DRAFT

Prepared for: California Energy Commission

Prepared by: Energy and Environmental Economics, Inc.

MAY 2013

CEC-400-2013-005-D

Energy + Environmental Economics

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ABSTRACT

This consultant report was written for the California Energy Commission in response to the requirements of Senate Bill 1 (Murray, Chapter 132, Statutes of 2006). The report provides information about the cost-effectiveness of rooftop photovoltaic systems, including the analysis approach and results. The report will be used to help the Energy Commission address the requirement in SB 1 for determining when and under which conditions solar electric systems should be required in the Building Energy Efficiency Standards. SB 1 guides the consideration of cost-effectiveness in making this determination.

Keywords: Photovoltaic, cost-effectiveness, Building Energy Efficiency Standards, rooftop.

Mahone, Amber, Katie Pickrell, Andrew DeBenedictis, Snuller Price. (Energy and Environmental Economics, Inc). 2011. *Cost-Effectiveness of Rooftop Photovoltaic Systems for Consideration in California's Building Energy Efficiency Standards*. California Energy Commission. Publication Number: CEC-400-2013-005-D.

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EXECUTIVE SUMMARY

This report was written for the California Energy Commission in response to the requirements of Senate Bill 1 (Murray, Chapter 132, Statutes of 2006), which calls for an evaluation of whether, and under what conditions, solar electric systems are cost-effective for inclusion in the state's Building Energy Efficiency Standards (Title 24, Part 6). The cost-effectiveness analysis, which forms the basis for the conclusions of this report, is based on the Warren-Alquist Act (1974), which requires the California Building Energy Efficiency Standards ("standards") to be cost-effective when taken in their entirety and when amortized over the economic life of the structure compared with historical practice.

Using the input assumptions and method described in this report, which projects the current trend in solar photovoltaic (PV) costs and maintains current rate structures and policies, we find that rooftop solar electric systems will be cost-effective in 2020 for a large portion of California's commercial and residential electricity consumers. The scope of this study is narrowly defined, with a particular focus on cost-effectiveness within the standards. Other factors besides cost-effectiveness must also be considered before PV installations are required in the standards. This report does not address any of the impacts of potential changes in practices within the construction or PV industries, nor does it consider the impacts of rooftop PV on the reliable operation of California's electric grid.

The cost-effectiveness analysis detailed here relies on several important assumptions about California's solar energy landscape through 2020. These key assumptions are:

- Utility electricity rate structures and Net Energy Metering (NEM) rules do not change significantly throughout the lifetime of rooftop PV systems installed through 2020. Changes in those areas could have a dramatic impact on solar's cost-effectiveness, but due to the difficulty in predicting what form such changes may take, the research team's analysis relies on existing rate structures and a continuation of the NEM policy.
- If rooftop PV systems are included in a Title 24 requirement, they will not be eligible for existing incentives such as the California Solar Initiative (CSI) and the New Solar Homes Partnership (NSHP).
- The federal investment tax credit (ITC) drops from 30 percent to 10 percent in 2017, as called for in existing legislation.
- Utility electricity rates increase at 2.11 percent per year through 2020 and 1.42 percent per year after 2020, in real terms. This is based on a forecast of retail rate escalation under an "AB 32" compliant scenario, which accounts for the impact of California's greenhouse gas reduction policies on retail electricity rates.
- Rooftop PV system costs continue to decline through 2020. The research team's PV cost forecast begins with reported 2012 costs from the CSI project database and then assumes that costs will drop significantly each year through 2020, continuing the trend in actual PV cost reductions observed from 2007 to 2012. For California's PV costs to meet this forecast, both module and installation costs must decline consistently, driven by a robust and competitive PV market.

The authors examine PV's cost-effectiveness using two approaches. The first approach, referred to as the average consumer analysis, follows the adopted time dependent valuation (TDV) method used in Title 24 evaluation since 2005. TDV is a time varying measure of energy that accounts for both the enery used at the building site and consumed in producing and delivering energy to the site, including, but not limited to power generation, transmission and distribution losses. Using the the average consumer analysis method, the authors find that rooftop PV will be cost-effective for both residential and nonresidential new construction across all climate zones by 2020.

The second approach, the market-segmented analysis, calculates PV's cost-effectiveness based on projected utility bill savings. Bill savings are calculated specific to different building types, annual electricity consumption, climate zones, and utility rates. The market-segmented analysis demonstrates the variability of PV cost-effectiveness based on those critical consumer characteristics. Rooftop solar installations are shown to be cost-effective in 2020 only for residential consumers whose annual electricity usage is above 5,000 kilowatt hours (kWh). Furthermore, while the average consumer analysis suggests that PV will be cost-effective for large and small commercial consumers in 2020, the market-segmented analysis projects that PV will be consistently cost-effective only for small commercial consumers, while cost-effectiveness for large commercial customers varies by utility service territory. This discrepancy is due to differences in rate structure: Small commercial consumers' rates allow them to access larger bill savings than large commercial customers. Contrasting the average consumer results to the market-segmented results demonstrates the importance of utility rate structures, climate zone, and annual consumption in determining PV cost-effectiveness.

CHAPTER 1: Introduction

This report prepared by Energy and Environmental Economics, Inc. (E3) was commissioned by the California Energy Commission to evaluate the cost-effectiveness of solar electric systems in the context of the state's Building Energy Efficiency Standards ("standards"). The report is written in compliance with the requirements of Senate Bill 1 (Murray, Chapter 132, Statutes of 2006) and is designed to help the Energy Commission determine whether, and under what conditions, solar electric systems[1] should be required on new residential and new nonresidential buildings as part of the state's standards. Furthermore, rooftop PV systems are expected to play an important role in meeting California's Long-Term Energy Efficiency Strategic Plan zero net-energy building goals and are included as part of the California Air Resources Board's *Scoping Plan* to meet the state's greenhouse gas reduction targets under Assembly Bill 32 (Nuñez, Chapter 488, Statutes of 2006).[2]

The conclusions in this report are based on a range of forecasts of the cost-effectiveness of rooftop photovoltaic installations on newly constructed buildings between 2014 and 2020. This report answers the following research questions:

- Under what conditions is rooftop PV on newly constructed residential and nonresidential buildings expected to be cost-effective from an average consumer savings perspective from 2014 to 2020?
- Is rooftop PV for newly constructed buildings expected to be cost-effective from 2014 to 2020 for specific residential or commercial market segments?

Approach

Cost-effectiveness is evaluated using two metrics: 1) average consumer savings, which evaluates whether PV is cost-effective to residential and commercial building owners on average across climate zones, and 2) market-segmented savings, which evaluates whether PV is cost-effective to building owners based on their specific retail rate and annual electricity consumption, again compared by climate zone. In both approaches, the life-cycle benefits and life-cycle costs of PV are evaluated over a 25-year horizon, corresponding with the current industry-standard PV module warranty lifetime. The life-cycle costs of PV are evaluated over a

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1 For purposes of this report, solar electric systems are limited to rooftop photovoltaic (PV) systems.

2 See the *Energy Efficiency Strategic Plan* at http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/eesp/ ; the *ZNE Action Plan* at: http://www.cpuc.ca.gov/NR/rdonlyres/6C2310FE-AFE0-48E4-AF03-530A99D28FCE/0/ZNEActionPlanFINAL83110.pdf ; and the California Air Resources Board *Scoping Plan* at: http://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm

20-year period, the standard duration of rooftop solar power purchase agreements (PPAs), followed by a 5-year period of no additional costs to the customer.

Average Consumer Savings Analysis[3]

The average consumer savings is analyzed for residential and nonresidential customer classes based on a forecast of average residential and nonresidential retail rates. The approach is the same as the one used to evaluate new building requirements in the Energy Commission Title 24 process based on time dependent valuation (TDV). The forecast reflects wholesale market forecasts for the future cost of electricity, including natural gas fuel, the cost of new conventional generation capacity, the cost of new renewable generation capacity, transmission, distribution, ancillary services, losses, and a forecast of market prices for carbon dioxide emissions and other air emissions criteria. The retail rate forecast includes the expected effects of current electricity sector policy goals, such as the 33 percent renewable electricity standard and higher levels of energy efficiency.

Market-Segmented Savings Analysis

In the market-segmented savings analysis[4], the benefits of a rooftop PV installation are calculated differently than for the average consumer analysis. The benefits include the avoided cost of retail electricity prices based on a customer's existing specific retail rate. Rate structures vary significantly by customer type. Most residential electricity rates in California are "inclining block," or tiered, meaning that the cost of electricity increases with higher volume consumption. In contrast, most commercial electricity rates in California do not increase with higher consumption. Many medium to large commercial rates vary based on the time of use (TOU) of electricity consumption. Under TOU rates, on-peak reductions in electricity use are valued more highly than off-peak reductions. An additional difference between residential and commercial rate structures is the inclusion of demand charges: Commercial consumers typically pay charges per their maximum energy demand in a specific period. For example, many TOU commercial rates include a high per kW demand charge during the summer on-peak period.

Key Assumptions

Evaluating the cost-effectiveness of rooftop PV installations for newly constructed buildings is complex and depends on many variables. The authors address this complexity by using scenario analysis and categorizing the results by climate zone and broad customer classes. However, it would be impossible to evaluate every possible combination of conditions that

3 The average consumer savings analysis is based on the time dependent valuation "base" values developed as part of the Commission's update to the *2013 Building Energy Efficiency Standards*. For more information on this method,
see: http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/

4 The market-segmented savings analysis approximates consumers' bill savings.

could affect PV's cost-effectiveness across California. Therefore, the results of the analysis should be interpreted as broadly indicative of cost trends for PV across the state.

PV system costs and characteristics are one set of critical variables that affect the cost-effectiveness analysis. The authors assume that the capital cost of PV will continue to decrease over time, in line with historical trends that have shown significant cost reductions since 2007 and earlier. Because the expected electricity generation of a PV system varies by location based on the solar resource available, the authors show PV cost-effectiveness results for each of California's 16 climate zones. PV system size is another important input; in this analysis, the authors assume that all residential and small commercial systems are smaller than 10 kW in size, while all large commercial PV installations are between 10 to 100 kW. The authors assume that all PV systems are roof-mounted and do not evaluate the cost-effectiveness of ground-mounted systems or larger "community solar" type installations.[5] Throughout this analysis, the authors assume that rooftop PV systems accrue benefits over a 25-year economic lifetime.

Another factor in this analysis is the forecast of electricity retail rate escalation. The research team assumes that retail rates will increase by 2.11 percent per year through 2020 and 1.42 percent per year after 2020 (in real terms), as California replaces much of its electricity generation with less-polluting resources and implements other greenhouse gas reduction measures in compliance with the Global Warming Solutions Act of 2006 (AB 32)[6].

E3's analysis assumes that if PV were incorporated into the building code, installations would not directly receive a financial credit for helping to meet the state's Renewables Portfolio Standard (RPS), nor would they be eligible for current state solar incentives such as the California Solar Initiative (CSI) and the New Solar Homes Partnership (NSHP).[7]

The structure of electricity rates and the Net Energy Metering (NEM) program is also important to the analysis. The authors assume that the structure of California utility rates will not change dramatically before 2020. Changes to utility rates, such as increasing demand and/or service charges while decreasing energy charges, could have a large effect on consumers' utility bill savings upon installing PV. Furthermore, the authors assume that California's existing NEM program will remain in place in its current form for the lifetime of systems installed through

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5 Community solar projects are expected to show some cost benefits over rooftop-mounted PV systems because the larger systems could achieve economies of scale. However, there are significant challenges to widespread deployment of community solar including tariffs and interconnection rules that are beyond the scope of this analysis.

6 For more information about AB 32, please see the California Environmental Protection Agency Air Resources Board website at http://www.arb.ca.gov/cc/ab32/ab32.htm.

7 Depending on how the Commission chooses to implement the updated Base Code and CALGreen Tiers 1 and 2, the NSHP incentive could continue to be available to new home construction. However, this analysis does not predicate the cost-effectiveness results based on the presence of state solar incentives.

2020. In reality, there is a cap on the installed capacity of NEM generation, and the NEM rules may change before 2020. The cost-effectiveness of rooftop PV could vary significantly depending on the compensation to NEM generators for exports to the grid. For this analysis, the authors rely on existing rate structures and NEM rules due to the large uncertainty in exactly how they might change and what alternatives could replace them.

While the cost-effectiveness analysis accounts for the major costs and benefits of rooftop PV, there are other less readily quantified attributes of solar that are not included. For example, in comparison to other renewable resources, rooftop PV has the benefit of being relatively quick to deploy and does not require additional land. Rooftop installations also have the potential to avoid new long-line transmission to interconnect generation to loads. Furthermore, rooftop PV does not use large quantities of water for thermal generation cooling. On the other hand, this report does not address any potential distribution system costs that could arise from introducing large quantities of behind-the-meter generation onto the grid.

Key Findings

Using an average consumer savings approach, rooftop PV installations are projected to be cost-effective by 2020 in residential new construction and both large and small commercial construction. While the degree of cost-effectiveness varies by climate zone, the average consumer benefits of installing PV outweigh the costs across all climate zones. In contrast, the market-segmented results indicate that rooftop PV will be cost-effective only for certain sectors of consumers in 2020, depending on climate zone, utility rate, and annual electricity usage. The central results of both the average consumer and market-segmented cost-effectiveness analysis in 2020 are shown in Table 1 below, segregated by building type.

Table 1: Summary of Cost-Effectiveness Results of California Rooftop PV for Newly Constructed Buildings, 2020

	Average Consumer Results, 2020	Market-Segmented Results, 2020
Residential Consumers	Cost-effective	Cost-effective in all climate zones only for consumers with annual electricity usage above 5,000 kWh
Small Commercial Consumers	Cost-effective	Cost-effective in most climate zones/utility service territories
Large Commercial Consumers	Cost-effective	Not cost-effective in most climate zones/utility service territories

Source: Energy and Environmental Economics, Inc.

Ultimately, deciding whether to include PV in the California Building Energy Efficiency Standards requires consideration of more than just the cost-effectiveness issues raised here. The integration of PV into the energy code should happen in a well-planned and phased manner, taking into account the state's policy objectives, as well as the costs, benefits, and less tangible attributes of PV. Any PV requirement would ideally be designed to ensure that the solar and building industries in California are ready to meet the additional need for solar installations with each successive building standard requirement. In addition, the code would need to include provisions to handle locations that are not suitable for solar generation. These other considerations are not addressed in this study.

CHAPTER 2: Benefit–Cost Analysis Approach

The research team evaluates the cost-effectiveness of PV using an approach that compares the costs and benefits over the life of the system from the owner's perspective. To calculate a benefit-cost ratio, the life-cycle benefits of PV are divided by the life-cycle costs of PV. If the ratio of benefits to costs is greater than one with reasonable certainty, then PV is determined to be cost-effective.

The cost of electricity produced by a solar electric system depends on the installed capital cost, financing costs, taxes, and federal incentives associated with PV, as well as the amount of electricity generated by the PV system. The benefits of solar to the consumer (that is, building owner) are the avoided utility bills. In the average consumer savings analysis, average consumer savings are calculated using the hourly time dependent valuation (TDV) costs adopted in the 2013 Title 24 proceeding. These TDV factors reflect the shape of the underlying market value of electricity in each hour of the year, including avoided greenhouse gas emissions, avoided energy and capacity costs, and avoided transmission and distribution costs. In the market-segmented savings analysis, the current utility rates, such as tiered residential retail rates and time-of-use commercial retail rates, are used to calculate the bill savings by segmented customer class. Each component of these benefit-cost analyses is discussed in more detail below.

Costs: PV Cost Assumptions

Installed System Cost and Progress Ratios

Installed PV system costs are based on the PowerClerk database[8] of California Solar Initiative systems, with adjustments to create a forward-looking forecast of capital costs. The PowerClerk data reflect the "self-reported" cost of more than 100,000 actual PV systems installed on buildings between 2007 and 2012. This database was used because it is the most detailed rooftop PV dataset available for actual California installations. Installed capital cost data from the New Solar Homes Partnership program are used to benchmark capital cost data for rooftop PV installations on newly constructed buildings.

8 The research team obtained data directly from the PowerClerk database manager, Clean Power Research. The PowerClerk database holds solar system data from applicants who have participated California Solar Initiative solar incentive program.The data are available online at https://csi.powerclerk.com/CSIProgramData.aspx; however, some fields are not publicly available to protect customer identities.

Table 2 shows the median cost, in $/watt, of CSI installed systems by size category for the years 2007 to 2012, based on the system reservation date.

Table 2: CSI Installed Systems, in $/Watt, From the PowerClerk Database

System Size Category (kW)	2007	2008	2009	2010	2011	2012
< 10	$8.00	$7.95	$7.39	$6.55	$6.36	$5.38
10-100	$7.70	$7.68	$6.77	$5.89	$5.39	$4.52

Source: Energy and Environmental Economics, Inc.

Using data from the NSHP and CSI, the Lawrence Berkeley National Laboratory report *Tracking the Sun V*[9] compares the cost of rooftop PV systems installed as a part of a residential retrofit to those installed in residential new construction from 2007 to 2011. For new construction installations, the report distinguishes between rack-mounted and building-integrated systems. The comparison includes only systems between 2-3 kW, the most common size range for PV systems installed in residential new construction. Between 2007 and 2009, rack-mounted PV systems installed in newly constructed homes cost between $0.80-$1.20/watt less than those installed as a retrofit on an existing home. In 2010 and 2011, the cost difference was much smaller, possibly due to a reduced sample size driven by the slowdown in residential construction during those years. In this analysis, the authors assume a $1.20/watt cost difference for retrofit versus new construction rooftop PV systems. This cost difference represents some of the uncertainty in the future capital costs of PV systems.

9 Barbose, Galen, Naim Darghouth, Ryan Wiser. December 2010. *Tracking the Sun V: A Historical Summary of the Installed Price of Photovoltaics in the United States From 1998-2011.* Lawrence Berkeley National Laboratory.

The research team developed two scenarios of PV capital costs to reflect the uncertainty of the future cost of PV systems:

- In Scenario 1, the authors use the 2012 CSI capital costs as the starting point for the analysis. Since the CSI program provides incentives to retrofit installations, which are historically more costly than installations in new construction, the authors use CSI reported costs to represent a more conservative (higher) trajectory for solar capital costs. They apply the progress ratio assumption described below to the 2012 costs to develop a forecast through 2020.

- In Scenario 2, the authors adjust the 2012 CSI PV capital costs downward by $1.20/watt to reflect that PV systems on newly constructed buildings may cost less than installations on existing buildings. They apply the same progress ratio assumption to these costs to generate a lower cost forecast through 2020.

The authors use a "progress ratio" approach in their analysis to develop a forecast of PV system costs through 2020. A progress ratio estimates the change in capital cost of solar after a doubling in cumulative installed capacity. Based on evidence from the available literature, we apply an 80 percent progress ratio to 2012 installed system costs, meaning that for every doubling in cumulative installed capacity after 2012, installed system cost declines by 20 percent.[10]

While solar progress ratios generally apply to module cost, the research team applies the 80 percent progress ratio to the full installed system cost. A Lawrence Berkeley National Laboratory study found that markets with large solar deployment programs tend to have lower installed system costs, suggesting that balance-of-system costs (such as installation costs) decline with market growth.[11] Based on this evidence, the authors believe the simplifying assumption of applying an 80 percent progress ratio to total installed cost is reasonable over the period of this study. For more details about how the progress ratio is applied to PV costs, see the CPUC California Solar Initiative Cost-Effectiveness Evaluation.[12]

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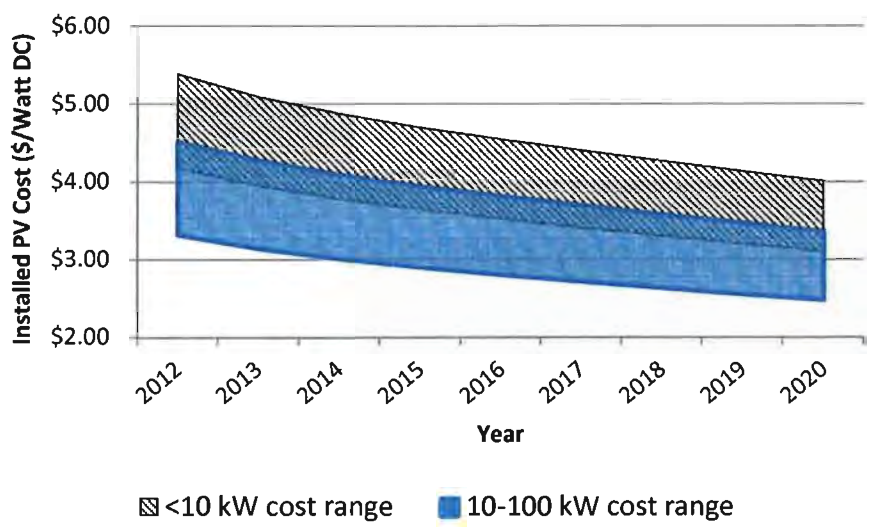
10 Surek, Thomas., 2007.National Renewable Energy Laboratory, *Progress in U.S. Photovoltaics: Looking Back 30 Years and Looking Ahead 20*; and, *Solar Energy Materials and Solar Cells Journal.*

11 Wiser, Ryan, Galen Barbose, and Carla Peterman. February 2009. *Tracking the Sun: The Installed Cost of Photovoltaics in the U.S. from 1998-2007.* Lawrence Berkeley National Laboratory,

12 CPUC CSI Program Evaluation, see the CSI Cost Effectiveness Evaluation of April 2011: http://www.cpuc.ca.gov/PUC/energy/Solar/evaluation.htm

The high and low forecasts of installed system cost for Scenarios 1 and 2 are shown in Figure 1 below.

Figure 1: High and Low PV Capital Cost Forecasts



Source: Energy and Environmental Economics, Inc

For this analysis, all residential and small commercial systems are modeled using the median cost of solar systems under 10 kW in size. For large commercial customers, the authors use the median average solar cost for systems between 10 and 100 kW in size.[13]

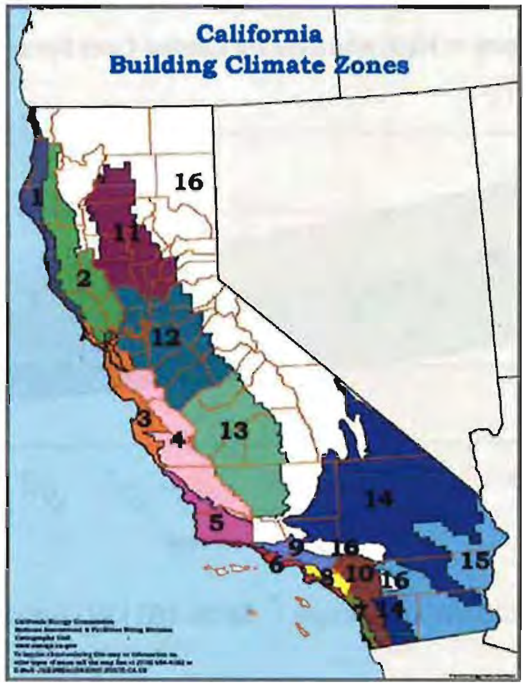
System Performance by Climate Zone

The amount of electricity generated by PV systems varies by climate zone based on the weather patterns and insolation (amount of solar radiation) in each region. The capacity factor of a PV system is a measure of the average energy produced over the year relative to the system's peak generating capacity. A difference in capacity factor of only a few percentage points can have a dramatic effect on solar's cost-effectiveness results.

The 16 climate zones used in this analysis are the same climate zones used in the Commission's Building Energy Efficiency Standards (see Figure 2).

13 *Small commercial* is defined as any rooftop PV installation under 10 kW in size, and large commercial is defined as any rooftop PV installation over 10 kW and under 100 kW in size.

Figure 2: California Building Energy Efficiency Standards Climate Zones



Source: California Energy Commission

Given the importance of the capacity factor assumption to the final results and the uncertainty in actual PV production forecasts for a given installation, the authors develop two scenarios of capacity factors by climate zone:

- Scenario 1 uses the capacity factor estimates by climate zone that are produced by the PVWatts model, a PV simulation tool developed by the NREL. [14]

- Scenario 2 uses capacity factors by climate zone based on actual, metered generation data from the CSI load impact studies.

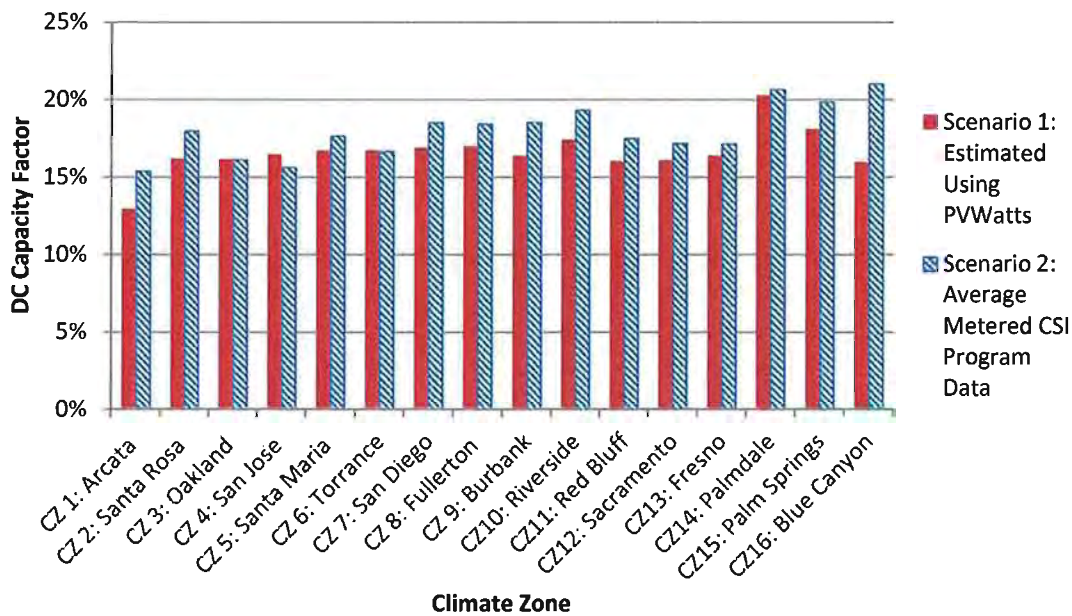
In general, the actual CSI database capacity factors are higher than the modeled PVWatts capacity factors. There could be a number of factors contributing to these differences, but the authors expect that the main difference is due to self-selection on the part of the CSI customers to install PV systems in areas with higher than average insolation within a given climate zone, coupled with the CSI program's performance-based incentive, which pays solar incentives based on a system's metered energy production.

14 Another potential source for capacity factors would be the CECPV model. In general, the CECPV model results in slightly higher capacity factor estimates compared to PVWatts and is closer to measured performance. The PVWatts capacity factors used here are conservative input assumptions for the "more expensive solar" scenario.

Although it is likely that the effects of shading differ between retrofit and newly constructed buildings, the authors have not found any documented evidence to suggest that the capacity factor varies for retrofit versus newly constructed building installations or between residential and commercial installations (for a given system type). Figure 3 shows the capacity factors by climate zone applied in Scenario 1 (PVWatts) and Scenario 2 (average metered CSI generation data).

Figure 3: PV Capacity Factors by Climate Zone

Scenario 1 Uses PVWatts Data, Scenario 2 Is Based on Average Performance of Actual CSI Installed Systems



Source: Energy and Environmental Economics, Inc.

Treatment of Uncertainty Through Two Scenarios

The research team uses two scenarios to reflect the uncertainty in forecasting PV cost-effectiveness. By combining the range of capital costs described in the section "Installed System Cost and Progress Ratios" and the range of capacity factors described in the section "System Performance by Climate Zone," the authors generate the following two scenarios:

1. Scenario 1 reflects a forecast of "more expensive solar" using higher capital costs and lower capacity factors.

2. Scenario 2 reflects a forecast of "less expensive solar" using lower capital costs and higher capacity factors.

These scenarios create reasonable uncertainty bounds on a range of potential PV costs and are summarized in Table 3 below.

Table 3: Assumptions Applied in Scenarios 1 and 2

Scenario	Capital cost assumptions	Capacity factor assumptions
Scenario 1: More expensive solar	Higher capital costs: CSI data based on retrofit installations, adjusted for 80% progress ratio	Lower capacity factors: PVWatts modeled data
Scenario 2: Less expensive solar	Lower capital costs: CSI costs reduced by $1.20/watt to approximate installations on newly constructed buildings, adjusted for 80% progress ratio	Higher capacity factors: actual CSI program metered generation data

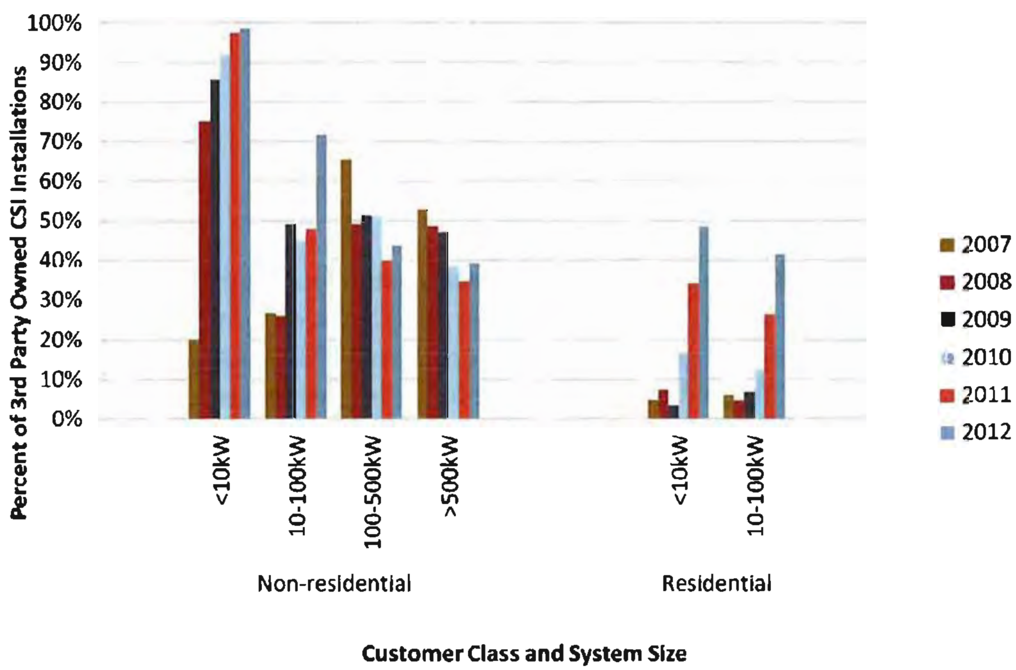
Source: Energy and Environmental Economics, Inc.

Levelized Cost of Energy Produced by PV Systems

System Financing

Several financing options exist for residential and commercial rooftop PV systems. Third-party ownership (power purchase agreement [PPA]) financing is very common among large commercial systems and is rapidly becoming more common for residential systems; we expect this trend to continue. The following figure shows the increasing share of third-party financed residential and non-residential systems participating in CSI since the program began in 2007.

Figure 4: Percentage of Third Party-Financed PV Installations in CSI Database



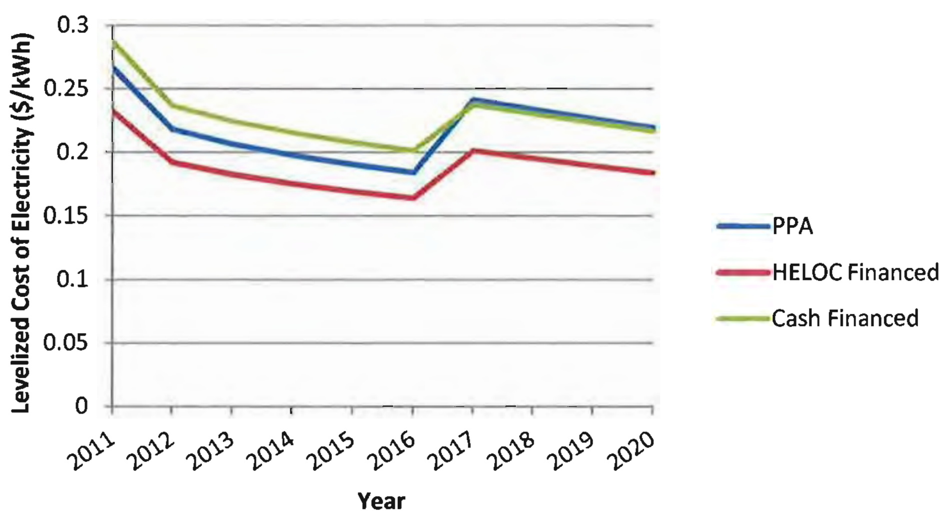
Source: California Solar Initiative

The research team assumes third-party ownership financing in the analysis due to its prevalence in the California market and because it allows straightforward comparison between the cost of commercial and residential systems. To calculate the life cycle or levelized cost of energy (LCOE) using third–party ownership financing, the authors calculate the revenue stream that a third party would need to collect from the customer to receive a return on investment, based on a financial *pro forma*, that is, a standardized financial cost model. The authors assume that PPAs are signed for a 20-year duration, which is the current PV industry standard. The resulting LCOE reflects the underlying assumption that PPA pricing is highly competitive and and that PV leases are priced to generate a 7.7 percent return on capital (10 to 12 percent return on equity); in reality, PPA prices may be higher based on dynamics and competition in the California market.

A common alternative to third-party finance for PV systems is private homeowner purchase of the system using a home equity line of credit (HELOC), or a second mortgage. A HELOC allows the homeowner to borrow the full value of the system cost at a low interest rate, and the loan interest is tax deductible. As a result, purchased systems yield a slightly lower LCOE than third-party owned systems. However, homeowners are continuing to opt for third party-owned PV systems, likely due to reduced hassle and relief of maintenance obligations. In addition, not all homeowners have the ability to qualify for a HELOC or increased borrowing from an existing loan. Figure 5 below compares the levelized cost of solar in Climate Zone 3 under the "less expensive solar" scenario, calculated using three different financing options: third-party ownership with a PPA, private ownership purchased with a HELOC, and private ownership purchased with cash. For this comparison, the authors assume a 20-year financing term and system lifetime for all financing structures.

Figure 5: PV Levelized Cost by System Financing Structure

Climate Zone 3, "Less Expensive Solar" Scenario (Scenario 2)



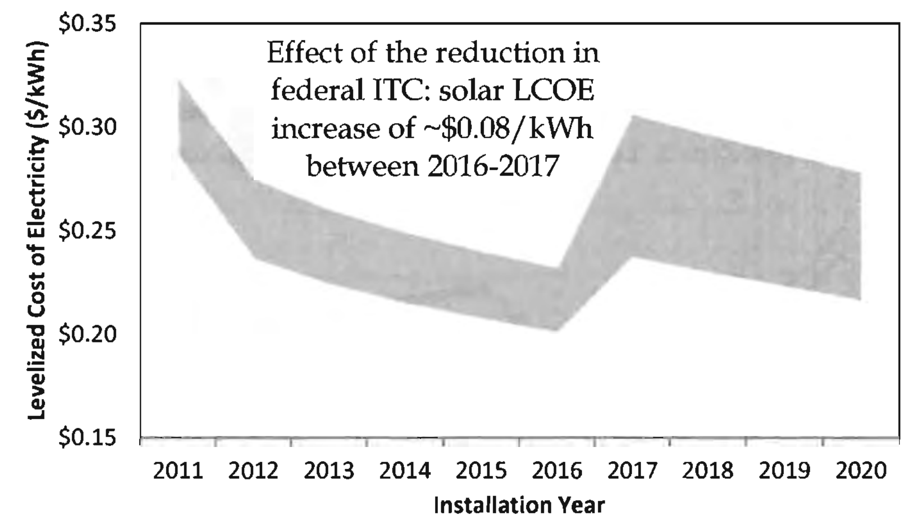
Source: Energy and Environmental Economics, Inc.

Taxes and Incentives

Tax considerations are another important component of the cost of solar electric systems in California. The research team's financial analysis applies state and federal taxes at the relevant rate for residential and commercial customers (see Table 4). The authors also include the federal investment tax credit (ITC) in their modeling, which they assume drops from 30 percent to 10 percent at the start of 2017, consistent with current federal policy. The dramatic effect of the expected change in the federal ITC after 2016 is shown in Figure 6. The LCOE of rooftop PV projects is shown to generally decline between 2011 and 2020 due to expected reductions in the capital cost of PV driven by industry growth; technology improvements; and streamlined manufacturing, marketing, and installation processes. However, the LCOE of solar is expected to increase significantly in 2017 with the reduction in the federal ITC from 30 percent to 10 percent. Figure 6 below shows the forecasted range of the LCOE of solar from 2011 to 2020. The top of the range reflects the Scenario 1 assumptions (more expensive solar), while the bottom of the range reflects Scenario 2 assumptions (less expensive solar).

Figure 6: Effect of the Expected Reduction in the Federal Investment Tax Credit on the Levelized Cost of Electricity From Rooftop PV Projects

2011 – 2020, Climate Zone 3 (Bay Area)



Source: Energy and Environmental Economics, Inc.

California's existing incentive programs, CSI and NSHP, are not included in this analysis. The authors assume that if PV systems are included in the building code, they will not qualify for incentive programs.

Table 4 summarizes the key financing and tax assumptions used in the analysis.

Table 4: Key Financing Assumptions

Financing Term	Input Assumption
After-tax weighted average cost of capital (WACC)	7.7%
Debt interest rate	6.8%
Cost of equity	10.15%, 12.2% after 2016
Debt period	20 years
Federal tax rate	35%
State tax rate	8.84%
Federal tax credit	30%, 10% after 2016
Percent financed with equity	60%, 45% after 2016
California state incentive (CSI or NSHP)	None
Accelerated depreciation (MACRS term)	5 years

Source: Energy and Environmental Economics, Inc.

Resulting Costs

Given the financing, tax, and incentive assumptions detailed above, the resulting levelized costs of electricity produced by PV systems vary by scenario, climate zone, and customer type. These costs range from $0.13/kWh to $0.25/kWh in 2014, as summarized in Table 5 below. This cost range is fairly wide due to the range of solar capacity factors and solar capital costs used in the scenarios. Climate Zones 3 and 10 are selected as examples in Table 5 because they are two highly populated areas of California and they represent the range of PV energy costs across the state. The solar resource in Climate Zone 3, located in the coastal San Francisco Bay Area, is not as good as the rest of the state on average, resulting in higher PV costs. Climate Zone 10 is located in inland Southern California and reflects a relatively plentiful solar resource, leading to lower PV costs.

Table 5: 20-Year Levelized Cost (LCOE) for Rooftop PV in 2014, Examples of Climate Zone 3 and Climate Zone 10 ($/kWh)

	Size	2014		2017		2020	
Climate zones	kW	Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2
3,10	< 10	$0.20, $0.16	$0.25, $0.23	$0.24, $0.20	$0.31, $0.28	$0.22, $0.18	$0.28, $0.26
3,10	10-100	$0.16, $0.13	$0.21, $0.19	$0.19, $0.15	$0.26, $0.24	$0.17, $0.14	$0.23, $0.21

Source: Energy and Environmental Economics, Inc.

In the next section, the levelized cost of solar by climate zone is compared to the 25-year life-cycle benefits for solar to determine cost-effectiveness.

Benefits: Avoided Cost of Electricity

The benefits of a rooftop PV system to a building owner are the retail electricity bill savings resulting from the system's generation. In this analysis, the bill savings are calculated using two approaches: 1) average consumer savings and 2) market-segmented savings. Each perspective is described in more detail below.

Average Consumer Savings

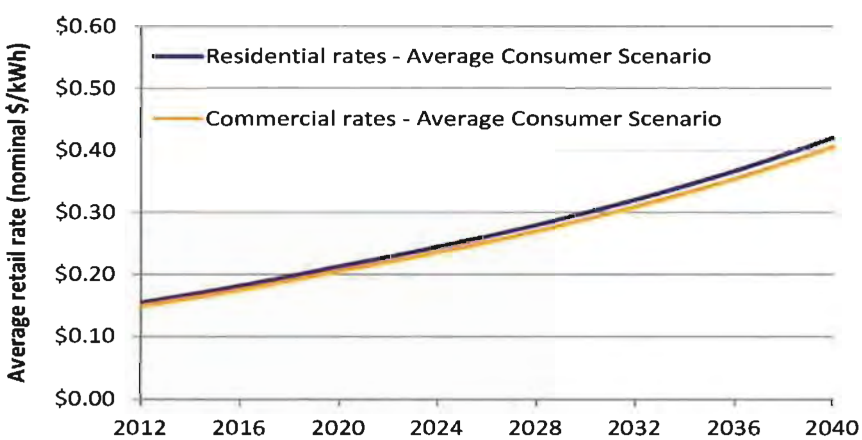
The average consumer savings analysis values energy savings (in the case of energy efficiency) and energy production (in the case of rooftop PV) based on an estimate of cost savings to the average consumer using a forecast of statewide average retail rates. The average consumer savings analysis approach has formed the foundation for the avoided cost of energy calculation underlying the *Building Energy Efficiency Standards* since 2005.[15] In this analysis, the value of electricity generated by PV varies on an hourly basis to reflect the actual costs of producing and delivering electricity to consumers. Specifically, the benefits of rooftop PV include a 25-year life-cycle assessment of PV's avoided energy costs, avoided capacity costs, avoided transmission

15 The average consumer savings analysis is based on the time dependent valuation "base" values developed as part of the Commission's update to the *2013 Building Energy Efficiency Standards*. For more information on this method, see: http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/

and distribution costs, and avoided greenhouse gas emissions, among other factors. These benefits are calculated based on a simulation of hourly market prices for electricity and depend on factors such as typical hourly temperatures by climate zone and season, a forecast of statewide electricity demand, and the forecasted future supply portfolio of generators. A retail rate adder is applied to these hourly values to bring the average hourly "market" avoided costs of electricity equal to statewide average retail rates in each year of the forecast. The authors use a 25-year PV lifetime in this analysis to represent the current industry-standard PV module warranty duration.

The retail rate adder escalates each year. From 2012 to 2020, retail rates are assumed to escalate at 2.11 percent per year, in real terms. This is based on a forecast of retail rates under an AB 32-compliant scenario, whereby the electricity sector meets the targets in the California Air Resources Board *Scoping Plan*" and achieves a 33 percent RPS by 2020, increased energy efficiency and other greenhouse gas reduction policy goals. Beyond 2020, retail rates are forecast to escalate at 1.42 percent per year, in real terms. This assumption reflects the assumption that California meets remaining load growth with natural gas generation after 2020. The retail rate escalation factors are calculated using the E3 RES Calculator, which was developed for the California Air Resources Board 33 percent RES proceeding.[16] This is the same retail rate forecast used in the adopted 2013 Title 24 building standard proceeding. Figure 7 below shows the retail rate forecast applied in this analysis, which is equivalent to the annual average benefit of PV generation.

Figure 7: Average Consumer Savings Analysis: Retail Rate Forecast



Source: Energy and Environmental Economics, Inc.

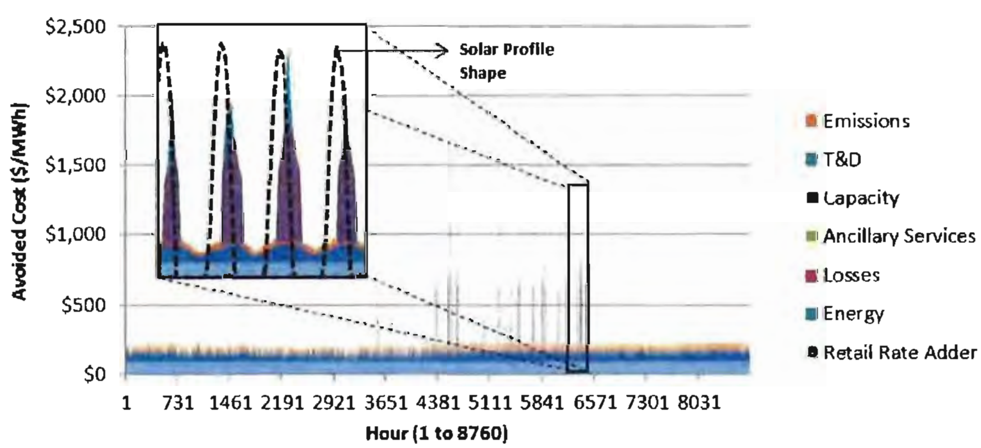
16 The E3 RES Calculator used to develop this rate forecast is available on the ARB website at: http://www.arb.ca.gov/research/econprog/econmodels/econmodels.htm

Using the average consumer approach, energy savings during summer peak hours are valued more highly than energy savings during the off-peak hours of the year. The average consumer savings approach values electricity as if residential and commercial retail customers in California paid their electric bills based on the retail value of electricity production and delivery in each hour of the year. In other words, this approach represents a hypothetical rate where customers would pay retail rates at an hourly price that reflects the underlying marginal cost in each hour, plus an additional amount to collect utility fixed costs.

The hourly value of electricity is correlated with the statewide typical weather files used in compliance software for the *Building Energy Efficiency Standards*. This is important because in California hotter weather tends to be correlated with increased demand on the electrical system, increasing the value of energy savings from energy efficiency and distributed generation during those hours.

The hours of PV output tend to be fairly well correlated with the hours of high electricity demand in California. For example, PV generation can offset a significant share of a house's electricity consumption during summer afternoons, when the cost of producing and delivering electricity is highest. This close link between hourly PV output and the hourly value of electricity is shown in the upper left-hand box in Figure 8 below. Solar PV output tends to peak in the early afternoon, while systemwide peak demand on the California grid tends to occur a little later in the afternoon, often between 4p.m. and 6p.m. In the average consumer analysis, the fact that electricity is valued more highly during hours of peak demand tends to improve the cost-effectiveness of PV.

Figure 8: One Year of Hourly Avoided Costs of Electricity, Average Consumer Scenario
Call-out box shows how the hourly PV generation profile correlates with the hourly value of electricity



Source: Energy and Environmental Economics, Inc.

As shown in the figure above, the hourly value of avoided cost of electricity in the average consumer analysis is made up of a number of components including: the wholesale value of energy, transmission and distribution losses, ancillary services, capacity costs, transmission and distribution costs, greenhouse gas emissions, and a statewide average retail rate adder. For more details about the method for calculating the hourly avoided cost of electricity for the average consumer savings analysis, see the Energy Commission report *Time Dependent Valuation of Energy for Developing Building Standards.*[17]

The table below describes some of the key input assumptions for the average consumer savings analysis. This analysis reflects a forecast of current and expected market conditions.

Table 6: Average Consumer Savings: Key Input Assumptions

Input	Description
Overview of Scenario:	*Average Consumer avoided cost of electricity is reflective of current state policy and energy trends.*
PV system lifetime	25 years, based on duration of industry-standard PV module warranty.
Retail rate	Statewide average rate for residential and commercial. Based on weighted average of 2008 rates for PG&E, SCE, SDG&E, LADWP and SMUD, derived from the Commission's *2010 Integrated Energy Policy Report* energy demand forecast.
Retail rate escalation	Retail rates escalate at a rate consistent with the E3/ARB 33% RES Calculator impacts: real rate of 2.1%/yr for 2011 – 2020. Beyond 2020, rates are escalated at real rate of 1.4%/year, the rate of the "natural gas only" build-out case from the E3/ARB 33% RES Calculator tool.
CO_2 price	Net present value of 2009 Market Price Reference CO_2 price forecast, which begins at about $14/ton in 2011 and escalates to $57/ton, in real $2010 dollars, by 2040.
CO_2 price policy	Assumes that a CO_2 pricing policy will not further increase rates beyond the retail rate assumptions above (i.e. revenue from CO_2 cap-and-trade market is used to offset any impacts to residential retail rates). However, CO_2 prices do affect the electricity market price shape, increasing the value of on-peak electricity.

17 Report available at: http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/

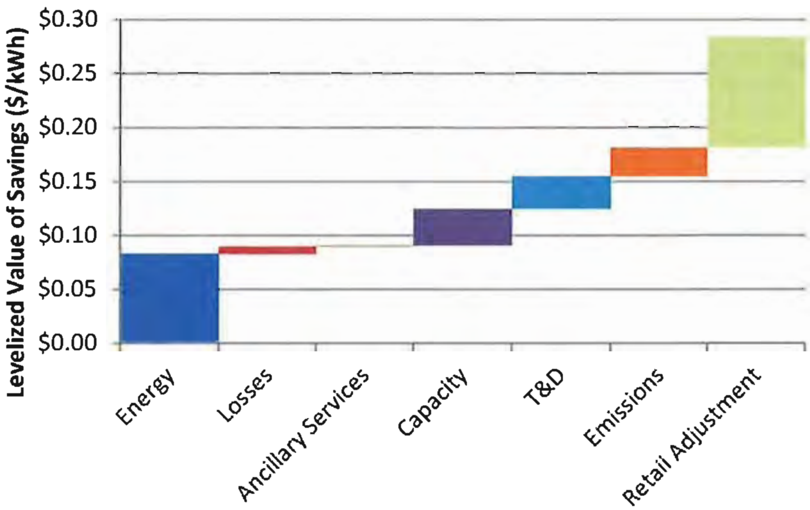
Input	Description
Electricity market price shape	The market price shape of electricity in 2020 is determined by the "High Wind" 33% RES case developed as part of the Commission's "Electricity System Implications of 33 Percent Renewables" Study completed in June 29, 2009. For years between 2008 and 2020, the change in the market price shape is based on an hourly linear extrapolation. No changes to the market price shape are forecast beyond 2020.
Other Policies (AB 32 Scoping Plan, Once-through cooling regulations)	Assumes statewide energy efficiency, rooftop PV and combined heat and power generation by 2020 are consistent with the *AB 32 Scoping Plan* goals and statewide compliance with proposed regulations on once-through cooling of coastal thermal power plants. The impact of these policies is reflected in the market price shape from the "High Wind" 33% RES case developed as part of the Commission's *Electricity System Implications of 33 Percent Renewables* study completed in June 29, 2009.
Real Discount Rate	3% real discount rate, consistent with Building Energy Efficiency Standards assumptions.

Source: Energy and Environmental Economics, Inc.

Using these input assumptions, the analysis shows that on a life-cycle (levelized) basis, the value of PV generation is expected to range from \$0.27/kWh - \$0.29/kWh for a residential PV system installed in 2014, depending on the climate zone. The example in Figure 9 below shows the components of the overall PV benefits in Climate Zone 3 for a residential system. The total life-cycle benefits of residential rooftop PV in Climate Zone 3 total \$0.28/kWh in 2014.

Figure 9: 2014 Life-Cycle Benefits of PV Generation Average Consumer Savings Assumptions

This example uses Climate Zone 3, residential data, nominal levelized $/kWh



Source: Energy and Environmental Economics, Inc.

Market-Segmented Savings

The market-segmented savings analysis calculates the avoided cost of electricity using the current rate structures of California's three largest investor-owned utilities: PG&E, SCE, and SDG&E. By using actual utility rate structures, the market-segmented analysis calculates the value of electricity generated by rooftop PV to different customer classes in California. As in the average consumer analysis, the authors assume a 25-year PV system lifetime. While the average consumer analysis calculates savings to the statewide average residential or commercial customer, the market-segmented savings analysis provides for a more disaggregated look at utility bill savings based on a typical residential or commercial building's annual electricity consumption. The research team's analysis focuses exclusively on single-family residential consumers and does not apply to multifamily residential buildings. The table below shows the primary utility retail rates used in the market-segmented analysis.

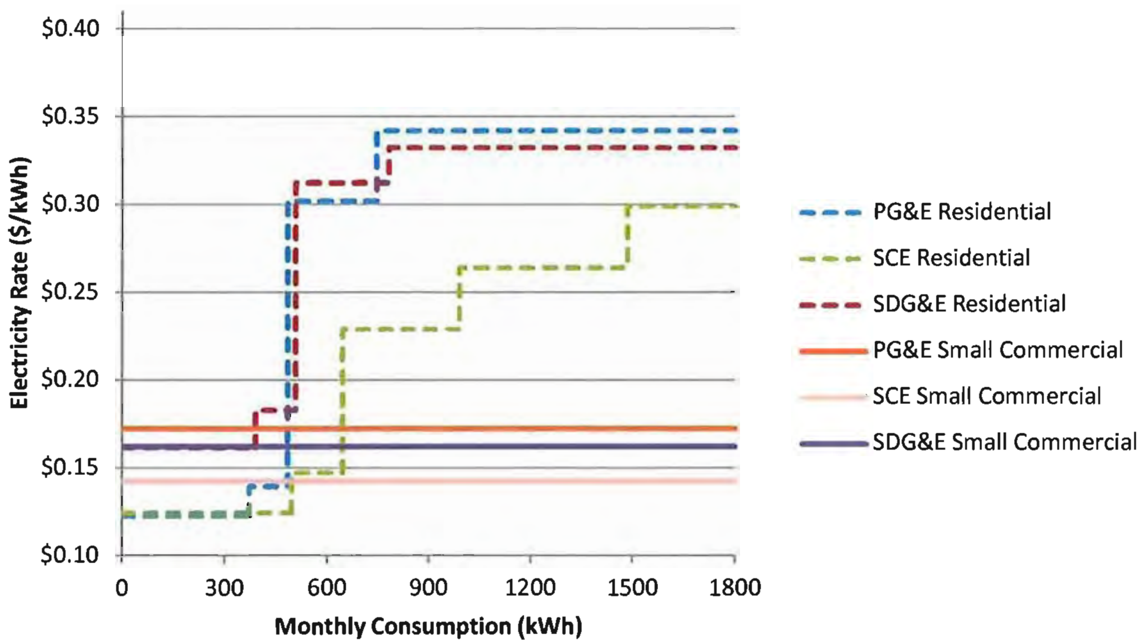
Table 7: Investor-Owned Utility Retail Rates Used in the Market-Segmented Analysis

	Residential	Small Commercial	Large Commercial
PG&E	E-1 (tiered)	A-1 (flat, seasonal)	A10S (time of use)
SCE	D (tiered)	GS-1 (flat, seasonal)	GS-2 (time of use)
SDG&E	DR (tiered)	A (flat, seasonal)	A6 (time of use)

Source: Energy and Environmental Economics, Inc.

Figure 10 illustrates the difference between the residential tiered rate structures that are common for residential customers in California and the small commercial rate structures. The chart does not include the large commercial rates, which are time-of-use (TOU) rates. These 2011 retail rates are assumed to escalate at the same annual rate as in the average consumer retail rate forecast.

Figure 10: 2011 Residential and Commercial Retail Rates ($/kWh, 2011)



Note: Baseline kWh allocation for Tier I rates varies by climate zone, not shown in figure above. Rates shown are for standard electric customers.

Source: Energy and Environmental Economics, Inc.

The market-segmented bill savings calculations are developed based on two hourly load shapes: (1) customer gross load without PV and (2) customer net load after PV is installed. The analysis applies billing determinants for each hourly load shape (including energy charges, demand charges, and other rate charges) and calculates monthly bills, including the effect of net metering rules in California. The process of calculating bills was performed using E3's bill calculation tool and summarized billing determinants developed as part of the analysis performed for the California Public Utilities Commission under the California Solar Initiative (CSI) cost-effectiveness evaluation[18].

Under California's NEM rules, any bill credits from excess PV production in one month are applied against the following month's bill. The authors also consider effects pursuant to Assembly Bill 920 (Huffman, Chapter 376, Statutes of 2009), under which customers receive compensation for any net-surplus energy carryover at the end of the 12-month billing period. A more detailed discussion of NEM effects may be found in the CPUC's NEM cost-effectiveness

18 See note 12

report.[19] The table below summarizes the key input assumptions applied in the market-segmented analysis.

Table 8: Market-Segmented Savings: Electricity Input Assumptions

Input	Description
Overview of Scenario:	*Market-Segmented analysis reflects the expected bill savings resulting from installing PV on a typical residential or commercial building in investor-owned utility service territories.*
PV system lifetime	25 years, based on duration of industry-standard PV module warranty.
Retail rates used	Uses 2011 residential and commercial rates for PG&E (E-1, A-1, A10S), SCE (D, GS-1, GS-2) and SDG&E (DR, A, A6)
Retail rate escalation	Retail rate escalated at a rate consistent with the E3/CARB 33% RES Calculator impacts: real rate of 2.1%/yr for 2011 – 2020. Beyond 2020, rates are escalated at real rate of 1.4%/year, the rate of the "natural gas only" build-out case from the E3/CARB 33% RES Calculator tool.
Bill savings calculation	Bill calculations performed in E3 tool developed for California Public Utilities Commission under the NEM Cost-Effectiveness Evaluation. Uses two hourly load shapes: (1) customer gross load in the absence of PV and (2) customer net load after PV is installed.
CO_2 price policy	Assumes that a CO_2 pricing policy will not further increase rates beyond the retail rate assumptions above (i.e. future CO_2 value is used to offset any impacts to residential retail rates).
Electricity market price shape	Not applicable. Retail rate structures are used.
Other policies (AB 32 Scoping Plan, Once-through cooling regulations)	Assumes statewide energy efficiency, rooftop PV and combined heat and power generation by 2020 are consistent with the AB 32 Scoping Plan goals and state compliance with proposed regulations on once-through cooling of coastal thermal power plants.

19 Energy and Environmental Economics, Inc.. January 2010. *Net-Energy Metering (NEM) Cost-Effectiveness Evaluation.*, Available at: http://www.ethree.com/documents/CSI/Final_NEM-C-E_Evaluation_with_CPUC_Intro.pdf.

Input	Description
Real discount rate	Residential: 3.43%, reflective of a low interest rate mortgage-style cost of borrowing Nonresidential: 6.13%, reflective of the commercial cost of borrowing

CHAPTER 3: Results

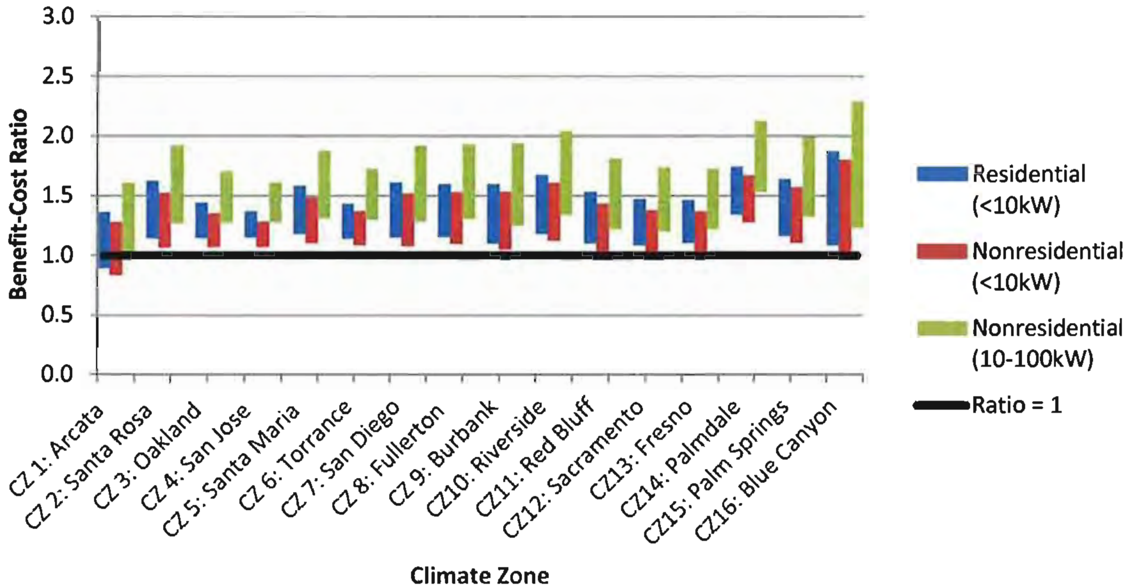
The cost-effectiveness of rooftop PV for newly constructed buildings is forecasted for 2014, 2017, and 2020. Cost-effectiveness results are shown using both Scenario 1 and Scenario 2 capital cost and solar capacity factor assumptions for both the average consumer analysis and the market-segmented analysis.

Average Consumer Results

The benefit-cost ratio is a way to summarize the results of the cost-effectiveness analysis and is calculated by dividing the benefits (levelized bill savings) by the cost (levelized cost of solar electricity). If the value of the benefit-cost ratio is greater than one with a reasonable level of certainty, then PV is determined to be cost-effective.

Figure 11 below shows the benefit-cost ratio for PV using the average consumer analysis for 2014. The bottom of the bars represents the results for Scenario 1 (higher cost solar); the top of the bars represents the results for Scenario 2 (lower cost solar). As can be seen, solar is generally cost-effective for both scenarios for residential customers and nonresidential customers installing systems with capacity between 10-100 kW. The notable exception to these results is Climate Zone 1, where the relatively weak solar resource means that PV is not cost-effective for any customers under Scenario 1. For nonresidential customers with system capacity below 10 kW, PV is cost-effective under Scenario 2 but is generally not cost-effective under Scenario 1. This is because the benefits of solar are smaller for nonresidential customers who pay lower average electricity rates, and the cost of solar installations smaller than 10 kW is higher per kW than the cost of larger systems.

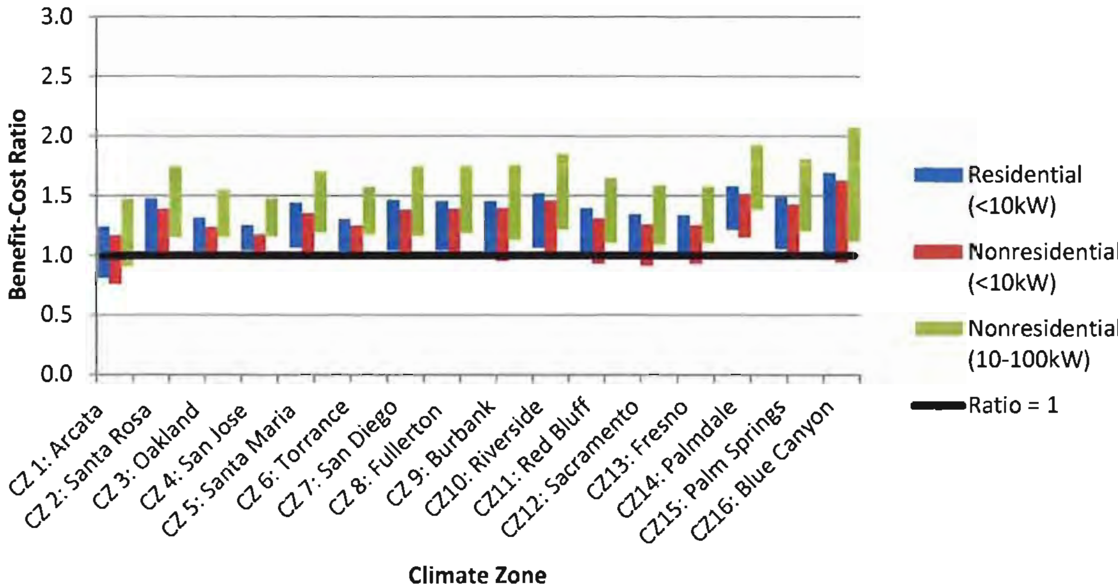
Figure 11: Average Consumer Cost-Effectiveness Results, 2014



Source: Energy and Environmental Economics, Inc.

Forecasting PV costs farther into the future, 2017 is expected to be the first year in which the federal investment tax credit (ITC) for PV will decrease from 30 percent to 10 percent. This means that while the capital costs of solar are expected to fall over time, the overall cost-effectiveness of PV declines slightly in 2017.

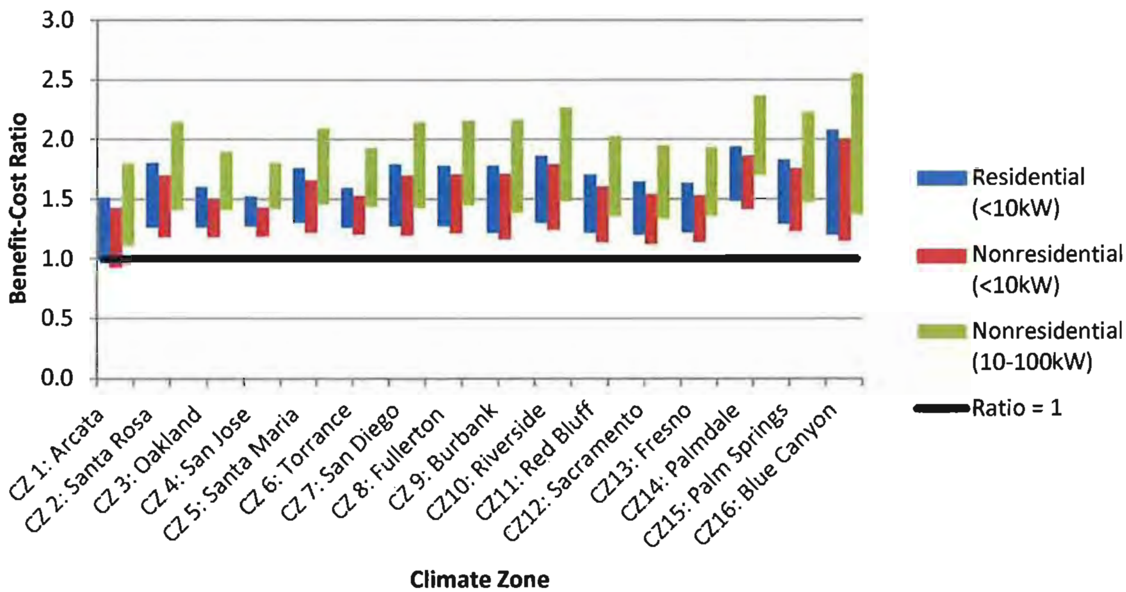
Figure 12: Average Consumer Cost-Effectiveness Results, 2017



Source: Energy and Environmental Economics, Inc.

By 2020, PV is expected to be more cost-effective than in 2014 due largely to the expected decrease in the installed capital cost of solar through continued technology development and learning. However, the lower ITC in 2020, at 10 percent, also reduces the cost-effectiveness of solar. Overall, by 2020, PV is expected to be cost-effective under Scenario 1 assumptions in all climate zones except for Climate Zone 1. Under Scenario 2 assumptions, PV is expected to be solidly cost-effective by 2020 in all climate zones.

Figure 13: Average Consumer Cost-Effectiveness Results, 2020



Source: Energy and Environmental Economics, Inc.

The results for 2020 are summarized in Table 9 below.

Table 9: Summary of Average Consumer Analysis Results, 2020

	Scenario 1: More expensive solar	Scenario 2: Less expensive solar
Residential *(<10 kW solar system)*	**Sometimes.** Solar is cost-effective in all climate zones except CZ1.	**Yes.** Solar is cost-effective in all climate zones.
Small commercial *(<10 kW solar system)*	**Sometimes.** Solar is cost-effective in all climate zones except CZ1.	**Yes.** Solar is cost-effective in all climate zones.
Large commercial *(10 – 100 kW solar system)*	**Yes.** Solar is cost-effective in all climate zones.	**Yes.** Solar is cost-effective in all climate zones.

Source: Energy and Environmental Economics, Inc.

Market-Segmented Results

The market-segmented analysis results vary between large and small residential and commercial customers because electricity rate structures are different for these different customer classes. Furthermore, the market-segmented savings of a given residential customer depends on how much electricity per month is consumed, due to the "inclining block" or tiered residential rate structure of most California utilities.

To select appropriate utility rates to use in the bill savings calculation in each climate zone, the authors assign each zone to one of California's three investor-owned utilities: PG&E, SCE, or SDG&E. The table below shows the assignment for each climate zone.

Table 10: Utility Assignment by Climate Zone

Climate Zone	Utility	Climate Zone	Utility
1: Arcata	PG&E	9. Burbank	SCE
2: Santa Rosa	PG&E	10. Riverside	SCE
3: Oakland	PG&E	11. Red Bluff	PG&E
4: San Jose	PG&E	12: Stockton	PG&E
5: Santa Maria	PG&E	13: Fresno	PG&E
6: Torrance	SCE	14: Palmdale	SCE
7: San Diego	SDG&E	15: Palm Springs	SCE
8: Fullerton	SCE	16: Blue Canyon	SCE

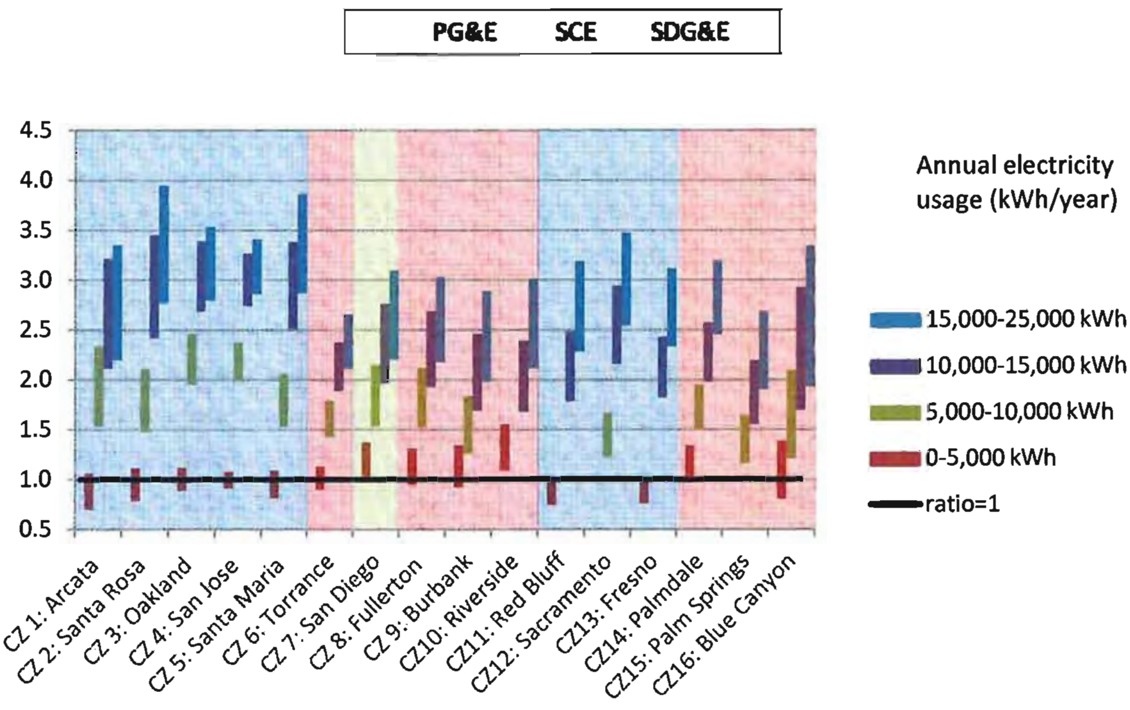
Source: Energy and Environmental Economics, Inc.

Residential Market-Segmented Results

The residential market-segmented cost-effectiveness results show dramatic differences based on a building's annual electricity consumption. This is due to California's utilities' tiered electricity rate structures. Tiered rate structures protect lower-income consumers and those who consume lesser amounts of electricity from higher electric rates. Tiered rates also make energy efficiency and rooftop PV more cost-effective for customers with higher electricity usage. The rates selected for this analysis represent single-family customers only. The results are not indicative of the cost-effectiveness of installing rooftop PV on multifamily residences.

In Figure 14 below, the benefit-cost ratios of PV systems are shown by climate zone and by a building's annual electricity consumption. A benefit-cost ratio above one determines that PV systems are cost-effective. As before, the bottom of the bars represents Scenario 1 (higher cost solar) assumptions and the top of the bars represents Scenario 2 (lower cost solar) assumptions.

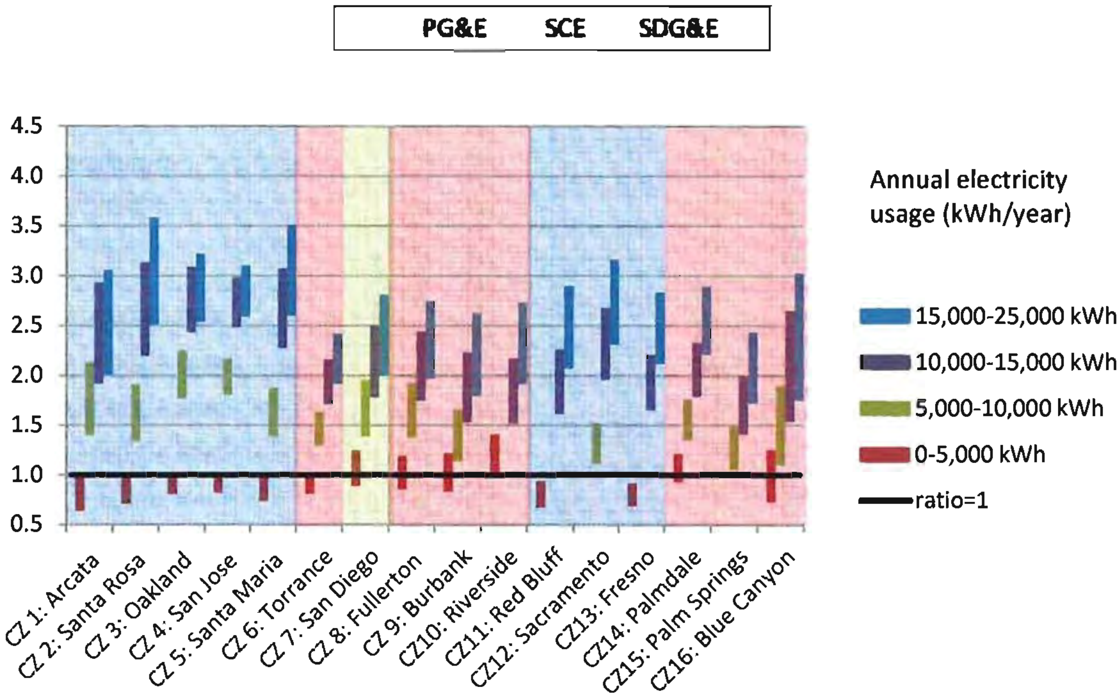
Figure 14: Residential Market-Segmented Results Based on a Building's Annual Electricity Consumption, 2014



Source: Energy and Environmental Economics, Inc.

PV is expected to be slightly less cost-effective in 2017 due to the reduction of the federal ITC at the end of 2016.

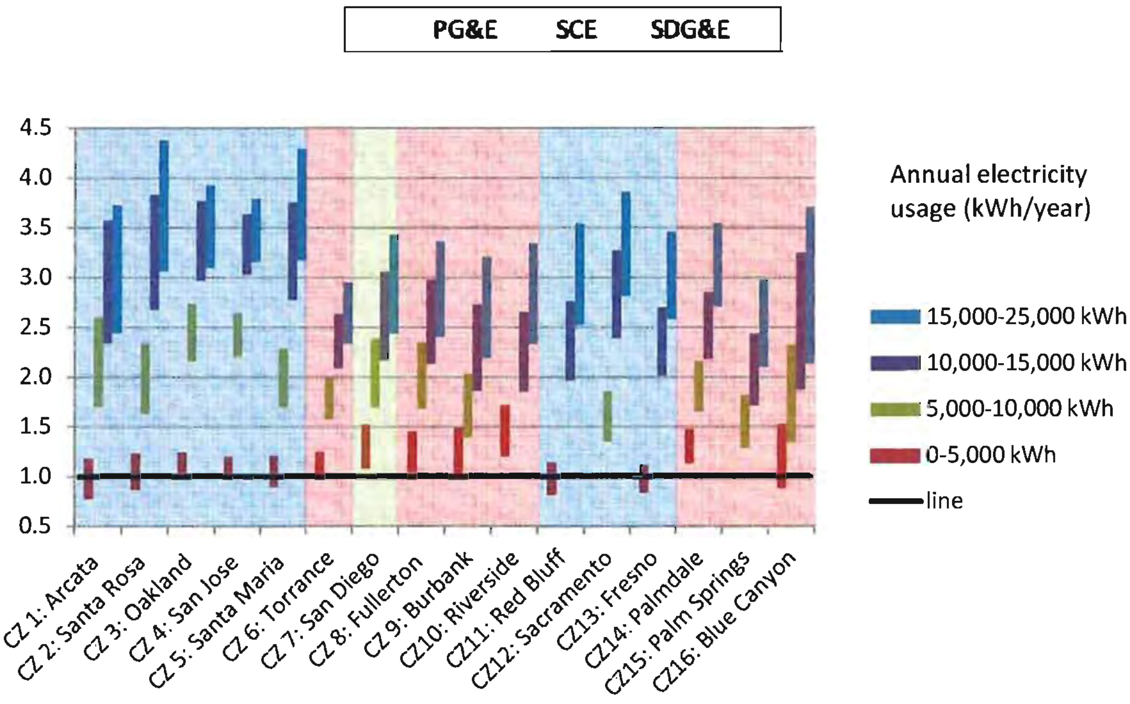
Figure 15: Residential Market-Segmented Results Based on a Building's Annual Electricity Consumption, 2017



Source: Energy and Environmental Economics, Inc.

By 2020, PV is expected to be slightly more cost-effective than in 2014, due to expected reductions in the capital cost of solar which counteract the reduction in the federal ITC.

Figure 16: Residential Market-Segmented Results Based on a Building's Annual Electricity Consumption, 2020



Source: Energy and Environmental Economics, Inc.

The cost-effectiveness results of the 2020 residential market-segmented analysis are summarized in the table below.

Table 11: Summary of Residential Market-Segmented Cost-Effectiveness Results, 2020

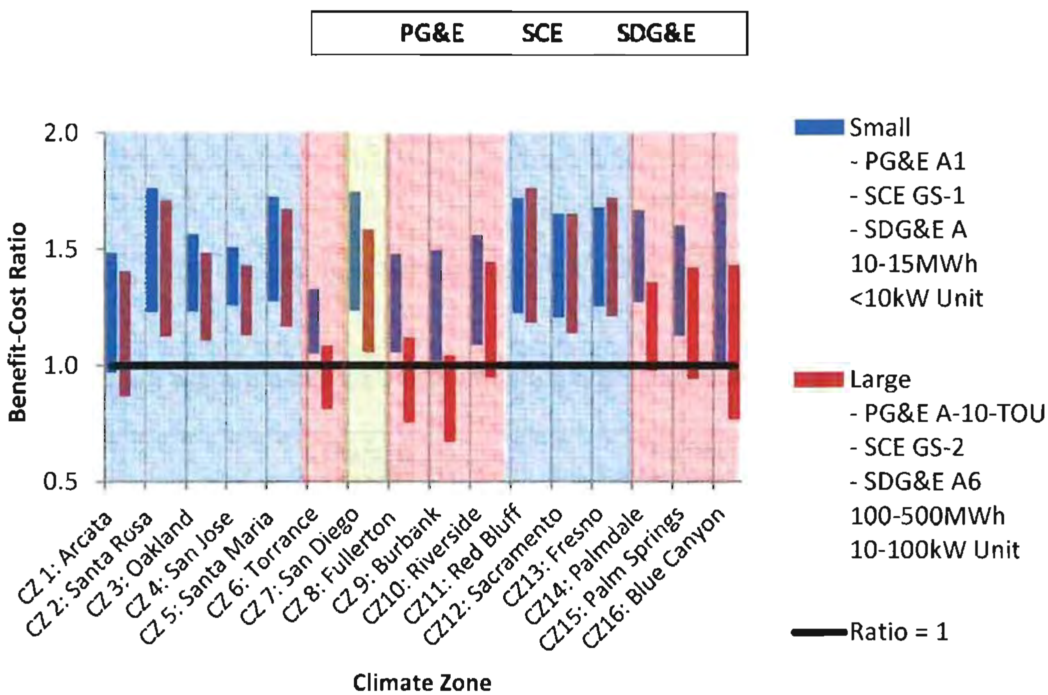
Customer class	Scenario 1 More expensive solar	Scenario 2 Less expensive solar
Residential, >5,000 kWh/year electric consumption	**Yes.** Cost-effective	**Yes.** Cost-effective
Residential, <5,000 kWh/year electricity consumption	**No.** Not cost-effective	**Yes.** Cost-effective

Source: Energy and Environmental Economics, Inc.

Commercial Market-Segmented Results

The commercial market-segmented results show that PV is expected to be less cost-effective as compared to installations on residential buildings. This is because, in California, commercial retail rates usually are lower than the upper tiers of residential rates. Commercial retail rate structures also vary more by utility than the residential rates do, making it difficult to generalize the cost-effectiveness results across climate zones. Figure 17 shows that solar is expected to be cost-effective for large commercial customers only under Scenario 2 (low-cost solar) and only in certain climate zones. The differences between climate zones are driven by both the natural solar resource and the applicable utility rate in that region. The results for climate zones in SCE's territory are notably less cost-effective, due to lower bill reductions driven by a combination of rate structure and rate levels for SCE's large commercial customers relative to the other utilities. For small commercial customers, Figure 17 shows that PV is cost-effective under Scenario 2 for all climate zones but is only cost-effective under Scenario 1 in a few climate zones.

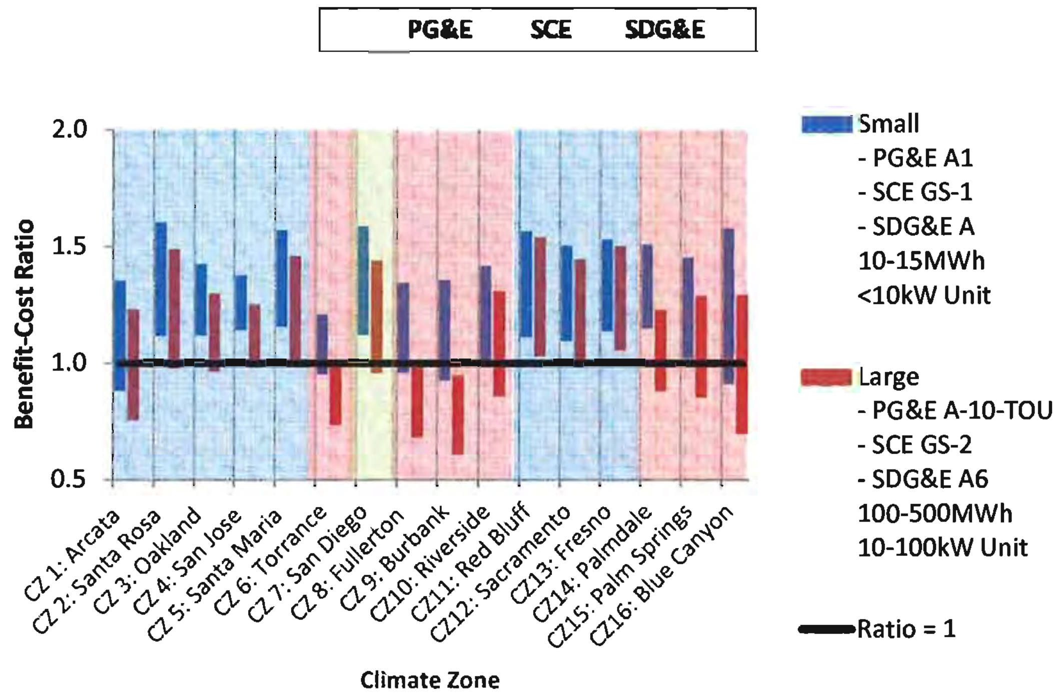
Figure 17: Commercial Market-Segmented Results, 2014



Source: Energy and Environmental Economics, Inc.

By 2017, PV is expected to be less cost-effective due to the reduction in the federal ITC in 2016.

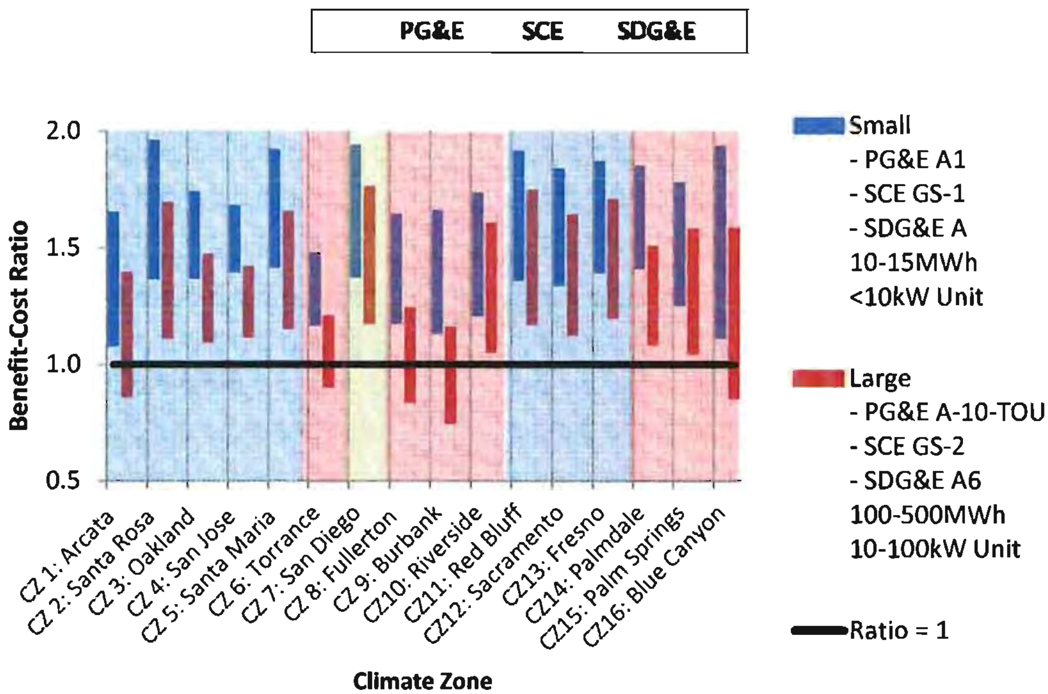
Figure 18: Commercial Market-Segmented Results, 2017



Source: Energy and Environmental Economics, Inc.

By 2020, PV is expected to be more cost-effective than in 2014 due to forecast reductions in the capital cost of rooftop PV for newly constructed buildings.

Figure 19: Commercial Market-Segmented Results, 2020



Source: Energy and Environmental Economics, Inc.

The cost-effectiveness results of the 2020 commercial market-segmented savings analysis are summarized in the table below.

Table 12: Summary of Commercial Market-Segmented Cost-Effectiveness Results, 2020

Customer class	Scenario 1 More expensive solar	Scenario 2 Less expensive solar
Medium to large commercial, 100 – 500 MWh/year	**Sometimes.** Solar is marginally cost-effective, depending on the utility service territory and climate zone.	**Yes.** Solar is cost-effective.
Small commercial, 10-15 MWh/year	**Yes.** Solar is cost-effective.	**Yes.** Solar is cost-effective.

Source: Energy and Environmental Economics, Inc.

CHAPTER 4: Summary of Results

Evaluating the cost-effectiveness of PV is a complex task, involving multiple uncertain variables. The authors have applied what they consider to be the best publicly available, unbiased assumptions about the future costs of PV. The conclusions in this report are based, in part, on the following key assumptions, which have a strong influence on the cost-effectiveness results:

- Increase in retail electricity rates, at 2.11 percent per year through 2020 and at 1.46 percent per year thereafter, in real terms.
- In the market-segmented analysis, existing utility retail rate structures (TOU rates and tiered rates) are maintained.
- Rooftop PV installations in the building standards are assumed to ***not*** qualify for state CSI and NSHP incentives but do qualify for the federal ITC.

Other key input assumptions that have a greater effect on the long-term, 2017 and 2020, results include:

- Steadily falling capital costs for PV through 2020 due to industry economies of scale and the effect of "learning by doing" on installer costs.
- Current net-energy metering rules remain applicable to all new PV installations.
- Maintenance of the federal investment tax credit for PV at 30 percent through 2016 and at 10 percent after 2016.

Any major changes to these assumptions could alter the cost-effectiveness of PV. The market-segmented results are especially sensitive to the structure of California utility rates and NEM rules, since they use utility bill savings to determine PV benefits and customer bill savings are very sensitive to rate structure under existing NEM policy. If the structure of utility rates is changed, for example by reducing energy-based charges and increasing demand-based and/or service charges, utility bill savings achieved installing PV could drop significantly. Similarly, if NEM were replaced with a different policy, for example, a flat compensation rate per kWh of distributed generation, the cost-effectiveness of solar may decrease. In this report's cost-effectiveness projections, the research team assumes that utility rates and the NEM program will not change other than the overall forecasted rate level increase.

Given the key assumptions above, the cost-effectiveness results for each of the two analysis approaches are shown in the following tables.

Average Consumer

Table 13 summarizes the results of the average consumer savings analysis for 2014, 2017 and 2020. The results are divided by PV cost scenario (lower cost or higher cost solar) and customer type (residential, small commercial, and large commercial).

Table 13: Average Consumer Savings Results

PV Cost Scenario	Consumer Type	2014	2017	2020
More expensive	Residential (<10 kW PV system)	Sometimes. Cost-effective in all climate zones except zone 1.	No. Not cost-effective in most climate zones.	Sometimes. Cost-effective in all climate zones except zone 1.
	Small commercial (<10 kW PV system)	Sometimes. Marginally cost-effective, depending on climate zone.	No. Not cost-effective in most climate zones.	Sometimes. Cost-effective in all climate zones except zone 1.
	Large commercial (10-100 kW PV system)	Sometimes. Cost-effective in all climate zones except zone 1.	Sometimes. Cost-effective in all climate zones except zone 1.	Yes. Cost-effective in all climate zones.
Less expensive	Residential (<10 kW PV system)	Yes. Cost-effective in all climate zones.	Yes. Cost-effective in all climate zones.	Yes. Cost-effective in all climate zones.
	Small commercial (<10 kW PV system)	Yes. Cost-effective in all climate zones.	Yes. Cost-effective in all climate zones.	Yes. Cost-effective in all climate zones.
	Large commercial (10-100 kW PV system)	Yes. Cost-effective in all climate zones.	Yes. Cost-effective in all climate zones.	Yes. Cost-effective in all climate zones.

Source: Energy and Environmental Economics, Inc.

In the "more expensive solar" scenario, average consumer savings results vary between the different sectors examined because the average retail rate is higher for residential than non-residential consumers, increasing the savings potential for residential consumers, while the cost of solar is less expensive per watt for commercial consumers who have adequate energy usage to install a system larger than 10 kW. In the "less expensive solar" scenario, PV is cost-effective for all customer types in 2020.

Market-Segmented

Residential

Table 14 shows the results of the residential market-segmented savings analysis for 2014, 2017, and 2020. The results are divided by PV cost scenario (lower cost or higher cost solar) and customer size (annual consumption less than 5,000 kWh, annual consumption greater than 5,000 kWh). These results are representative of single-family residential consumers only.

Table 14: Residential Market-Segmented Savings Results

PV Cost Scenario	Consumer Type	2014	2017	2020
More expensive Solar	Residential, <5,000 kWh/year electric consumption	No. Not cost-effective.	No. Not cost-effective.	No. Not cost-effective.
	Residential , >5,000 kWh/year electric consumption	Yes. Cost-effective.	Yes. Cost-effective.	Yes. Cost-effective.
Less expensive Solar	Residential, <5,000 kWh/year electric consumption	Sometimes. Marginally cost-effective.	Sometimes. Marginally cost-effective.	Yes. Cost-effective.
	Residential , >5,000 kWh/year electric consumption	Yes. Cost-effective.	Yes. Cost-effective.	Yes. Cost-effective.

Source: Energy and Environmental Economics, Inc.

The market-segmented results highlight the importance of rate structure in determining whether solar is cost-effective. The average consumer analysis projects that PV will be cost-effective for all residential customers in 2020, based on statewide average electricity rates. The market-segmented results show that with California's current tiered residential rates, a customer's annual energy consumption is an important consideration in measuring the cost-effectiveness of solar. This result is particularly relevant for new residential construction, where energy efficiency standards are likely to result in lower annual electricity usage before the addition of a PV installation.

Commercial

Table 15 shows the results of the commercial market-segmented savings analysis for 2014, 2017, and 2020. The results are arranged by PV cost scenario (lower cost or higher cost solar) and customer size (annual consumption 10,000-15,000 kWh, annual consumption greater than 100,000-500,000 kWh).

Table 15: Commercial Market-Segmented Savings Results

PV Cost Scenario	Consumer Type	2014	2017	2020
More Expensive Solar	Small commercial, 10,000-15,000 kWh/year electric consumption	Sometimes. Cost-effectiveness depends on climate zone and utility service territory.	Sometimes. Cost-effectiveness depends on climate zone and utility service territory.	Yes. Cost-effective.
	Large commercial, 100,000-500,000 kWh/year electric consumption	Sometimes. Cost-effectiveness depends on climate zone and utility service territory.	No. Not cost-effective.	Sometimes. Cost-effectiveness depends on climate zone and utility service territory.
Less Expensive Solar	Small commercial, 10,000-15,000 kWh/year electric consumption	Yes. Cost-effective.	Yes. Cost-effective.	Yes. Cost-effective.
	Large commercial, 100,000-500,000 kWh/year electric consumption	Yes. Cost-effective.	Sometimes. Cost-effectiveness depends on climate zone and utility service territory.	Yes. Cost-effective.

Source: Energy and Environmental Economics, Inc.

Comparing the average consumer and market-segmented results for the commercial sector also demonstrates the effect of utility rates on solar's cost-effectiveness. In the average consumer analysis, the benefit of solar is based on average retail rates for all commercial consumers statewide. As a result, solar looks more cost-effective for large commercial consumers, who can purchase larger PV systems at a lower cost per watt. In the market-segmented analysis, it becomes apparent that large commercial customers actually pay retail rates that are less conducive to solar cost-effectiveness than the rates paid by small commercial customers, so that solar is less cost-effective for large customers than small despite the lower cost to install PV.

ACRONYMS

Acronym	Definition
ACM	Alternative Calculation Method
ARB	California Air Resources Board
Energy Commission	California Energy Commission
CO_2	Carbon dioxide
CPUC	California Public Utilities Commission
CSI	California Solar Initiative
DC	Direct current
GHG	Greenhouse gas
ITC	Investment tax credit
kW	Kilowatt
kWh	Kilowatt-hour
LADWP	Los Angeles Department of Water & Power
LCOE	Levelized cost of energy
NREL	National Renewable Energy Laboratory
NSHP	New Solar Homes Partnership
PG&E	Pacific Gas and Electric
PPA	Power purchase agreement
PV	Photovoltaic
RES	Renewable Electricity Standard
RPS	Renewables Portfolio Standard

Acronym	Definition
SCE	Southern California Edison
SDG&E	San Diego Gas & Electric
SMUD	Sacramento Municipal Utility District
TDV	Time dependent valuation
TOU	Time of use

COPY

Notice of Exemption

To: ____ Office of Planning and Research
1400 Tenth Street, Room 121
Sacramento, CA 95814

__X__ County Clerk
County of Los Angeles
Environmental Filings
12400 E. Imperial Hwy, Rm 2001
Norwalk, CA 90650

From: Planning Department
City of Lancaster
44933 North Fern Avenue
Lancaster, CA 93534

(Date received for filing)

Project Title: Mandatory Requirements for the Implementation of Solar Energy Systems

Project Location - General: City of Lancaster, County of Los Angeles, State of California

Project Location - Specific: City-wide

Project Description: Amend Lancaster Municipal Code Section 15.28.020 to adopt mandatory requirements for the implementation of solar energy systems, providing standards and procedures for builders of new dwelling units to install solar energy systems in an effort to achieve energy savings and greater usage of alternative energy.

Name of Public Agency Approving Project: City of Lancaster

Name of Person or Agency Carrying Out Project: City of Lancaster

Exempt Status: (*check one*)

	Ministerial (Sec. 21080(b)(1); 15268):
	Declared Emergency (Sec. 21080(b)(3); 15269(a)):
	Emergency Project (Sec. 21080(b)(4); 15269(b)(c)):
	Categorical Exemption. State type and section number:
	Statutory Exemptions. State type and section number:
X	Other: Sec. 15061(b)(3); 15308

Reasons why project is exempt: The proposed ordinance is intended to preserve and enhance the environment of the City of Lancaster and is not subject to the California Environmental Quality Act pursuant to Section 15061(b)(3) of the CEQA Guidelines, because there is no possibility that the ordinance may have a significant negative impact on the environment and is exempt from the requirements of CEQA pursuant to Section 15308 of the CEQA Guidelines, which exempts actions taken by regulatory agencies for the enhancement and protection of the environment.

Lead Agency
Contact Person: Chuen Ng **Area Code/Telephone:** (661) 723-6100

Chuen Ng | Associate Planner | October 23, 2013

Signature | Title | Date

Date received for filing at OPR:

Revised 2009

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CITY OF LANCASTER
Planning Department
44933 North Fern Avenue
Lancaster, CA 93534
(661) 723-6100

October 31, 2013

LETTER OF TRANSMITTAL

TO: L.A. County Clerk
Environmental Filings
12400 E. Imperial Highway, Room 2001
Norwalk, California 90650

ATTENTION: Ms. L. Arterberry (562) 462-2057

SUBJECT: Notice of Exemption for Mandatory Requirements for the Implementation of Solar Energy Systems

REMARKS: Enclosed please find a check for $75.00 to file the enclosed Notice of Exemption for Mandatory Requirements for the Implementation of Solar Energy Systems in the City of Lancaster, California.

Pursuant to Sections 21092.3 and 21152 of the Public Resources Code, please post this notice within 24 hours of receipt.

We are submitting one original notice; please return the copy for our files indicating the document filed date. A self-addressed stamped envelope is enclosed for your convenience.

Sincerely,

Marion Coleman

Marion Coleman
Secretary II

Enclosures

Santa Monica mandates solar PV on new buildings

04. MAY 2016 | APPLICATIONS & INSTALLATIONS, FINANCIAL & LEGAL AFFAIRS, MARKETS & TRENDS | BY: CHRISTIAN ROSELUND

The new mandate is the fifth by a California municipality, and will apply to both residential and commercial buildings.

Santa Monica is the fifth municipality in California to pass such a requirement.

On April 27, the city council of Santa Monica, California voted to require rooftop solar PV systems on all new construction in the city, both residential and commercial. The ordinance will go into effect at the end of May.

The beachfront city of 90,000 residents in Los Angeles County is the fifth in the state of California to include this mandate, following the cities of Culver City, Lancaster, Sebastopol and San Francisco, which passed a similar ordinance a week prior. However, Santa Monica says that its mandate is stricter than any of these except San Francisco's.

New single family homes will be required to install a minimum of 1.5 watts of solar PV for every square foot of the building, meaning that a 2,000 square foot (186 square meter) home would need a minimum of 3 kW of solar PV. Multi-family buildings, non-residential buildings and hotels will be required to install 2 watts of PV for every square foot of building footprint.

The city has argued that the benefits of installing solar outweigh the additional cost. The city estimates that new solar PV is expected to add 2.8% to the cost of a single-family home while long-term electricity costs will be reduced an average of 65%, ultimately meaning savings for homeowners.

Santa Monica has very expensive real estate compared to other parts of the United States, and as such up-front costs will likely be borne by high-income homeowners.

The requirement is also in line with Santa Monica's commitments to sustainability, including its plans to reach carbon neutrality by 2050. "This is not only the smart thing to do, it is also imperative if we are to protect our kids and grandkids from the worst effects of climate change," states Santa Monica Sustainability Manager Dean Kubani.

In 2008 Culver City, also in Los Angeles County, passed a requirement that all new buildings must host solar PV in 2008. This was followed by Lancaster, California, which was the first to require PV on new residential buildings in 2013. Sebastopol's requirement came shortly thereafter.

The idea of mandating solar is not entirely new. A number of cities around the world, including Beijing, require the use of solar water heating in new buildings. Israel passed the first mandate at the national level in the 1980s, as a response to political concerns over imported oil.

Related News:

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- The pv magazine weekly news digest 06.05.2016

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There is even a difference for single family and multi-family, interesting.

MARKETS & POLICY

Solar Mandate Embraced by a Second California City

Photo Credit: Solar Works (http://www.solarworksca.com)

Sebastopol, in Sonoma County, Calif., joins Lancaster in backing a solar mandate for new construction, with an ordinance that is much stronger.

by Earthtechling, Pete Danko
May 14, 2013

Forget about your complicated tax credits, your net metering, and your feed-in tariff schemes. Let's go solar the straightforward way: Mandate it!

Lancaster (http://www.greentechmedia.com/articles/read/Lancaster-CA-Becomes-First-US-City-to-Require-Solar), Calif., in Los Angeles County, did so (http://earthtechling.com/2013/03/solar-required-in-california-city-thanks-to-gop-mayor/) earlier this year, and the move had the feel of a one-off, the unique inspiration of a Republican mayor with an admirable love for renewable energy and a hankering for attention. But now the town of Sebastopol, in the apple- and grape-growing rolling hills of western Sonoma County, is following suit with a much more aggressive ordinance [PDF (http://ci.sebastopol.ca.us/sites/default/files/events-and-meetings/agenda_item_number_5_pv_ordinance.pdf)], suggesting that solar-by-fiat might be more viable as policy than we thought.

Sebastopol leaders this week unanimously backed an ordinance that, pending final approval later this month, will require residential *and* commercial buildings (Lancaster's measure covers only residential (http://www.greentechmedia.com/articles/read/Lancaster-CA-Becomes-First-US-City-to-Require-Solar)) to include a solar-power-generating system or pay an in-lieu fee.

Under the ordinance, how much solar a building will need can be calculated by one of two methods.

Two watts of capacity per square foot will do the trick -- so we're talking a 5-kilowatt system for a 2,500-square-foot home. That's a pretty standard-sized setup. Compare that to Lancaster (http://www.earthtechling.com/tag/lancaster), which only requires 1 kilowatt per home.

In Sebastopol, a system would also qualify if its output meets three-quarters of the building's electrical load on an annual basis. The ordinance also includes a provision that allows officials to exempt buildings from the requirement if a site isn't conducive to solar, but a fee or other energy-saving measures could be required.

Mayor Michael Kyes told the *Press-Democrat (http://www.pressdemocrat.com/article/20130507/ARTICLES/130509624/1350?p=2&tc=pg)* in nearby Santa Rosa that Sebastopol, with a population of around 7,500, already had some 1.2 megawatts of installed solar capacity. "This ordinance will add to it," the mayor said.

According to the *Press-Democrat*, there was a citizen objection to the solar requirement registered at the Sebastopol Council meeting; someone said "mandatory sort of implies coercion" (a sentiment it's hard to argue with). But of course all manner of building requirements are essentially coercive, and Councilman Robert Jacob seemed to capture the sentiment of the town leaders when he said that "this ordinance is not only cost-saving…it's the responsible thing to do."

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Editor's note: This article is reposted (http://www.earthtechling.com/2013/05/solar-mandate-embraced-by-second-california-city/) in its original form from EarthTechling (http://www.earthtechling.com/). Author credit goes to Pete Danko.

Earthtechling

STAFF REPORT

DATE: June 24, 2014

TO: City Council

FROM: Mike Webb, Community Development and Sustainability Director
Mitch Sears, Sustainability Programs Manager
Eric Lee, Assistant Planner

SUBJECT: Renewable Energy Ordinance

Recommendation

1. Determine that the proposed Renewable Energy Ordinance is exempt from environmental review under CEQA and direct staff to file a Notice of Exemption (Attachment 2)

2. Introduce the attached ordinance adopting the proposed Renewable Energy Ordinance, (Attachment 1). The ordinance will be added to the City's Municipal Code, Chapter 8, Buildings

Summary and Background

The proposed Renewable Energy Ordinance would add requirements and establish standards for the installation of solar photovoltaic (PV) systems on all new single-family dwellings and duplexes. The purpose of the ordinance is to increase the use of renewable energy sources, reduce energy costs and installation costs for homeowners, help the City achieve its targets for the reduction of greenhouse gas emissions, and provide greater clarity and certainty to developers about project requirements. As part of the review of new residential projects, the City has strongly encouraged the integration of PV in the projects. This ordinance would establish a minimum PV requirement, but it would not prevent a builder from installing a greater amount of PV or prevent a greater amount being required via a Development Agreement. The new ordinance would be located in Chapter 8 (Buildings) of the Municipal Code.

The required solar systems would range in size from 1.5 kW to 3.5 kW depending on the house size and would be designed and installed as part of the initial construction. It is expected that the required systems would generate approximately 50 percent of the average household electrical needs. The offset could be greater if additional efficiencies are built into the building envelope and depending on the particular household's lifestyle and energy needs. The ordinance provides for alternative compliance measures if other renewable energy sources are used, as well as an exemption from the requirements for certain situations or hardship circumstances

This ordinance was based on efforts of the Natural Resources Commission (NRC) Energy Subcommittee which drafted and proposed an initial ordinance. The proposed ordinance is based on current and foreseeable conditions related to PV solar systems, research on similar ordinances, consistency with City requirements, outreach to interested and affected parties, and additional review by the Natural Resources Commission and Planning Commission.

Staff believes that the proposed ordinance establishes reasonable requirements that are economically feasible. Many new residential developments currently offer solar photovoltaics as a standard item or as an optional feature. PG&E's net energy metering program and financial incentives have helped to make solar systems more widely accessible. The proposed ordinance takes into account the various objectives and related concerns raised. It provides flexibility on how to meet the requirement and allows the developer or builder to determine whether the system would be owned by the homeowner or owned by a third party as a leased system with no upfront cost to the homeowner. After an evaluation period for the ordinance, it may be appropriate to consider expanding the requirement to other types of development, such as live-work units, multi-family, or commercial buildings. Alternately, should circumstances or costs related to solar photovoltaics change significantly for the worse, other adjustments may be needed.

Fiscal Impact

The proposed requirement for solar photovoltaics on new residential dwellings could result in an increase in the housing cost for the homeowner by the incremental cost of the solar system, but no direct fiscal impact to the City of Davis from the proposed ordinance would be expected except for staff time that was required to process the ordinance. Staff time to implement and enforce the ordinance requirements would be included as part of the fees for the required building permits.

Commission Review

Natural Resources Commission

On April 28, 2014, the Natural Resources Commission (NRC) reviewed a draft of the proposed Renewable Energy Ordinance for comment. Clarifications and minor changes were made based on their comments.

On May 28, 2014, the Natural Resources Commission (NRC) considered the revised ordinance and voted 4-1 to recommend adoption of the ordinance to the City Council with minor comments and further clarifications that have been incorporated. One public comment was made at the meeting urging support of the ordinance adoption and an exploration of pilot project opportunities for multi-family and commercial developments for future expansion of the ordinance. The vote in opposition to the proposed ordinance was made based on comments that the ordinance should be simplified and that it should include requirements for multi-family and commercial developments. The NRC expressed a general desire for continued efforts to expand the ordinance to include other types of development, but the majority was satisfied with the proposed ordinance as a starting point.

Planning Commission

Planning Commission review of the proposed ordinance was not required. However, staff presented the Planning Commission of the ordinance proposal and general details as an informational item at the Planning Commission meeting on April 9, 2014 for any comments or questions. No concerns or substantive comments were made.

Staff Review

City staff review included discussion and analysis of the ordinance requirements with planning, building, affordable housing, the urban forest manager, and legal counsel to identify and address potential issues.

Public Outreach

As part of development of this ordinance, staff contacted a number of local developers and solar experts to discuss the scope of the ordinance and its general requirements. While there were questions and some concerns, comments were generally supportive provided the ordinance had reasonable requirements and retained sufficient flexibility. Staff believes that the ordinance as proposed adequately addresses the issues raised.

Public Noticing

The project was noticed in accordance with City requirement and included publication of a notice of this public hearing in the Davis Enterprise. Interested parties which included local developers and solar experts contacted by staff were also provided notice of the public hearing.

Public Comments

In discussions with local developers and solar experts about the proposed ordinance, the general consensus was that the installation of solar PV on new homes is a feature that many homebuyers appreciate and is currently being offered on many new homes because of the interest and financially feasibility. The main concern raised is the potential uncertainty about the financial incentives encouraging solar PV installation and the financial consequences if and when the incentives go away. Other comments or concerns included:

- Wanting to retain flexibility for the developer and homebuyer for the installation decision and system sizing.
- Ensuring that it did not require ownership of the solar system, but allowed a variety of programs such as leasing options.
- Concern about a one-size-fits-all approach and caution about oversizing the system or requirements.
- Comment that if left up to the homeowner, the homeowner is more likely to choose a larger system better sized to their needs rather than a minimum system requirement provided by the developer.
- Ensuring the financial feasibility of the requirement.
- Concern about additional requirements on new construction and comment that requirements on existing homes needed to be looked at.
- Comments that the required system sizes appeared reasonable.

Two written comments were received and are included as Attachment 3.

Ordinance Summary

The following table lists the solar PV requirements from the proposed ordinance. This tiered system approach relies on the house size to determine the minimum system size. While there are other important factors such as the number of residents and lifestyle which determine a household's energy use, there is a correlation of energy use to house size because of the heating and cooling needs and lifestyle choices. As a general measure, house size is a reasonable guide.

Proposed Solar PV Requirement

Single-Family or Duplex Unit Size	Minimum Required System Size
1,500 sq. ft. or less	1.5 kW
1,501 to 2,000 sq. ft.	2.0 kW
2,001 to 2,500 sq. ft.	2.5 kW
2,501 to 3,000 sq. ft.	3.0 kW
More than 3,000 sq. ft.	3.5 kW

In addition to the specific PV requirement, other ordinance provisions include:

- Exempts existing residential and commercial buildings, accessory dwelling units, and new commercial buildings.
- Flexibility in an alternative compliance provision if other types of renewable energy systems are employed for the residence.
- Exemption provision in the case of solar shading, tree preservation, lack of roof space, undue system expense, and hardship situations.
- Flexibility as to whether the system is owned or leased.
- Provisions for informational requirements needed to ensure compliance.
- General location and design standards to provide certainty about the requirements and to minimize potential conflicts.

The PV requirement would complement the CalGreen Tier 1 building requirements which are currently mandatory for construction in the City of Davis.

<u>Projects Subject to Proposed Ordinance</u>
The proposed ordinance would apply to all new single-family dwellings and duplexes, including affordable dwellings. It would <u>not</u> apply to:

- Existing residential dwellings.
- New or existing multi-family dwellings or non-residential buildings.
- Mixed-use, live-work units
- Accessory dwelling units.

New single-family subdivision projects would be subject to the ordinance requirements. However, existing approved subdivisions such as the Cannery Project, Grande Subdivision, and Chiles Ranch Subdivision with approved entitlements and development agreements would <u>not</u> be subject to the ordinance, unless amendments to the approvals are required.

<u>Alternative Compliance and Exemption Provisions</u>
The proposed ordinance recognizes that other renewable energy sources and technologies are also available or may be available in the future. The alternative compliance provision allows a builder to meet the requirements of this ordinance by other means besides on-site solar. It would require appropriate documentation and information to be submitted in order to prove that the alternative compliance is equivalent.

Additionally, in certain cases when the requirements of this ordinance cannot be fully met due to site or design constraints (roof space, shading), conflicts with other city policies (tree preservation), or other undue hardship or expense, the department director is empowered to waive or reduce the requirements. A justification and supporting documentation would need to be submitted and would include an analysis of alternative compliance measures or an economic analysis if there is a cost issue. Given that it is possible to install a leased solar system with little or no upfront costs provided there is adequate solar access and structural design costs to handle the additional load are minimal with the new construction, staff does not expect the cost issue to be significant. Should financial incentives or solar costs change so that it becomes uneconomical, an economic exemption may be warranted.

Background Assumptions and Information

- The average cost and installation of a PV system (less than 10 kW) is $5.68 per watt, according to the Go Solar California website. This is compared to approximately $12 per watt for a residential system in 1998. It puts a PV system in the range of $5,000-$6,000 per kW before any incentives. The cost to install a system on a new home is generally less than the cost to retrofit it on an existing house.
- Current system costs would be offset by federal tax credits. Federal tax credits currently cover 30% of the system cost and are scheduled to be reduced to 10% in 2017. It is assumed that the continued falling cost of solar systems would compensate for the reduction or elimination of tax credits. Additionally, energy costs are expected to continue rising which would make solar systems more competitive.
- Recent adoption of the Property Assessed Clean Energy (PACE) program by Yolo County provides a new mechanism for property owners to finance clean energy systems such as solar energy through their property tax assessment.
- It is assumed that PG&E's Net Energy Metering (NEM) program or a similar program will continue to be in place. The California Public Utilities Commission recently extended the NEM program for 20 years for customers who interconnect before July 2017. The NEM program allows customers to average their usage out on an annual basis by running their electrical meter backwards when production exceeds consumption. After the 2017 date or at the end of the 20-year grandfathering period, a new yet-to-be developed program would apply.
- The proposed requirements are not trying to offset 100% of a household's electrical needs because of the difficulty in appropriately sizing a system for a new household as well as the reduced financial incentive of offsetting the lower-tiered electrical rates. It is expected the proposed requirements would offset approximately 50% of the average household's electricity needs. See Figure 1 below based on estimates provided by the Davis Energy Group and included as Attachment 4.

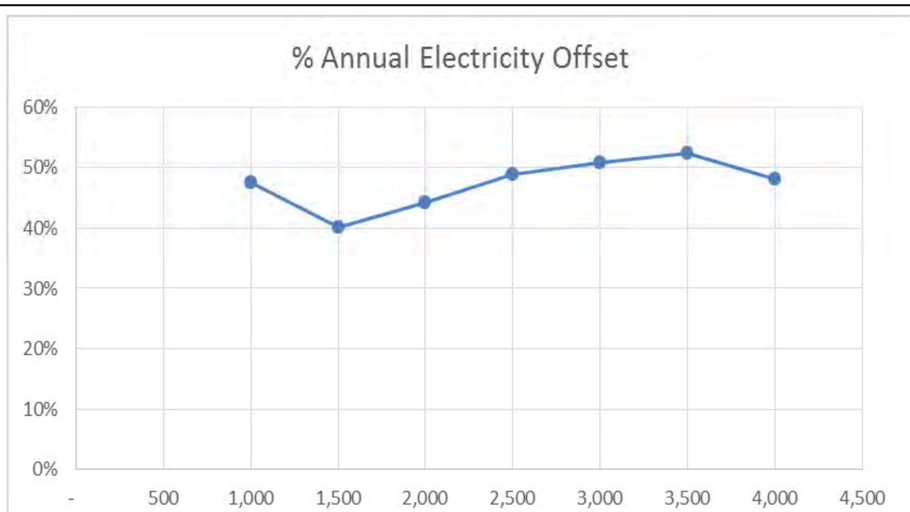


Figure 1. Percent of Average Annual Electricity Offset by Proposed Ordinance per House Size (sq. ft.)

Comparison to Approved Projects and Other Jurisdictions

PV requirements on several projects in the City and other jurisdictions are provided below for comparison purposes.

- Chiles Ranch subdivision is required to provide a minimum of 37 kW of household PV among other measures as part of the greenhouse gas (GHG) reduction plan for the subdivision of 76 detached dwellings, 10 attached dwellings and 22 condominium units.
- Willowbank Park subdivision was required to provide a minimum of 23.5 kW of PV in the subdivision. With the 22 market rate units approved that would average out to 1.07 kW per unit. Several units did not choose to have PV installed, but the subdivision exceeds the project requirement. A typical system is the 2.7 kW system installed at 4503 Blue Oak Place which is a 2,678 sq. ft. house.
    - Under the proposed ordinance and assuming an average unit size in 2,001-2,500 square-foot range with a 2.5 kW system requirement on each unit, the total for the 22 units would be 55 kW. This does not include the 4 affordable units which would also be subject to the requirements.
- The Cannery project is required to provide a minimum of 1.5 kW of PV per residential unit. It applies to a variety of house types sizes. The Cannery also provides for zero net electric and zero net energy options to buyers. There are additional PV requirements for common areas. Requirements to encourage greater early adoption are also built into the project.
- Resolution 09-043 adopted in 2009 established greenhouse gas emission reduction standards and targets for new residential projects. It identified mitigation measures to reduce emissions to meet 1990 target levels. One of the possible mitigation measures was use of solar PV on-site or via a solar farm. To receive full-credit mitigation it identified an average household PV system size of 4 kW.
- The City of Lancaster, CA recently adopted solar PV requirements for new homes based on the lot size. The minimum requirement ranged in size from 0.5 to 1.5 kW. Under the ordinance, a single-family home on a lot 15,000 square feet in size or larger would be required to install a 1.5 kW PV system.
- Lennar Homes has a development in Woodland, CA called Camellia in the Spring Lake subdivision which provides a 3 kW solar PV system as a standard feature on all of their homes. Houses range in size from 2,616 to 2,981 square feet. It is a lease-type program with no upfront cost to the homeowner with an ownership option if the homeowner would prefer to purchase the system.

Additional Future Considerations

Areas for future consideration in the ordinance include:

- Solar water heater requirements.
- Electrical Vehicle charging needs. A standard condition of approval on new subdivisions already requires pre-wiring in the garage for EV charging.
- Requirements for new multi-family and new commercial buildings.
- Requirements for existing residential and commercial buildings.

Expanding the requirement to other types of development and existing buildings can be considered, but it would raise some practical issues and possible legal issues. It would require a more significant investment of staff time and effort as well as greater public outreach to fully evaluate. It should also be recognized that other options may exist for helping the City achieve its objectives, such as energy savings and GHG emission reductions through building upgrades and other efficiency measures or an option to purchase from a solar farm should one be developed.

Cost Effectiveness Study

A cost effectiveness study is required for any energy code requirement in California. This will be conducted prior to the effective date of the ordinance on January 1, 2015.

Environmental Review

The City has determined that the proposed project is categorically exempt from further environmental review pursuant to CEQA Guidelines Section 15308 which categorically exempts actions taken by regulatory agencies for the protection of the environment and Section 15303 which categorically exempts the construction and installation of minor accessory structures and equipment. Furthermore, pursuant to CEQA Guidelines Section 15061(b)(3), CEQA only applies to projects which have the potential for causing significant effects on the environment. This ordinance is intended to help preserve and enhance the environment and there is no possibility that it will have a significant negative effect on the environment.

Whereas the proposed ordinance would require the installation of solar photovoltaics on new single-family dwellings and duplexes and reduce the consumption of non-renewable energy sources and associated greenhouse gas emissions, it would therefore help to reduce or mitigate environmental impacts related to climate change and help to protect the environment. The direct physical change related to the ordinance requirements would consist of the installation of solar panels and ancillary equipment on residential dwellings. The solar systems would be accessory to the residential use and structures and would not result in any adverse environmental effects. A Notice of Exemption will be filed upon approval of the project and is included as Attachment 2.

Attachments

1. Proposed Renewable Energy Ordinance
2. Notice of Exemption
3. Public Comments
4. Estimated Average Energy Offset, Davis Energy Group

ATTACHMENT 1

ORDINANCE NO. _____

ORDINANCE AMENDING CHAPTER 8 OF THE DAVIS MUNICIPAL CODE TO ADD ARTICLE 8.20 ESTABLISHING A RENEWABLE ENERGY ORDINANCE

WHEREAS, the City of Davis ("City") pursuant to its Climate Action and Adaptation Plan intends to become carbon neutral no later than 2050; and

WHEREAS, the Energy Committee of the Natural Resource Commission of the City of Davis, in their titled "Fostering Clean Energy Development in the Urban Forest," documented climate change impacts from rising greenhouse gas emissions which include atmospheric CO2 exceeding 400 ppm for the first time in three million years and average daily temperatures projected to increase by as much as 4 degree Celsius this century resulting in sea-water intrusion, desertification, food insecurity, extreme heat waves, loss of agricultural production, extended drought, species loss, ocean acidification, increased disease risk; and the report recognized the opportunities and feasibility of increasing the use of renewable energy sources on individual buildings; and

WHEREAS, continued development of new buildings in the City that do not incorporate renewable energy generation will lock residents of the City into an insecure, inefficient and high-carbon energy future; and

WHEREAS, rooftop solar reduces the need for distribution system upgrades, reduces peak electricity demand, reduces transmission losses, avoids costly expansions of long-distance transmission systems, and allows undeveloped land to be used for other economic, social or environmental purposes; and

WHEREAS, according to the US Department of Energy, the reported installed median system price for residential and commercial solar photovoltaic systems has declined an average of 6% to 7% per year from 1998 to 2012 and by 6% to 14% from 2011 to 2012, depending on system size; and

WHEREAS, numerous residential projects have been built over the past several years that incorporate rooftop solar demonstrating its economic and technical feasibility; and

WHEREAS, renewable energy generation can be installed at considerably less expense and more efficiently when the installation is done as a part of the original construction and can be done in way that minimizes aesthetic effects; and

WHEREAS, installing on-site renewable generation fixes energy costs and insulates owners from increases in energy prices and escalating utility costs; and

WHEREAS, City residents have reported that the installation of a roof-top PV system has increased their awareness of their personal energy use, leading to potential behavior shifts and the reduction of overall household energy use; and

WHEREAS, this Renewable Energy Ordinance will establish consistent standards and will provide predictability for new housing in the City; and

WHEREAS, the Davis Natural Resources Commission reviewed the Ordinance on April 28, 2014 and May 28, 2014 and voted 4-1 to recommend that the City Council adopt the Ordinance; and

WHEREAS, the City Council of the City of Davis held a public hearing on June 24, 2014 to take public comments and consider adoption of the Ordinance.

NOW, THEREFORE, THE CITY COUNCIL OF THE CITY OF DAVIS DOES HEREBY ORDAIN AS FOLLOWS:

SECTION 1. Findings
The City Council of the City of Davis hereby finds:

1. The City of Davis Natural Resources Commission held public meetings on April 28, 2014 and May 28, 2014 to consider the ordinance and recommended approval of the ordinance by the City Council.

2. The City of Davis City Council held a public hearing on June 24, 2014 to take public comments and consider the ordinance.

3. That the proposed ordinance is in general conformance with the City of Davis General Plan, in particular supporting the General Plan policies related to protection of the environment and to increasing renewable energy generation capacity while decreasing energy demand.

4. That the public necessity, convenience and general welfare require the adoption of the proposed ordinance, in that the ordinance reduces the community's reliance on non-renewable energy sources that contribute greenhouse gas emissions and it provides consistent standards for the installation of solar photovoltaic systems and ensures minimal negative aesthetic effects.

5. That the proposed ordinance is categorically exempt from environmental review pursuant to CEQA Guidelines Section 15308 which exempts actions taken by regulatory agencies for the protection of the environment and Section 15303 which exempts the construction and installation of minor accessory structures and equipment. Furthermore, pursuant to CEQA Guidelines Section 15061(b)(3), CEQA only applies to projects which have the potential for causing significant effects on the environment and this ordinance is intended to preserve and enhance the environment and there is no possibility that it will have a significant negative effect on the environment. There are no new or unusual circumstances related to the project or project site that would require further environmental review.

SECTION 2. Amendment
Chapter 8 (Buildings) of the Municipal Code of the City of Davis is hereby amended to add Article 8.20 Renewable Energy, as follows:

ARTICLE 8.20 Renewable Energy

8.20.010 Purpose

The purpose of this article is to encourage the use of renewable energy sources and to establish requirements and standards for the installation of solar energy and other renewable energy systems on new residential structures that would be compatible with the building and appropriate for the district.

8.20.020 Applicability

(a) The provisions of this article shall apply to:

(1) New single-family dwellings or duplexes as defined in Section 40.01.010 of the City's Municipal Code, including the demolition of an existing residence and construction of a replacement residence.

(b) The provisions of this article shall be imposed as conditions of approval for all tentative and final maps approved pursuant to the Subdivision Map Act (Government Code sections 66410 et seq.) on or after January 1, 2015 for the uses described in this article, above; and compliance with these conditions shall be required for the issuance of a building permit. Where a map pursuant to the Subdivision Map Act is not required, the provisions of this article shall be imposed as conditions of approval for building permit applications filed on or after January 1, 2015 for the uses described in this article, above.

(c) The provisions of this article do not apply to:

(1) Residential projects with a valid final planned development approval received prior to January 1, 2015.

(2) Additions or remodels to existing single-family dwellings or duplexes, except as noted above.

(3) New or existing multiple dwelling development as defined in Section 40.01.010 of the City's Municipal Code.

(4) New or existing non-residential development.

(5) Accessory buildings or structures as defined in Section 40.01.010 of the City's Municipal Code.

8.20.030 Solar Photovoltaic System Requirement

(a) All applicable single-family dwellings or duplexes shall install a solar photovoltaic system and comply with the following standards, as shown in Table 1 and noted below.

Table 1. Minimum Solar Photovoltaic Requirement per Dwelling Unit

Single-Family or Duplex	Minimum System Size
1,500 sq. ft. or less	2.0 kW
1,501 sq. ft. to 2,000 sq. ft.	2.3 kW
2,001 sq. ft. to 2,500 sq. ft.	2.5 kW
2,501 sq. ft. to 3,000 sq. ft.	3.0 kW
More than 3,000 sq. ft.	3.5 kW

(1) **Demolition and Replacement**. For the purposes of this article, the demolition and replacement of an existing residence is considered to be a new residence subject to the requirement for a solar system when it meets all of the following:

A. It qualifies as a demolition pursuant to the City's Demolition Ordinance; and

B. The new construction for the replacement residence includes both: 1) the permanent or temporary removal of more than 60% of the existing linear perimeter walls or the replacement or enclosure of more than 60% of the existing linear perimeter walls with new perimeter walls; and 2) the replacement or reconstruction of more than 60% of the existing roof area.

(b) System Expansion and Prewiring. All residential solar systems installed pursuant to this article shall reserve sufficient roof space to accommodate a 50 percent expansion of the required system capacity and shall provide electrical conduit to accommodate any additional wiring. The expansion area shall be shown on the building plans.

8.20.040 Submittal Requirements

(a) The project applicant shall obtain all required building permits and shall submit plans and documentation necessary to demonstrate compliance with the requirements of this article, as determined by the Directory of Community Development and Sustainability.

(b) As part of the site plan approval of the building permit for the dwelling unit, the applicant shall provide the layout of the required solar system and any additional necessary details for review and approval. The site plan for the solar system layout shall address, but is not limited to, the following details: size of the required or proposed system size, building and roof square footage, roof orientation, roof penetrations, nearby trees which may include tree size, height, shading, and identification of an expansion area for the solar system.

(c) The building permit for the solar system may be issued separately from the permit for the dwelling unit, but shall be installed prior to occupancy of the dwelling unit.

8.20.050 Location and Height Standards

All solar systems shall comply with the following standards and guidelines for location and height.

(a) Ground-mounted systems. All ground-mounted systems shall comply with the setback requirements for accessory structures pursuant to Section 40.26.010. Ground-mounted systems may encroach into the setbacks provided they are screened from adjacent properties and streets, do not exceed the fence height and comply with Building Code requirements.

(b) Roof or building-mounted systems may not exceed the maximum allowed building height of the structure to which they are attached, except in the case of a primary structure that is constructed to the maximum allowed building height, the attached solar system may exceed the allowable height by no more than 2 feet or up to the height of the building parapet if there is one, whichever is greater.

(c) Roof or building-mounted systems, including the solar collectors and associated equipment and appurtenances should be located and designed to minimize aesthetic impacts without compromising the effectiveness of the solar collectors. Solar system appurtenances should be screened to the extent feasible and should be painted a color similar to the color of the surface upon which they are mounted.

(d) Accessory structures. Solar systems mounted on an accessory structure shall comply with the yard and height requirements of that accessory structure.

8.20.060 Alternative Compliance

The Director of Community Development and Sustainability ("Director") may approve alternative compliance in lieu of on-site solar PV for the following:

(a) Off-Site Solar Gardens. In the event that the electricity utility provider for Davis enables the use of off-site PV systems to off-set electricity charges, projects subject to this Ordinance my utilize such methods to fully or partially satisfy the requirements of this Ordinance. In determining compliance, the Director shall consider the longevity of the contract for local off-site power and the certainty that such contract will remain with the property. The intent is to allow for local off-site solar to satisfy the objectives of this ordinance with reasonable assurance that it will provide similar benefits and longevity as a PV system fixed to the property.

(b) Aggregated System. In the case of a tract home or production subdivision, installation of a solar system is not required on all individual units if the aggregated energy requirement for the subdivision or subdivision phase is provided on other units within the development. The developer shall demonstrate compliance to the satisfaction of the Director.

(c) Solar Water Heater. Installation of a solar water heater or other similar system may substitute for an equivalent amount of energy to be produced by the required solar system or for an equivalent amount of roof space occupied by the required solar system.

(d) Other Renewable Energy Sources. Upon demonstration that space heating and cooling requirements or other significant energy needs will be met with an acceptable solar, ground source system such as geothermal, or other renewable energy source that meets the intent of this article.

8.20.070 Exemptions

(a) Exemption Request. The Director of Community Development and Sustainability may waive or reduce all or part of the requirements of this article upon written request by the applicant and the provision of any required supporting information for the following:

(1) Urban Forest. When compliance would conflict with the growth and/or maintenance of the city's existing urban forest or conflict with the City's Tree Preservation Ordinance to the extent that existing shading or future shading from existing trees would substantially impact the effectiveness of the required solar system, consistent with the Davis Solar Shade Control Act. It is the responsibility of the project applicant/developer to identify potential shading conflicts. The project applicant/developer shall make all reasonable effort to avoid and minimize new shading conflicts when planning the site and building layout and design, site landscaping, the location and species of new trees.

(2) Solar Access. When insufficient solar access, such as shading from existing buildings or trees, would substantially impact the effectiveness or ability to accommodate the required solar system.

(3) Building and Roof Design. When there is insufficient roof space or the design or orientation of the building or roof would preclude full compliance. It is the responsibility of the project applicant/developer to demonstrate how alternative building design and/or lot orientation that would allow for full compliance with this Ordinance is infeasible.

(4) Hardship Exemption. When compliance would impose a demonstrated undue hardship or expense, or would otherwise be infeasible.

(b) Exemption Requirements. A request for an exemption shall comply with the following requirements:

(1) A written request and justification for the exemption.

(2) Supporting information to the satisfaction of the Director documenting a demonstrated hardship, unique circumstances or other compliance with the intent of this article. Required information may include, but is not limited to, an alternatives analysis evaluating ability to comply with alternative compliance measures, an economic analysis evaluating the cost issues, or documentation of additional project measures or energy efficiency features above and beyond the minimum requirements that may warrant a reduction or waiver.

(3) The cost for any outside peer review that may be required to review supporting documentation shall be borne by the project applicant.

SECTION 3. Effective Date
This ordinance shall become effective on and after the thirtieth (30^{th}) day following its adoption and shall be published as required by law.

INTRODUCED on June 24, 2014, AND PASSED AND ADOPTED on ______, by the following vote:

AYES:
NOES:
ABSENT:
ATTEST:

____
Joseph F. Krovoza
Mayor

____
Zoe S. Mirabile, CMC
City Clerk

ATTACHMENT 2

Notice of Exemption

TO:	FROM:
Office of Planning and Research P.O. Box 3044, Room 113 Sacramento, CA 95812-3044 County Clerk County of Yolo 625 Court Street Woodland, CA 95695	City of Davis Community Development Dept. 23 Russell Blvd., Suite 2 Davis, CA 95616

Project Title
Renewable Energy Ordinance (PA#14-22)

Project Location – Specific
City-wide

Project Location -- City	**Project Location – County**
Davis, CA 95616	Yolo County

Description of Nature, Purpose, and Beneficiaries of Project
The project is an ordinance amendment to establish requirements and standards for the installation of solar photovoltaic systems on new single-family dwellings and duplexes. The purpose of the ordinance is to encourage the use of renewable energy sources, reduce energy costs and installation costs for homeowners and help the City achieve its targets for the reduction of greenhouse gas emissions.

The required solar system would range in size from 1.5 kW to 3.5 kW depending on the house size and would be designed and installed as part of the initial construction. It is expected that the required systems would generate approximately 50 percent of the average household electrical needs. The ordinance provides for alternative compliance measures if other renewable energy sources are used as well as an exemption from the requirements for certain situations or hardship circumstances.

Name of Public Agency Approving Project
City of Davis

Name of Person or Agency Carrying Out Project
City of Davis, Community Development and Sustainability Department

Exempt Status: (Check One)

_____ Ministerial (Sec 15073)
_____ Declared Emergency (Sec. 15071(a))
_____ Emergency Project (Sec. 15071(b) and (c))
__X__ Categorical Exemption. State type and section number: Section 15308 for regulatory actions for the protection of the environment and Section 15303 for small accessory structures and equipment.

Reasons why project is exempt: The city has determined that the proposed project is categorically exempt from further environmental review pursuant to CEQA Guidelines Section 15308 which categorically exempts actions taken by regulatory agencies for the protection of the environment and Section 15303 which categorically exempts the construction and installation of minor accessory structures and equipment. Furthermore, pursuant to CEQA Guidelines Section 15061(b)(3), CEQA only applies to projects which have the potential for causing significant effects on the environment. This ordinance is intended to help preserve and enhance the environment and there is no possibility that it will have a significant negative effect on the environment.

Whereas the proposed ordinance would require the installation of solar photovoltaics on new single-family dwellings and duplexes and reduce the consumption of non-renewable energy sources and associated greenhouse gas emissions, it would therefore help to reduce or mitigate environmental impacts related to climate change and help to protect the environment. The direct physical change related to the ordinance requirements would consist of the installation of solar panels and ancillary equipment on a residential dwelling. The solar systems would be accessory to the residential use and structures and would not result in any adverse environmental effects.

________________	________	Ext. # ____
Lead Agency Contact	Telephone	Extension

________________	________________	____________
Signature	Title	Date

_X_ Signed by Lead Agency ___ Signed by Applicant

Date Received for filing at OPR: _______________

ATTACHMENT 3

From: Jason Taormino [mailto:jtaormino@me.com]
Sent: Wednesday, April 23, 2014 9:24 AM
To: Eric Lee
Subject: Re: Renewable Energy (Solar PV) Ordinance - Natural Resources Commission Meeting 4/28

Hi Eric,

Thanks. I would attend but am out of town. If there is a written public comment option I would like to provide the following.

Dear Commissioners,

As one of the developers of the first solar subdivision in Davis I would like you to be aware of several items regarding a requirement for solar on new construction. First, the only reason it makes economic sense for a new energy efficient home to have solar is because of the government subsidies. When these subsidies go away such a requirement will be another significant tax on builders. Second, a new 2,000 sf home built to current energy standards and utilizing LED lights will have an average monthly electric bill of less than $100 and in many cases it will be closer to $75 if the owner is frugal. Therefore, such a requirement is focusing on an area with diminishing returns. Lastly, having built and sold 18 homes, 17 of which have solar on the roof, it is unclear whether the buyers paid for the solar or the builder lost money on the solar panels. It is clear that buyers, in general, want the solar systems but we do not have significant data that tends to suggest they will pay full fare for these systems.

My suggestion is that you start collecting data for all new homes, whether they have solar, and whether the buyers was happy to pay for the solar. That would be more work for your commission but would help prove that buyers do or do not value solar as much as you want it on every new roof.

Thank you,

Jason Taormino

-----Original Message-----
From: Don Fouts [mailto:don@foutsconstruction.com]
Sent: Monday, April 28, 2014 9:53 AM
To: Eric Lee
Subject: PV Ordinance

Eric,

I will be unable to attend tonights meeting but want to submit my comments for the record.

I would like to express my general support for such an effort but with a few qualifications. It should be noted that I have been placing PV on all but one of the 15 plus homes that i have built in the past 4 years. Most recently the systems have been with Solar City on their 20 year lease program. It should also be noted that not one home buyer initiated the request for PV system nor did any of my home buyers make their buying decision for their new home based on the fact that the new home included solar. Contrary to popular thought I am of the opinion that PV is not a very high priority to the home buyer. Having said that I still am in favor of a reasonable PV ordnance.

First, there needs to be clear language that should the tax credits go away the requirement be immediately suspended and re-evaluated. The burden should not be placed entirely on the developer/builder/new home homebuilder.

Second, the required systems should not be intended to eliminate a homes electrical consumption but only to try and lower the homes electrical consumption to help the home stay in the first tier. All solar cost benefit comparisons realize that it is too costly and non beneficial to offset first tier electric rates with what it cost to produce the same amount of electricity via installation of PV solar.

Third, there needs to be serious attention to putting requirements to the retrofitting of the existing housing stock. New homes being built today consume far less energy to run as currently constructed than do the thousands of existing homes. But the reality is that it is far easier to require high energy threshold on developers of homes who's residence don't vote yet. Placing these kinds of requirements on existing homeowners would result in loud outcries of many of the same people whom are demanding high energy requirements on new homes but will revolt if similar costly demands are placed on them. it is time to apply these heady desires on the entire Davis community.

So in summary, I am in favor of a fairly worded PV ordnance.

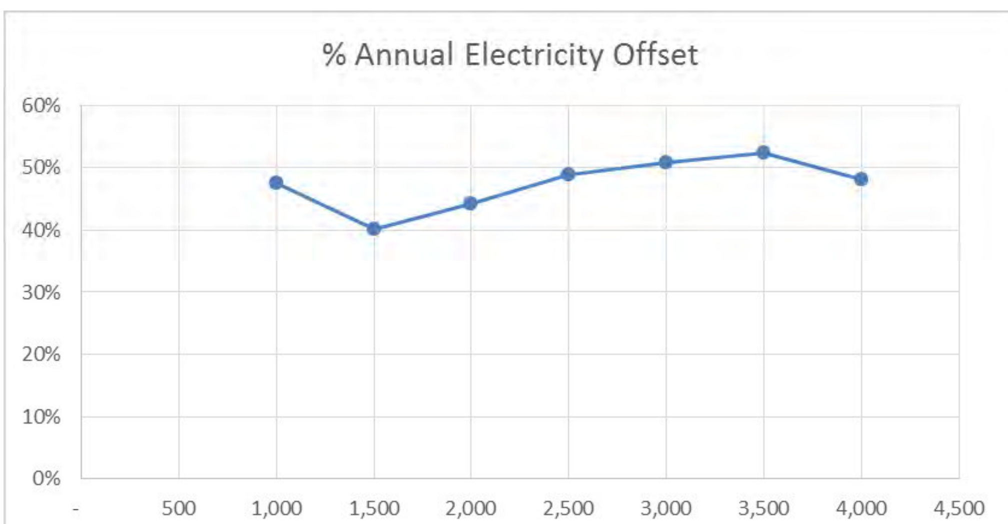
Don Fouts, President
Fouts Construction

ATTACHMENT 4

Percent Annual Electricity Offset of Proposed Ordinance for 2013 Code House
(Source: Davis Energy Group)

House Size (sq. ft.)	City of Davis PV Size (kW)	Avg. Electricity Consumption kWh/yr	ZNE PV kW	% Annual Electricity Offset		PV Size @ 50% ZNE
1,000	1.5	4,418	3.15	48%		1.6
1,500	1.5	5,230	3.73	40%		1.9
2,000	2.0	6,343	4.53	44%		2.3
2,500	2.5	7,155	5.11	49%		2.6
3,000	3.0	8,263	5.90	51%		2.9
3,500	3.5	9,367	6.69	52%		3.3
4,000	3.5	10,179	7.27	48%		3.6

ZNE – Zero Net Energy



Eugene Wilson
President
California Clean Energy Committee
3502 Tanager Avenue
Davis, CA 95616

Ezra Beeman
Managing Director
Energeia USA
132 E Street, Suite 310
Davis, CA 95616

3 June 2016

Dear Mr Wilson,

RE: Review of Rooftop Solar PV Economics for Martis Valley West Specific Plan project

The letter is to communicate the results of our review of the economics of rooftop solar PV at the Martis Valley West Specific Plan project at 5001 Northstar Drive, Truckee, CA 96161 in accordance with our Terms of Reference.

Terms of Reference

The California Clean Energy Committee engaged Energeia USA (Energeia) on 19 May 2016 to:

- review the Martis Valley West Specific Plan project in order to undertake a high level investigation and assessment of the economics of rooftop solar PV at the site, and to
- draft a letter summarizing our methodology, findings and conclusions.

Scope and Approach

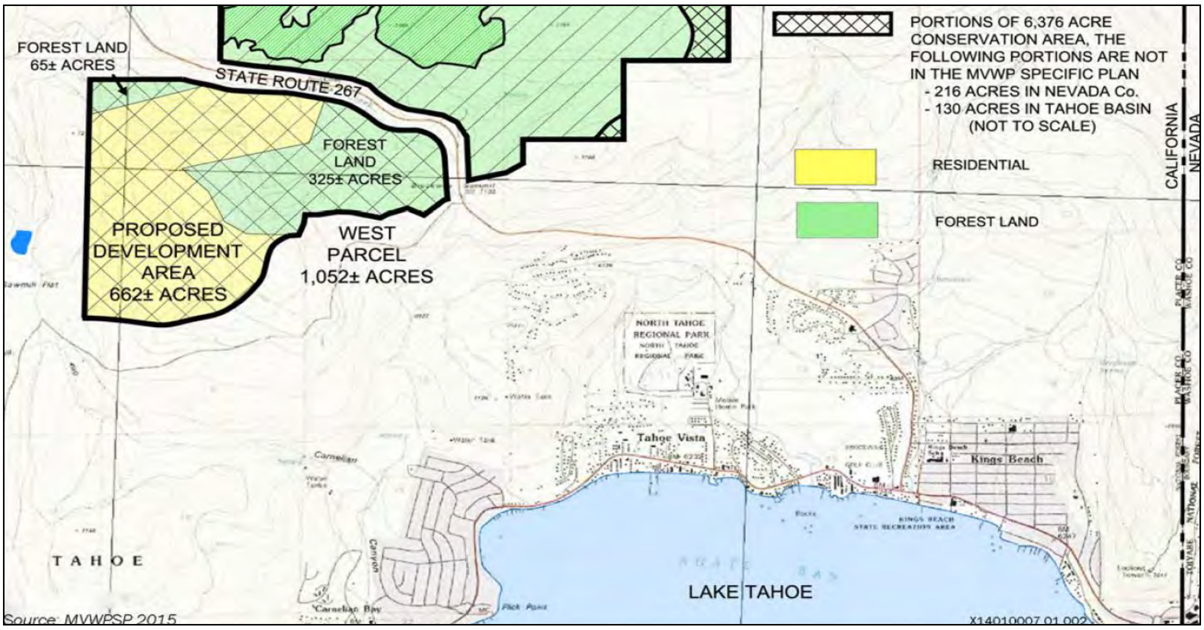
In conducting our review, investigation and assessment, Energeia:

- Reviewed provided documents covering the project site, solar PV NET Engineering Requirements and Net Metering Application.
- Undertook independent research into the annual level of solar PV energy available in the region per annum, tariff arrangements, expected consumption profile and solar PV costs.
- Modelled breakeven solar PV systems across a range of potential dwelling sizes and financing assumptions.
- Documented the methodology, findings and conclusions in this letter.

Project Background

The Martis Valley West Specific Plan project (the Project) is situated to the northwest of Lake Tahoe, shown in Figure 1. The project scope is yet to be finalized, but is expected to include approximately 662 acres of residential dwellings. The size and number of residential dwellings are yet to be determined.

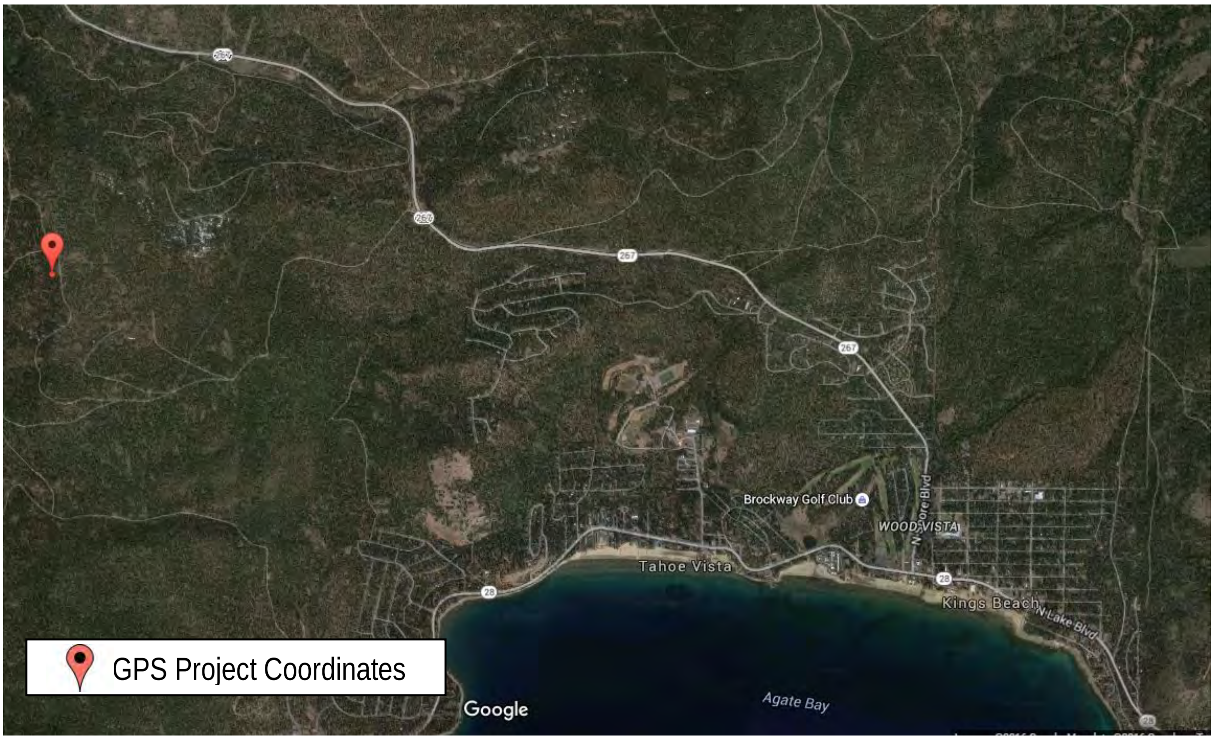
Figure 1 – Proposed Project Location



Source: Ascent

The Project's approximate GIS coordinates are 39.2580, -120.1012 using Google Maps, as shown in Figure 2 below. These are the coordinates Energeia has used to estimate the annual solar PV energy generation per rooftop kW.

Figure 2 – Proposed Project Coordinates



Source: Google

Key Inputs and Assumptions

The following sections describe the key inputs and assumptions used by Energeia in its assessment of the Project's cost-effective solar PV potential.

Solar PV Potential

Energeia's review found that all new housing will have 250 square feet of roof space ('solar ready') available for rooftop solar PV to comply with California building codes.[3] This equates to 2-3 kW of panels, depending on the assumed panel efficiency, as shown in the table below.

Table 1 – Solar PV Square Footage by Power and Efficiency

Panel Efficiency	Panel Power (kW) 1.0	1.5	2.0	2.5	3.0	3.5	4.0
16%	94	141	188	235	282	329	376
17%	88	133	177	221	265	310	354
18%	84	125	167	209	251	292	334
19%	79	119	158	198	237	277	317
20%	75	113	150	188	226	263	301

Source: Solarmango.com

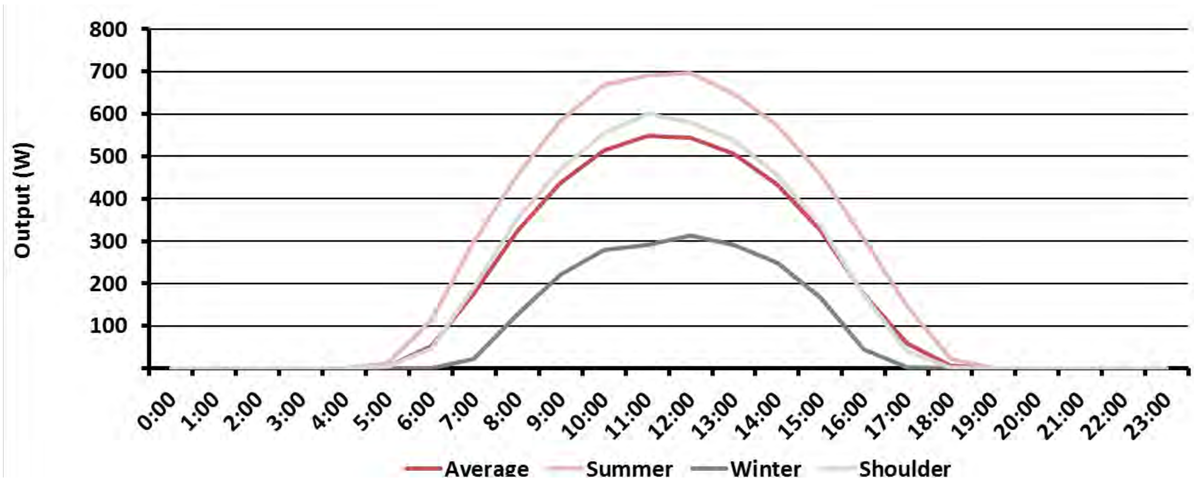
It is important to note that the economically optimal efficiency of panels depends on a range of factors, and not simply delivering a system that uses all 250 square feet. These other factors are detailed below.

It is also important to note that the output of solar PV systems not installed with the optimal orientation will be lower than those optimally installed; this issue is addressed in the output analysis.

Solar PV Output

Energeia obtained an estimated annual solar PV generation profile from the National Renewable Energy Lab (NREL) for Lake Tahoe that assumed an optimal orientation.[4] This estimate accounts for weather including cloud cover, but not standing snow. The NREL estimates were then reduced by 10% to account for expected conditions, the main one being non-south facing rooftops.

Figure 3 – NREL Estimate of Average Annual Solar PV Output per kW at Lake Tahoe



Source: NREL, Energeia

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[3] CEC minimum rooftop area requirements may be found at: http://www.energy.ca.gov/2013publications/CEC-400-2013-001/chapters/07_Solar_Ready.pdf

[4] NREL PV Watts available at: http://pvwatts.nrel.gov/

Energeia has assumed a further 5% degradation of solar PV output due to snow covering. Figure 4 shows daily snowfall near Tahoe in 2016, which indicates that only 14 days had >6 inches of snowfall. In other words, around 4% of days experienced snowfall unlikely to melt the next day.

Figure 4 – Sierra-at-Tahoe Snowfall

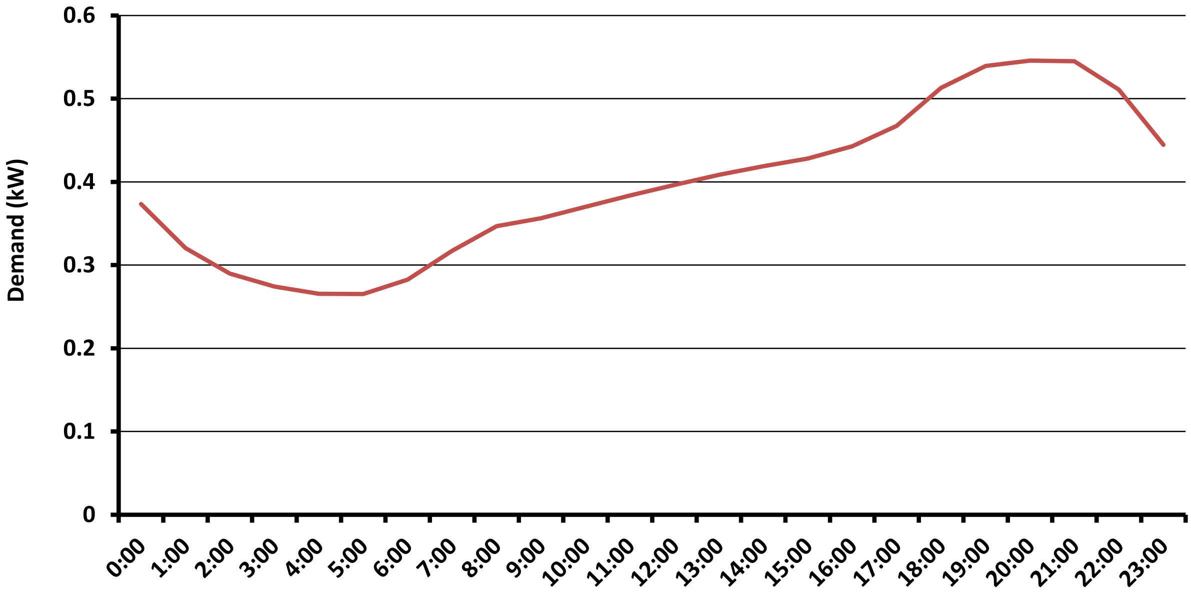
Source: OntheSnow.com

Customer Demand Patterns

No customer consumption profile data is available from the local utility, Liberty Utilities, so Energeia used a representative hourly load profile from PG&E, which serves most of Northern California. The average reported annual consumption of customers in Liberty Utilities' territory is around 8,000 kWh.[5]

Figure 5 shows the annual average hourly load profile of a residential PG&E customer using around 7,000 kWh.[6] The PG&E profile does not account for the occupancy rates of Liberty Utilities customers, which typically have a higher weekend usage due to the prevalence of holiday homes in the area.

Figure 5 – PG&E E1 Average Annual Residential Electricity Demand Profile



Source: PG&E

However, Liberty Utilities' electricity rates do not include a weekend component, so the higher weekend usage is not relevant to this assessment.

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[5] More information for Liberty Utilities in CA available at: http://www.whatsmypower.com/locations/96150/rates/3154647

[6] Liberty Utilities CA Service Electric Rates for D-1 Domestic available here: https://california.libertyutilities.com/uploads/Schedule_D-1.pdf

Electricity and Net Metering Tariffs

Residential customers in the Project will be able to choose to be on an inclining block (IBT) or ToU based tariff, which are presented in Table 2. Inclining block means that the more the customer uses, the higher the per kWh cost of energy.

Table 2 – Liberty Utilities' Residential IBT Rates

Month	Max Daily kWh Allowed for Block 1	Block 1 Cap per month (kWh)	Block 1 Rate	Block 2 Rate	Meter Charge
Jan	18.4	552	$ 0.11	$ 0.14	$ 7.10
Feb	18.4	515.2	$ 0.11	$ 0.14	$ 7.10
Mar	18.4	570.4	$ 0.11	$ 0.14	$ 7.10
Apr	18.4	552	$ 0.11	$ 0.14	$ 7.10
May	13.8	427.8	$ 0.11	$ 0.14	$ 7.10
Jun	13.8	414	$ 0.11	$ 0.14	$ 7.10
Jul	13.8	427.8	$ 0.11	$ 0.14	$ 7.10
Aug	13.8	427.8	$ 0.11	$ 0.14	$ 7.10
Sep	13.8	414	$ 0.11	$ 0.14	$ 7.10
Oct	13.8	427.8	$ 0.11	$ 0.14	$ 7.10
Nov	18.4	552	$ 0.11	$ 0.14	$ 7.10
Dec	18.4	570.4	$ 0.11	$ 0.14	$ 7.10

Source: Liberty Utilities

Energeia assessed the cost effectiveness of solar PV using the IBT tariff as it is typically the most favorable for rooftop solar PV investment.

Solar PV Costs

Energeia's estimates of the cost of installing a residential solar PV system is based on NREL published average cost data.[7] Energeia's analysis of the NREL cost data has found an average installed cost of $3,080 per kW for a 5 kW system.

Other Solar PV Assumptions

The current Federal income tax credit covers 30% of project costs. Solar PV panels are assumed to last for 20 years and the inverters are assumed to last for 10 years. Panel efficiency is assumed to be 18%[8].

Financial Assumptions

Energeia has assumed a discount rate of 8% and 5% to represent the cost of capital at solar PV market and mortgage rates. The mortgage rate is relevant where the solar PV was included in the housing cost.

[7] NREL Report, "U.S. Photovoltaic Prices and Cost Breakdowns: Q1 2015 Benchmarks for Residential, Commercial, and Utility-Scale Systems" available at: http://www.nrel.gov/docs/fy15osti/64746.pdf

[8] CEC Report, "Cost-Effectiveness of Rooftop PV Systems for Consideration in California's Building Energy Efficiency Standards" available at: http://www.energy.ca.gov/2013publications/CEC-400-2013-005/CEC-400-2013-005-D.pdf Average of Scenarios 1 and 2 for CZ16, detailed on p. 13.

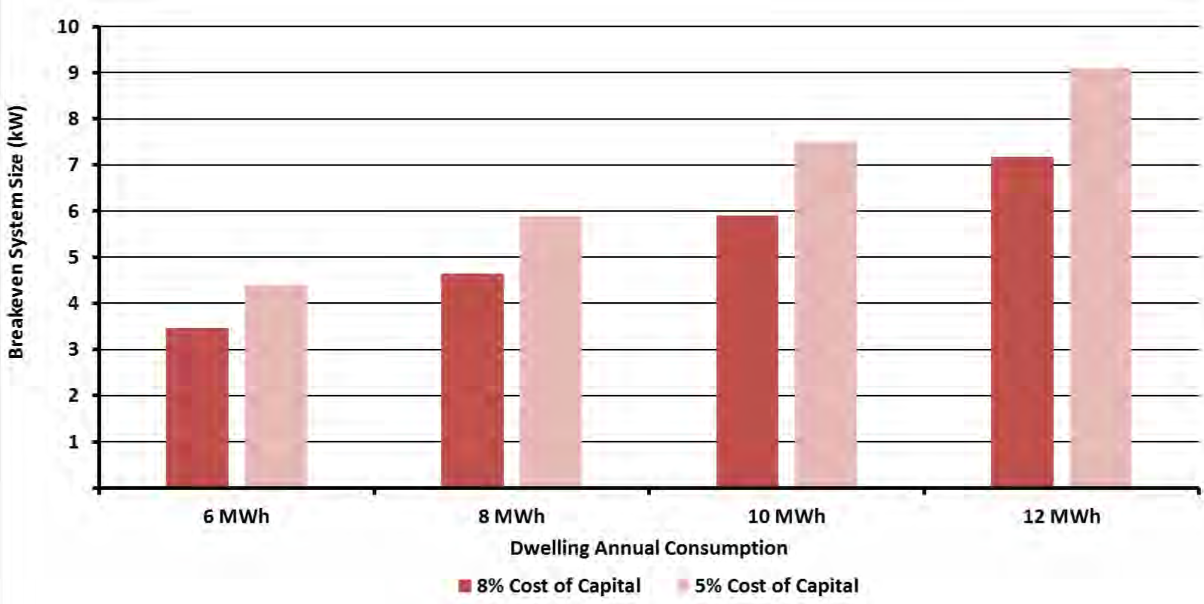
<u>Findings and Conclusions</u>

Using the inputs detailed in the previous section, Energeia modelled the breakeven solar PV sizing for a reasonable range of potential consumption levels, with the following results:

Solar PV Sizing

Our modelling shows that the breakeven solar PV size varies as a function of the dwelling's annual consumption, due to the structure of the inclining block tariff, as shown in Figure 6.

Figure 6 – Solar PV Breakeven Sizing by Dwelling Annual Consumption and Financing Costs



Source: PG&E

Energeia notes that the above range starts from the minimum required capacity. Energeia's analysis shows that the return on investment improves significantly if the solar PV is slightly under the breakeven point, for example by 1 kW in each case.

Solar PV Economics

Solar PV economics for the Project are driven by the difference in price between the first and second block or tier. As solar PV output increases above the breakeven level, more and more of the output is used to offset the lower priced tier, reducing the overall economics of the investment.

Overall, Energeia has found solar PV economics are likely to be positive for dwellings in the area based on our assumed solar PV sizing and output, adjusted for snowfall and orientation, solar PV tariff and solar PV system costs. They are significantly improved when financed at 5% compared to 8% interest.

Solar PV Penetration

Based on our high level review and modelling, Energeia expects that rooftop solar PV could be installed on 100% of the project's dwellings economically if properly sized. An estimate of the Project's total economic rooftop solar PV capacity requires finalization of the number of residential dwellings.

Key Conclusions

Consequently, our expert view is that solar PV is likely to be an economic investment at the present time for housing in the Tahoe Area we examined. This view is based on current utility electricity and solar PV tariffs, Federal incentives and solar PV costs, and the situation may change in the future due to changes any in these key assumptions.

Thank you again for the opportunity to undertake this review.

Yours faithfully,

Ezra Beeman
Managing Director

Disclaimer

While all due care has been taken in the preparation of this report, in reaching its conclusions Energeia has relied upon information provided third parties. To the extent these reliances have been made, Energeia does not guarantee nor warrant the accuracy of our conclusions. Furthermore, neither Energeia nor its Directors or employees will accept liability for any losses related to this report arising from these reliances. While this report may be made available to the public, no third party should use or rely on the report for any purpose.

Appendix 1 – About Energeia

Energeia Pty Ltd (Energeia) was founded in 2009 in Australia and opened its first US office in 2015. It specialises in the electricity supply industry, related policymaking and regulation, and emerging energy technology, particularly related to distributed energy resources and smart grids.

Energeia provides advisory and technical services in the following areas:

- Smart networks and smart metering
- Energy policy and regulation
- Energy storage
- Electric vehicles and charging infrastructure
- Distributed generation and storage technologies
- Network planning and design
- Demand management and energy efficiency
- Energy product development and pricing
- Wholesale and retail electricity markets

Energeia's energy industry only focus ensures that its research and advice reflects a deep understanding of the industry's current and emerging issues. This understanding is based on first-hand practical industry experience combined with primary research and rigorous analytics.

<u>Energeia's Relevant Experience</u>

Our relevant project experience includes:

- Development of a 10-year market outlook for residential and commercial rooftop solar PV demand, growth strategies and business model for a top-tier electric retailer.
- Development of a 10 year demand outlook for commercial solar PV, including financial products and a market model.
- Development of a distributed energy resource uptake model for an Australian network company, including rooftop solar PV and battery storage.
- Design of a micro-grid optimization model to gain understanding of techno-economic industry trends relevant to network planning, emerging technologies and emerging business models.
- Development of a technical and economic model to underpin the national cost benefit assessment for the Smart Grid, Smart City deployment program.
- Development of a Smart Grid Roadmap for the Energy Networks Association.
- Development of a model to forecast the impact of residential battery storage and electric vehicle uptake for a distribution network utility with 1.8 million customers.
- Development of network pricing strategy to develop and implement cost-reflective network pricing for a distribution network utility with 800,000 customers.

 **Kaleb M. Roedel**
kroedel@sierrasun.com

April 27, 2016

California, Tahoe-area tree deaths climb to record levels thanks to bugs, drought

An aerial view of pockets of dead or dying trees, as seen within the Lake Tahoe Basin on the West Shore.

Large swaths of dead trees are seen last July in the Tahoe National Forest, where an estimated 33,266 acres were affected by mortality in 2015.

A look at a fir tree trunk, after an Ips engraver beetle infestation.

A Jeffrey pine beetle is small in size, but can cause massive damage in the long run.

By the numbers*

28 million: Number of trees dead or dying in California

93,167: Number of trees dead or dying within Tahoe National Forest

35,038: Number of trees dead or dying within Lake Tahoe Basin

Source: U.S. Forest Service Aerial Survey. *Figures are estimates, and are as of the end of 2015.

More online

Visit tahoe.livingwithfire.info to learn all sorts of tips and information about Sierra trees and how to live in a fire-prone area.

TRUCKEE, Calif. — Twenty-eight million.

That's the estimated number of trees in California that were dead or dying in 2015 as a result of the ongoing drought, according to the U.S. Department of Agriculture.

The 28 million figure is not only a record-high for the state, it's roughly 10 times more dead trees than were recorded in 2014 — just one year prior — by the U.S. Forest Service Aerial Survey team.

In other words, California's tree mortality is rising at a historic rate and showing no signs of slowing down.

"We've had four years of drought, and it's just compounded year after year," said Rita Mustatia, a silviculturist (a person who looks after trees in the forest) with the U.S. Forest Service Lake Tahoe Basin Management Unit. "We need a couple normal winters in a row — similar to this year — to bring us back to some sense of normalcy."

> "We need a couple normal winters in a row — similar to this year — to bring us back to some sense of normalcy."Rita MustatiaU.S. Forest Service Lake Tahoe Basin Management Unit

According to the U.S. Forest Service, Forest Health Monitoring Program, Region 5, there was an estimated 35,038 dead or dying trees within the Lake Tahoe Basin in both Nevada and California by the end of 2015, with 11,215 acres affected by mortality.

Meanwhile, the Tahoe National Forest — which extends east of Sacramento, through the foothills and across the Sierra crest to the California state line — showed roughly 93,167 dead or dying trees and 33,266 acres of mortality.

"The tree mortality issue is definitely a top priority because we're behind the curve," Mustatia said. "With all these trees toppling over on the ground, you're just looking at a gigantic fuel load of dead trees."

BEETLE OUTBREAK

Indeed, the drought has led to millions of California and Sierra Nevada trees deprived of water. This, Mustatia said, results in swaths of trees that become stressed, consequently losing their ability to fight off the attacks of bark beetles.

“The trees need water to survive, but also to protect themselves from insects that bore into the tree and create galleries where they lay their eggs,” said Mustatia, who went on to explain the breakdown of a tree’s defense system. “The trees use the water to create a pitch to push the beetles out of the tree. And if they don’t have the water, they can’t use that mechanism to keep the beetles from attacking.

“They can stand some of the attacks, but if the beetles are aggressive and able to continue to attack … the trees will eventually succumb to that.”

At Lake Tahoe, the Jeffrey pine beetle — described by USFS as the primary insect pest of the pine trees — is the most prevalent, Mustatia said.

But they are not the only borers on the North Shore. Additionally, Ips engraver beetles infest red and white fir trees in the region, she said.

“And then,” Mustatia continued, “the beetles use a pheromone to attract other beetles if they are happy with the area, and draw more beetles to attack that tree — that’s how the spread continues.”

In fact, in some areas of the state, primarily Southern California, the beetles are adapting to the warmer climates and subsequently having more than one life cycle, Mustatia said.

“You’re basically looking at double the insects,” she said.

THINNING THE PROBLEM

For Lake Tahoe, the bark beetle epidemic, thus far, is minimal compared to other pockets of the state, said Jeff Dowling, the North Tahoe Basin forester with Calfire.

“We haven’t yet seen a significant increase in the amount of mortality driven by the drought on the east slope of the Sierra,” said Downing.

Pausing, he added, “The insects are always in the system; that goes on whether we’re in a normal participation cycle or not.”

So what can be done to help save our drought-stricken trees?

Dowling, who has worked for Calfire for over 30 years, points to a method that may seem counterproductive to the general public: tree thinning.

“Here, locally, where we’ve aggressively gone out and thinned spans (of trees), we are not seeing mortality in the numbers we might see had we not aggressively thinned,” Dowling said.

Essentially, too many trees on too few acres creates a logjam, if you will, in the forests. This results in suffocated trees fighting for moisture, sunlight, and nutrients — especially during this unprecedented drought.

Tree thinning, meanwhile, helps alleviate the trees' fight for survival, agreed Mustatia.

"I attribute some of the healthier forests in Lake Tahoe to eliminating so much of the competition," she said. "You're creating a healthier forest. The trees that we left on the ground have more water available to them.

"I think if we hadn't done some of that (thinning) in the last four years we might be seeing a lot more (tree deaths) than what we are."

FRIENDLY FIRES

Another method used to help maintain a healthier forest is prescribed fire, said Forest Schafer, who is, fittingly, a forester with the Incline Village-based North Lake Tahoe Fire Protection District.

"There's an increased use in prescribed fires because it mimics the natural role the wilderness plays in the Sierra Nevada ecosystem in magnitude, diversity and resilence," Schafer explained. "We have fire-adaptive ecosystems; it evolves with fire, and fire is a necessary part of our environment."

Quite simply, fire removes dead accumulations as well as young trees that are not as fire-adaptive. With fewer trees to compete for water, the ones left can grow strong and be less susceptible to fires and more capable of pitching out bark beetles.

For instance, Dowling said, on the east side of the Sierra at lower elevation, more frequent fires would stamp out the small trees in the brush and give the large trees — the pines — more space for sustainability.

"Prescribed burning is a really useful tool to keep forests healthy and reduce those fuels," added Bill Seline, deputy chief of the Truckee Fire Protection District. "And keep fires from getting too big — unnaturally big."

The truth of the matter is, Seline said, during the drought the trees are so dry that as soon as the snow melts, forests in the region and state will begin to experience midsummer fire behavior.

DEFENSIBLE SPACES

For property owners of Truckee-Tahoe, Seline said the most important thing to do is create and manage defensible spaces.

Notably, a law enacted in 2005 requires defensible space clearance — in other words, decreasing the amount of fuels — around homes and structures to remain at 100 feet.

"We realize that it takes a lot of work and diligence for property owners to manage that," he said. "But, it's not if a fire will start in Truckee, it's when — is your house defensible?

"If a tree dies in someone's front yard because it was drought stressed and a beetle took over and killed, now you have a dead tree in a person's property and of course it's a fire risk."

With that in mind, Dowling said homeowners should routinely keep a sharp eye on the health of their trees, especially when the Tahoe fire season heats up this summer.

"If they start to see a tree's not looking as green as they did, they need to pay close attention to whether or not they're seeing pitch running out of the trees," Dowling said. "If the tree does indeed die, they need to get it cut as soon as they possibly can. Because the longer you let the tree sit there, the opportunity for the insects to escape and move to another tree increase.

You may be able to stop them from emerging and getting to another tree."

Top Video Headlines

of 3

- 

Predicting Tree Mortality

A National Center for Ecological Analysis and Synthesis working group study analyzes

a variety of factors contributing to forest die-offs
By Julie Cohen
Tuesday, June 9, 2015 - 10:00
Santa Barbara, CA

The western U.S. has been a hotspot for forest die-offs such as this one in Colorado.

Photo Credit: William M. Ciesla, Forest Health Management

A combination of drought, heat and insects is responsible for the death of more than 12 million trees in California, according to a new study from UC Santa Barbara's National Center for Ecological Analysis and Synthesis (NCEAS). Members of the NCEAS working group studying environmental factors contributing to tree mortality expect this number to increase with climate change.

The study is the first of its kind to examine the wide spectrum of interactions between drought and insects. Lead author William Anderegg, a postdoctoral researcher at the Princeton Environmental Institute, and his coauthors first devised a framework to look at the effects that each stressor can have on tree mortality and then examined interactions among them. The researchers' findings appear in New Phytologist.

"We wanted to be able to get a sense of how these die-off patterns will shift with climate change," explained study coauthor Naomi Tague, an associate professor at UCSB's Bren School of Environmental Science & Management. "Are there huge forests that will be at higher risk of dying sooner?"

The western U.S. has been a hotspot for forest die-offs. Local economies in states like California and Colorado are highly dependent on the nature-based tourism and recreation provided by forests, which offer a scenic backdrop to the skiing, fishing and backpacking opportunities that draw so many people to live and play in the West. But lingering drought, rising temperatures and outbreaks of tree-killing pests such as bark beetles have spurred an increase in widespread tree mortality — especially within the past decade.

"Very often both drought and insects together are responsible for tree mortality," explained Anderegg, "but there are several good examples of trees dying because of one impact and not the other. We've worked to detail the spectrum of interactions between drought and insects and examine how they go hand in hand to affect tree die-offs."

Forest mortality has also been shown to impact everything from real estate to clean water. Property values in Colorado plummeted after swaths of coniferous forests were damaged by pine beetle infestations. Water purification services provided by forests continue to be disrupted when hectares of forests are lost to pests and drought. What's more, forest die-off events are projected to increase in frequency and severity in the coming decades.

"If we want to account for forest die-off events at local and global scales, we need some way of estimating how often they are likely to occur," Tague said. "We're putting together the pieces of how climate conditions can affect that mortality and putting together the pieces of how climate conditions can affect that mortality and how to identify the specific stressors that cause it."

The study's framework is a first step toward developing the tools that resource managers need to better predict the impacts of climate change on forests. Scientists and forest specialists are now tasked not only with determining what conditions prompt tree mortality but also how they will shape forested landscapes in the years to come. Being able to predict forest mortality in a changing climate is key to conservation and land use planning.

"Ultimately, forests are a critical part of western U.S. landscapes and state economies," Anderegg said. "They are also a canary in the coal mine for climate change. These massive forest die-offs that we are starting to see are a sign that climate change is already having major impacts in our backyard."

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You Are Exploring

TENS OF MILLIONS OF TREES IN DANGER FROM CALIFORNIA DROUGHT

Monday, December 28, 2015

Washington, DC—California's forests are home to the planet's oldest, tallest and most-massive trees. New research from Carnegie's Greg Asner and his team reveals that up to 58 million large trees in California experienced severe canopy water loss between 2011 and today due to the state's historic drought. Their results are published in *Proceedings of the National Academy of Sciences*.

In addition to the persistently low rainfall, high temperatures and outbreaks of the destructive bark beetle increased forest mortality risk. But gaining a large-scale understanding a forest's responses to the drought, as well as to ongoing changes in climate, required more than just a picture of trees that have already died.

A higher-tech approach was necessary; so Asner and his team used the laser-guided imaging spectroscopy tools mounted on the Carnegie Airborne Observatory (CAO) to measure the full impact of the drought on California's forests for the first time. They combined the CAO data with more-traditional satellite data going back to 2011.

Their new approach revealed a progressive loss of water in California's forest canopies over the four-year span. Mapping changes in canopy water content tells scientists when trees are under drought stress and greatly aids in predicting which trees are at greatest death and fire risk.

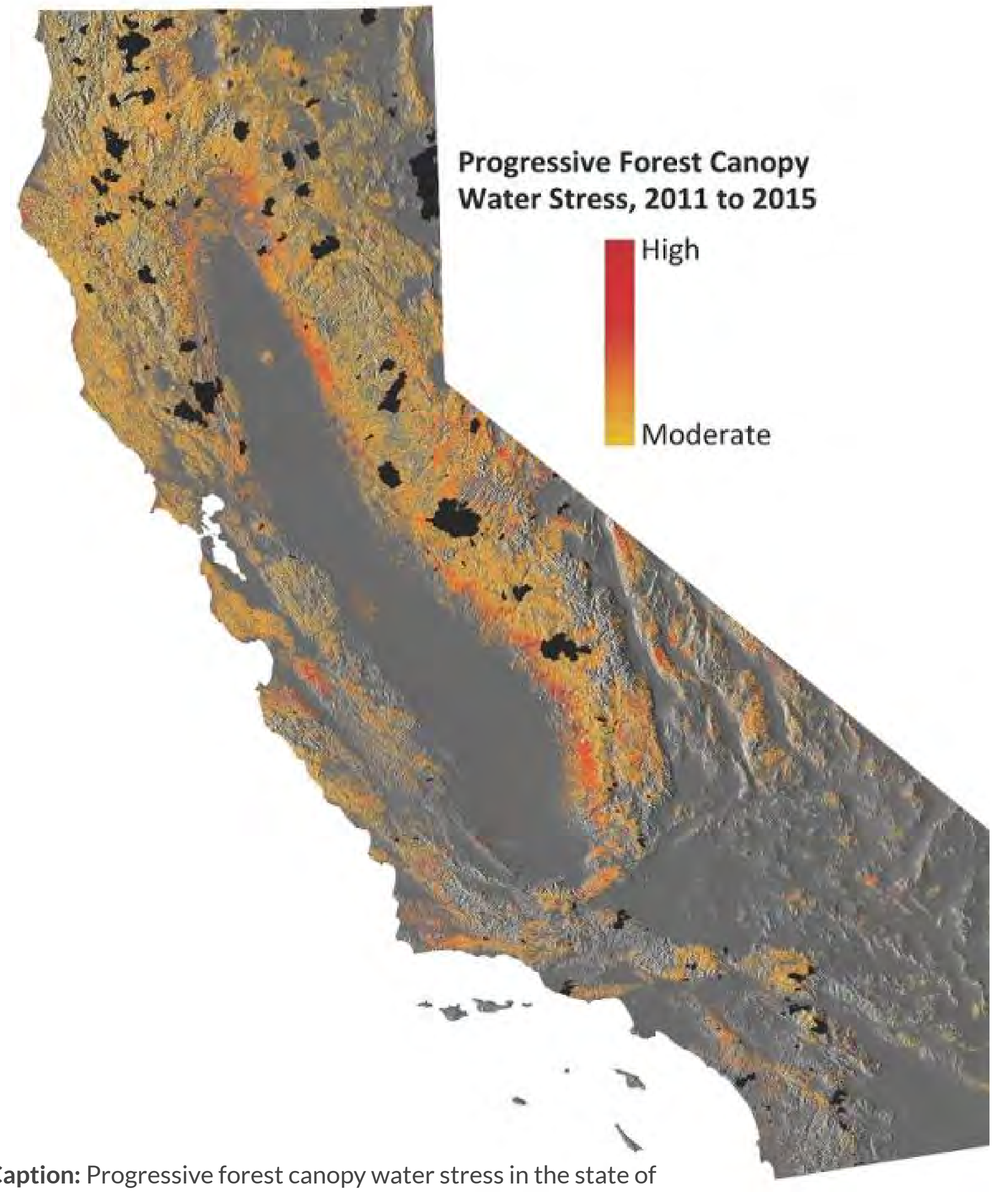
"California relies on its forests for water provisioning and carbon storage, as well as timber products, tourism, and recreation, so they are tremendously important ecologically, economically, and culturally," Asner explained. "The drought put the forests in tremendous peril, a situation that may cause long-term changes in ecosystems that could impact animal habitats and biodiversity."

The team's advanced tools showed that about 41,000 square miles (10.6 million hectares) of forest containing up to 888 million large trees experienced measurable losses of canopy water between 2011 and 2015. Of this group, up to 58 million large trees reached water loss thresholds that the scientists deemed extremely threatening to long-term forest health. Given the severity of the situation, even with increased precipitation due to El Nino, if drought conditions reoccur in the near future, the team predicts that there would be substantial changes to already significantly weakened forest structures and systems.

"The Carnegie Airborne Observatory's research provides invaluable insight into the severity of drought impacts in California's iconic forests. It will be important to bring their cutting-edge data and expertise to bear as the state seeks to address the effects of this epidemic of dying trees and aid in the recovery of our forests," said Ashley Conrad-Saydah, deputy secretary for climate policy at the California Environmental Protection Agency.

Since day one of CAO flight operations, Asner has been engaged with forest managers and officials from the California EPA and Department of Forestry and Fire Protection to inform decision-makers on the severity of forest water losses from the drought and beetle outbreaks. The team's results also helped motivate the California governor's recent proclamation of a state of emergency for dead and dying trees across the state. The latest CAO maps of forest vulnerability were recently transmitted to both state and federal partners.

"Our high-resolution mapping approach identifies vulnerable trees and changing landscapes," Asner added. "Continued airborne and satellite monitoring will enable actions on the ground to mitigate a cascade of negative impacts from forest losses due to drought, as well as aid in monitoring forest recovery if and when the drought subsides."



Caption: Progressive forest canopy water stress in the state of California from 2011 to 2015, courtesy of Greg Asner.

(**Top image caption:** Mixed levels of drought stress in one of California's forest landscapes, courtesy of Greg Asner.)

———————

This study was supported by the David and Lucile Packard Foundation.

The Carnegie Airborne Observatory is currently supported by the Avatar Alliance Foundation, the John D. and Catherine T. MacArthur Foundation, Mary Anny Nyburg Baker and G. Leonard Baker Jr., and William R. Hearst III.

Scientific Area:
Global Ecology
Reference to Person:
Greg Asner
Reference to Project:
The Carnegie Airborne Observatory

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Systems Plan Update
for the
Tahoe Truckee Area Regional Transit in
Eastern Placer County

Prepared for the

County of Placer

Prepared by

TRANSPORTATION
CONSULTANTS, INC.

LSC Transportation Consultants, Inc.

Systems Plan Update

Tahoe Truckee Area Regional Transit in Eastern Placer County

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April 6, 2016

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Chapter 1
Introduction

Placer County has been providing public transit services in eastern Placer County and adjacent areas under the Tahoe Area Regional Transit (TART) appellation since 1975. Since the adoption of the most recent plan (*Tahoe Area Regional Transit Systems Plan*) in 2005, the importance of public transportation services has grown, in terms of ridership as well as to regional economic and environmental goals.

Beginning in 2012, the North Lake Tahoe Resort Association (NLTRA) and the Truckee North Tahoe Transportation Management Association (TNT/TMA) have been leading a regional effort to expand public transit to match the quality of service provided in many similar mountain resort areas. This “Transit Vision” effort has included a series of annual transit summits, as well as technical analyses of operational strategies, financial strategies, and economic benefits. The resulting Transit Vision focuses on improvements in service frequency, expansion of the hours of service, and elimination of transit fares. This current plan is intended to focus specifically on transit program enhancements consistent with the Transit Vision that are the implementation responsibility of Placer County, within the larger Vision structure.

The Placer County TART program was recently rebranded, along with the Town of Truckee’s transit program, into a single region wide Tahoe Truckee Area Regional Transit brand. This includes a consistent public image (logo, signage, and bus paint scheme), combined marketing pieces, and single combined telephone information service and internet presence. This planning process, however, focuses on Placer County’s directly operated service, and does not include plans for the parallel Town of Truckee services.

This document represents a focused systems plan rather than a traditional short range transit plan. This is appropriate because of the three years of work that preceded this systems plan related to the Transit Vision Plan. This focused scope includes (1) a concise review of existing service area characteristics, (2) a summary and evaluation of existing transit services (including the results of an onboard passenger survey), and (3) a short-range (five year) service, capital, management and financial plan for the Placer County TART program.

Placer County staff will continue to work with TRPA to incorporate the TART Systems Plan Update into a long range transit plan for the entire Tahoe basin. This longer range transit plan will also be coordinated with broader regional transportation studies such as the Trans-Sierra Transportation Plan and the Corridor Connection Plan. The Trans-Sierra Transportation Plan encompassed 11 counties and included the Placer County Transportation Planning Agency (PCTPA), Tahoe Transportation District (TTD) and Tahoe Metropolitan Planning Organization (TMPO) to study travel into the region and assembles plans and strategies to address the impacts. The Corridor Connection Plan, being led by the TTD, TMPO and TRPA, is more focused on multi-modal corridor level planning within the Tahoe Basin. The TART Systems Plan will also be incorporated into the Regional Transportation Plans of both the TRPA and the PCTPA.

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Study Setting

The focus of this plan is the eastern portion of Placer County encompasses the unincorporated areas east of the Sierra Crest. It is bounded by Nevada County, California (including the Town of Truckee) to the north, Washoe County, Nevada to the east, and El Dorado County, California to the south. It includes the West Shore and North Shore of Lake Tahoe, the Truckee River Canyon and adjacent Olympic Valley and Bear Valley areas, as well as the Martis Valley area. It includes mountain resorts (Squaw Valley, USA, Alpine Meadows Ski Area, Northstar California, and Homewood Mountain Resort), commercial activity centers (including Homewood, Tahoe City, Kings Beach, Northstar Village, and Squaw Valley Village), state parks and state recreation areas, and a wide variety of residential and recreational centers.

Eastern Placer County is part of a larger North Tahoe / Truckee region. Reflecting this, the Placer County TART system (through intergovernmental agreements) also serves Crystal Bay (North Stateline) and Incline Village, Nevada and Truckee, California.

Population

Table 1 presents US Census population figures from the 2000 and 2010 decennial censuses, as well as the 2014 American Community Survey estimates. The population of the general area served by TART currently (as of 2014, the most recent data available) stands at 37,676, including all of eastern Placer County, the Incline/Crystal Bay portion of Washoe County, Nevada, the Town of Truckee, as well as the Tahoma/Rubicon Bay portion of El Dorado County, California. Of this, 12,809 live in eastern Placer County, consisting of 9,832 in the Tahoe Basin, 1,829 in the Martis Valley area, and 1,148 in the census tract encompassing Squaw Valley, Alpine Meadows and Serene Lakes.

Note that select 2000 Census Tracts differ from the 2010/2014 Census Tracts. Overall, most of the 2000 Census Tracts are comparable to one or more of the 2010/2014 Census Tracts, allowing for a valuable evaluation of demographic change throughout the years. However, as the 2010/2014 Census Tracts encompassing the Martis Valley/Squaw Valley/Alpine Meadows Area geographically differ from the corresponding 2000 Census Tracts (which included portions of Colfax), the 2000 Census Tracts are omitted from this analysis. It should also be noted that there are differences in data collection between the decennial census and the 2014 sample data that affect the trends.

The available comparable population data indicates the following trends:

- The population of the Tahoe Basin portion of eastern Placer County dropped considerably (23 percent) between 2000 and 2010. However, it is estimated to have increased by 5 percent from 2010 to 2014.

TABLE 1: TART Service Area Population

Area	2010, 2014 Census Tract	2000 Census Tract	Total Persons			Youth (10-17)			Elderly (60+)			Persons with a Disability		Persons Below Poverty			Zero Vehicle Households		
			2000	2010	2014	2000	2010	2014	2000	2010	2014	2000	2014	2000	2010	2014	2000	2010	2014
Eastern Placer County																			
Kings Beach	201.07	201.07	3,774	3,171	3,111	433	187	264	187	108	280	21	189	698	266	536	28	155	39
Tahoe Vista	201.06	201.06	1,931	1,683	1,605	194	178	88	185	212	351	343	44	151	74	153	14	0	12
Carnelian Bay	201.05	201.05	1,694	1,047	1,183	62	107	67	231	299	379	253	74	117	34	101	16	0	0
Dollar Point	201.04	201.04	1,806	1,090	1,140	166	108	62	368	328	264	237	84	206	112	170	7	0	0
Tahoe City	222	201.03	1,058	802	1,080	105	69	113	91	282	172	94	51	5	85	56	0	0	6
Sunnyside	221	201.02	1,087	860	975	66	63	11	97	81	204	124	39	49	32	46	11	11	11
Homewood	223	201.01	808	701	738	74	63	39	122	158	177	108	82	67	67	72	0	38	30
Subtotal: Placer Tahoe Basin			*12,158*	*9,354*	*9,832*	*1,100*	*775*	*645*	*1,281*	*1,468*	*1,827*	*1,180*	*563*	*1,293*	*670*	*1,134*	*76*	*204*	*98*
Martis Valley	220.11	Note 1	--	1,354	1,829	--	222	373	--	329	325	--	96	--	211	80	--	11	4
Squaw Valley, Alpine Meadows, Serene Lakes	220.14			956	1,148		49	47		371	344		69		116	99		0	0
Subtotal: Eastern Placer County	--	--	--	*11,664*	*12,809*	--	*1,046*	*1,065*	--	*2,168*	*2,497*	--	*728*	--	*997*	*1,314*	--	*215*	*102*
Other Areas Served																			
Incline Village/Crystal Bay	--	--	9,952	8,606	8,582	952	637	573	1,828	2,119	2,634	1,300	737	709	384	1,036	56	66	64
Truckee	--	--	10,422	15,975	16,285	1,403	1,943	1,777	782	1,406	2,008	1,635	907	533	1,367	1,393	56	329	121
Tahoma/Rubicon Bay	320	305.03	1,158	801	676	110	22	76	136	115	166	167	110	88	84	60	19	33	25
Total Study Area			--	36,245	37,676	--	3,626	3,415	--	5,692	7,139	--	2,372	--	2,748	3,742	--	610	287

Note 1: 2000 Census Tract included portions of Colfax, making direct comparison of census tract data impossible. SOURCE: US Census

- The population of the Washoe County area served by TART dropped by 14 percent between 2000 and 2010, and has been relatively unchanged between 2010 and 2014.

- Truckee has seen the greatest growth, with 2014 population 56 percent (5,863 persons) over 2000 levels.

- The El Dorado County census tract encompassing Tahoma and the Rubicon Bay area dropped 31 percent in population between 2000 and 2010, and another 11 percent between 2010 and 2014.

<u>Transit Dependent Population</u>

Nationwide, public transit ridership is drawn in large part from the potentially transit-dependent population consisting of elderly and youth, low-income, disabled, and households with no available vehicles. Estimates of current population by categories and households are available at the Census Tract level through the US Census Bureau.

Youths

Youths represent a transportation-dependent population, as those younger than 18 are often unable to drive and may not have a parent available to transport them. In particular, junior high school students who are independent enough to attend after-school activities but are unable to drive are a representative group. The population between 10 and 17 years of age (inclusive), by Census Tract, is presented in Table 1, while the proportion of total population in this category is shown in Table 2. As of 2014, there are an estimated 3,415 youth within the study area, comprising 9.1 percent of the total study area population. The highest youth population (1,777, accounting for 49 percent of total study area youths) exists in the Truckee area (Census Tracts 12.03 – 12.06). While the 2014 Truckee youth population has grown by 26 percent since 2000, it has decreased by 9 percent since 2010, contributing to the recent overall 6 percent decline in study area youth population.

Elderly

In 2014 the population aged 60 years of age and older comprises 7,139 persons, which is 18.9 percent of the total study area population. The senior population has risen from 5,496 in 2010. Within the Tahoe Basin portion of eastern Placer County, elderly residents have increased from 1,281 in 2000 to 1,827 in 2014. There are particularly high concentrations of seniors in the Incline Village/Crystal Bay area, where 31 percent of the residents are age 60 or above, along with the Carnelian Bay area (32 percent). In comparison, the proportion of elderly is relatively low in Kings Beach (9 percent) and Truckee (12 percent).

TABLE 2: TART Service Area Population Characteristics

Area	Youth (10-17)		Elderly (60+)		Persons with a Disability		Individuals Below Poverty		Zero Vehicle Households	
	2000	2014	2000	2014	2000	2014	2000	2014	2000	2014
Eastern Placer County										
Kings Beach	11.5%	8.5%	5.0%	9.0%	0.6%	6.1%	18.5%	17.2%	1.6%	2.2%
Tahoe Vista	10.0%	5.5%	9.6%	21.9%	17.7%	2.7%	7.8%	9.5%	1.6%	1.4%
Carnelian Bay	3.7%	5.7%	13.6%	32.0%	14.9%	6.3%	6.9%	8.5%	2.6%	0.0%
Dollar Point	9.2%	5.4%	20.4%	23.2%	13.1%	7.4%	11.4%	14.9%	1.1%	0.0%
Tahoe City	9.9%	10.5%	8.6%	15.9%	8.9%	4.7%	0.5%	5.2%	0.0%	1.0%
Sunnyside	6.1%	1.1%	8.9%	20.9%	11.4%	4.0%	4.5%	4.8%	2.6%	2.6%
Homewood	9.2%	5.3%	15.1%	24.0%	13.4%	11.1%	8.3%	9.8%	0.0%	8.3%
Subtotal: Placer Tahoe Basin	9.0%	6.6%	10.5%	18.6%	9.7%	5.7%	10.6%	11.5%	1.4%	1.9%
Martis Valley	--	20.4%	--	17.8%	--	5.2%	--	4.4%	--	0.4%
Squaw Valley, Alpine Meadows, Serene Lakes	--	4.1%	--	30.0%	--	6.0%	--	8.7%	--	0.0%
Subtotal: Eastern Placer County	--	*8.3%*	--	*19.5%*	--	*5.7%*	--	*10.3%*	--	*1.4%*
Other Areas Served										
Incline Village/Crystal Bay	9.6%	6.7%	18.4%	30.7%	13.1%	8.6%	7.1%	12.1%	1.3%	1.5%
Truckee	13.5%	10.9%	7.5%	12.3%	15.7%	5.6%	5.1%	8.6%	0.7%	1.4%
Tahoma/Rubicon Bay	9.5%	11.2%	11.7%	24.6%	14.4%	16.3%	7.6%	8.9%	3.7%	6.6%
Total Study Area	--	9.1%	--	18.9%	--	6.3%	--	9.9%	--	1.4%

SOURCE: US Census

Disability

Tables 1 and 2 also depict the study area population with disabilities by Census Tract for the year 2000 and 2014. Note that this information is not available for 2010. As of 2014, 2,372 individuals within the study area reported that they have a disability, equal to 6.3 percent of total population Truckee has the highest disabled populations (569 individuals). In the year 2000, the disabled population was much larger, consisting of 4,115 individuals (not including the Martis Valley/Squaw Valley/Alpine Meadows region).

Poverty

The US Census also counts the population living below the poverty level, defined by a number of factors including household income and the number of dependent children. Residents living below the poverty level comprise 9.9 percent of the study area population, compared to 16.4 statewide. The areas with the greatest number of residents below the poverty level include Kings Beach (536 individuals, or 17 percent of total), Truckee (1,393 residents or 8.6 percent of total) and Incline Village/Crystal Bay (1,036 individuals, or 12.1 percent of total). Overall, the number of persons below poverty in the Tahoe Basin portion of Placer County and the Tahoma area have declined somewhat since 2000, while those in Truckee and Incline Village/Crystal Bay have increased.

<u>Zero-Vehicle Households</u>

Finally, one of the strongest indicators of transit dependency is the number of households without a vehicle available. As of 2014, there are a total of 287 households in the study area without a vehicle (1.4 percent of all households). Truckee has the highest number of zero-vehicle households (121, or 1.4 percent of all households). Within eastern Placer County, zero vehicle households are largely in Kings Beach and in Homewood.

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Existing Transit Services

Placer County's TART program is the primary public transit service in eastern Placer County. In addition, there are connecting public transit services as well as privately operated shuttle services.

TAHOE TRUCKEE AREA REGIONAL TRANSIT – Placer County Services

Overall Service Description

As of April 2016, Placer County TART fixed route services consist of the following:

- The **Mainline Route** consists of buses operating along the Lake Tahoe shoreline between Sugar Pine Point State Park (in El Dorado County) and the Hyatt Regency Resort in Incline Village (Washoe County, Nevada). Three buses are used to operate hourly service between Sugar Pine Point State Park and Crystal Bay, as well as half-hourly service between Crystal Bay and the Hyatt. In summer, the half-hourly service is expanded west to Tahoe City through the operation of a fourth bus. The overall span of service is from 6:00 AM to 7:25 PM, year-round, though the span of service on the West Shore portion between Tahoe City and Sugar Pine Point State Park is limited to 7:10 AM – 5:50 PM.

- The **Highway 89 Route** provides hourly service between Tahoe City and Truckee using two buses. Service is provided between 6:00 AM and 6:28 PM, year-round. All runs serve stops at the Alpine Transportation Center (Deer Park) and in Squaw Valley at the Resort and Square Creek, the Clock Tower, and the Village at Squaw Valley.

- The **Highway 89 Route** consists of two buses providing hourly service between Crystal Bay (Crystal Bay) and Truckee, via Northstar and the Truckee Airport. Service is operated from 6:00 AM to 6:28 PM. As of the beginning of the 2015/16 winter season, service will be provided year-round.

- Placer County also operates the **Night Service**, in both summer and winter. This free-to-the-rider service consists of two buses operating hourly between Squaw Valley and Crystal Bay (7:00 PM to 2:00 AM), one bus operating hourly between Tahoe City and Tahoma (6:30 PM to 1:30 AM), and one bus operating hourly between Crystal Bay and Northstar (6:30 PM and 12:30 AM). In previous years, this service was operated by a contractor and was branded as the Night Rider. The service is no longer separately branded, to provide a more cohesive overall TART service identity.

- The **North Tahoe Ski Shuttle** consists of two buses operating two runs in both the morning and the afternoon on peak ski days. These days consist of a two-week period around the Christmas holidays, a one-week period around Presidents Day, a second one-week period around Spring Break, as well as other weekend days between December 18 and March 27. Schedules are designed to provide access from lodging properties along the North Shore, the West Shore and in Squaw Valley to the ski lifts at Squaw Valley, Alpine Meadows and Homewood. Also as part of this program, free TART vouchers are made available to lodging properties in Placer County for use by their guests.

Placer County also manages and funds a **Subsidized Taxi Service** to comply with the requirements of the Americans with Disabilities Act (ADA). This service is available to residents of the service area that are identified as being eligible through an application process (that requires a physician's authorization). Once in the program, the rider purchases vouchers, that are available at the Kings Beach Library, the Kings Beach Safeway, and through the mail. Ride requests are made directly with the taxi operator (Tahoe Blue Taxi), at least 24 hours in advance and up to 14 days in advance. The operator is paid at a rate of $3.84 per mile the passenger is transported.

Major Changes in TART over the Last Ten Years

There have been a number of changes to TART services over the last ten years:

- Implementation of electronic fare collection system – 2005
- First summer of half-hourly North Shore service (Tahoe City to Crystal Bay) – 2005
- Improvement of Truckee-Tahoe City route in non-winter seasons to hourly service – 2008
- Fare Increase from $1.25 (base fare) to $1.75 and elimination of transfers – 2009
- Initiation of Winter SR 267 Service – 2007
- Last year of summer daytime Tahoe City Trolley -- 2008
- Last year of summer daytime Tahoe Vista – Crystal Bay Trolley – 2009
- Construction of 12 new shelters – 2009 to 2015
- Initiation of Summer SR 267 Service between Northstar and Crystal Bay – 2010
- Opening of Tahoe City Transit Center – 2012
- Implementation of Nextbus real-time bus tracking capabilities – 2012
- Initiation of Skier Shuttle service – 2012 (Operated by private contractor in 2012/13, by TART starting winter of 2013/14
- Conversion of summer and winter evening service from Trolley service (Squaw Valley – Incline Village and Crystal Bay – Northstar) to contracted Night Rider bus service (Squaw Valley – Crystal Bay, Crystal Bay – Northstar, and Tahoma – Tahoe City) – 2013
- Initiation of SR 267 Summer Service – 2015
- Initiation of SR 267 Spring and Fall Service – 2016
- Placer County assumes direct operation of Night Rider Service – 2015
- Joint branding with Town of Truckee as Tahoe Truckee Area Regional Transit – 2015
- Begin replacement of existing bus fleet -- 2016

Fare Structure

TART's fares for daytime are as follows:

	Full Fare	Discounted Fare
Single Boarding	$1.75	$0.85
24-Hour Pass	$3.50	$1.75
10-Ride Pass	$14	$7
14-Day Pass	$30	$15
30-Day Pass	$53	$26.50

Discounted fares are provided to passengers age 60 and above, youth age 6 to 12, and Medicare card holders. Children age 5 and under ride for free with an adult. No transfers are provided; instead, passengers making transfers are encourage to purchase a 24-hour pass. Evening services (summer and winter) are provided free to the passenger.

Ridership

<u>TART Ridership History by Route and Season</u>

Table 3 presents the seasonal TART ridership on the individual routes from FY (Fiscal Year) 2010-11 to FY 2015-16 (year-to-date). As shown, during this period, ridership has generally declined:

- During the **fall** season, ridership has decreased most substantially on the North Shore and Nevada routes, dropping by 21.4 percent and 19.2 percent, respectively. In total, daytime fixed route ridership during the fall has decreased by 16.5 percent (or 9,970 passenger-trips).

- During the **spring** season, total daytime fixed route ridership fell by 17.7 percent between 2011 and 2015. The North Shore routes experienced the largest reduction in spring ridership, amounting to 6,739 (or 22.6 percent) less passenger-trips.

- The **summer** season also experienced a large net reduction in passenger-trips (14,645 or 21.5 percent less passenger-trips) between 2011 and 2015. While summer ridership on most of the daytime fixed routes (particularly Hwy 89, Nevada and North Shore) decreased, ridership on the Hwy 267 route increased by 2,232 passenger-trips, or 82.5 percent.

- Ridership within the **winter** season between 2011 and 2015 has stayed relatively steady, only decreasing by 3.4 percent, or 5,768 passenger-trips. While winter ridership did decrease by 10,358 passenger-trips (or 26.2 percent) on the Highway 267 routes, it grew by 3,554 passenger-trips (or 24.6 percent) on the West Shore routes and 2,299 passenger-trips (or 5.2 percent) on the Hwy 89 routes.

TABLE 3: TART Ridership History by Route and Season

	Fixed Route Daytime Routes						Trolley					
	West Shore	North Shore	Nevada	89	267	Subtotal	CA	NV	Subtotal	Skier Shuttle	Night Rider	TOTAL
Fall												
2011	6,616	29,753	8,810	15,130	0	60,309	0	0	0	0	0	60,309
2012	7,092	30,577	9,416	14,225	225	61,535	0	0	0	0	0	61,535
2013	6,344	28,783	9,095	16,606	0	60,828	0	0	0	0	0	60,828
2014	6,660	26,739	7,995	17,945	209	59,548	0	0	0	0	0	59,548
2015	5,921	23,371	7,120	13,927	0	50,339	0	0	0	0	0	50,339
5 Yr Change	-695	-6,382	-1,690	-1,203	0	-9,970	--	--	--	--	--	-9,970
5 Yr % Change	-10.5%	-21.4%	-19.2%	-8.0%	--	-16.5%	--	--	--	--	--	-16.5%
Winter												
2010-11	14,424	60,694	13,125	43,903	39,532	171,678	0	0	0	0	0	171,678
2011-12	13,340	50,748	16,058	37,594	40,488	158,228	0	0	0	0	0	158,228
2012-13	15,750	58,532	16,240	32,612	36,811	159,945	0	0	0	0	0	159,945
2013-14	14,103	60,881	13,942	42,966	33,792	165,684	0	0	0	1,218	0	166,902
2014-15	17,978	59,571	12,985	46,202	29,174	165,910	0	0	0	1,680	0	167,590
2015-16 YTD	11,330	37,519	8,918	24,735	26,299	108,801	0	0	0	1,362	20,912	131,075
5 Yr Change	3,554	-1,123	-140	2,299	-10,358	-5,768	--	--	--	--	--	-4,088
5 Yr % Change	24.6%	-1.9%	-1.1%	5.2%	-26.2%	-3.4%	--	--	--	--	--	-2.4%
Spring												
2011	7,250	29,802	8,508	15,367	27	60,954	29	14	43	0	0	60,997
2012	7,199	29,964	9,221	14,349	679	61,412	0	0	0	0	0	61,412
2013	7,169	29,230	9,072	11,919	521	57,911	0	0	0	0	0	57,911
2014	6,522	25,388	8,218	14,634	316	55,078	0	0	0	0	0	55,078
2015	6,705	23,063	7,336	13,036	0	50,140	0	0	0	0	0	50,140
5 Yr Change	-545	-6,739	-1,172	-2,331	-27	-10,814	--	--	--	--	--	-10,857
5 Yr % Change	-7.5%	-22.6%	-13.8%	-15.2%	-100.0%	-17.7%	--	--	--	--	--	-17.8%
Summer												
2011	8,848	31,461	9,818	15,369	2,706	68,202	7,740	1,937	9,677	0	0	77,879
2012	9,166	30,714	9,127	13,368	2,627	65,002	0	0	0	0	0	65,002
2013	7,835	29,868	8,958	11,920	3,323	61,904	0	0	0	0	0	61,904
2014	7,727	28,202	7,826	13,533	3,122	60,410	0	0	0	0	0	60,410
2015	7,801	23,137	7,372	10,309	4,938	53,557	0	0	0	0	0	53,557
5 Yr Change	-1,047	-8,324	-2,446	-5,060	2,232	-14,645	-7,740	-1,937	-9,677	0	0	-24,322
5 Yr % Change	-11.8%	-26.5%	-24.9%	-32.9%	82.5%	-21.5%	--	--	--	--	--	-31.2%
TOTAL (1)												
2010-11	37,138	151,710	40,261	89,769	42,265	361,143	7,769	1,951	9,720	0	0	370,863
2011-12	36,797	142,003	43,822	79,536	44,019	346,177	0	0	0	0	0	346,177
2012-13	37,098	146,413	43,365	73,057	40,655	340,588	0	0	0	0	0	340,588
2013-14	35,012	141,210	37,981	89,078	37,439	340,720	0	0	0	1,218	0	341,938
2014-15	38,405	129,142	34,813	83,474	34,112	319,946	0	0	0	1,680	0	321,626
2015-16 YTD	11,330	37,519	8,918	24,735	26,299	108,801	0	0	0	1,362	20,912	131,075
5 Yr Change	1,267	-22,568	-5,448	-6,295	-8,153	-41,197	-7,769	-1,951	-9,720	1,680	0	-49,237
5 Yr % Change	3.4%	-14.9%	-13.5%	-7.0%	-19.3%	-11.4%	--	--	--	--	--	-13.3%

Winter season -- December 14th to April 5th
Summer season -- July 1st to Sept 7th

- The change in **total annual** ridership is shown at the bottom of Table 3. As illustrated, ridership among the daytime fixed routes decreased by a total of 11.4 percent, or 41,197 passenger-trips, between 2011 and 2015. The West Shore routes have experienced a slight increase in ridership (3.4 percent or 1,267 passenger-trips). In contrast, the North Shore routes and Hwy 267 routes had the largest decreases in ridership, respectively 14.9 percent (or 22,568 passenger-trips) and 19.3 percent (or 8,153 passenger-trips).

As also shown in the table, Trolley service has not been in commission since the year 2011. The Skier Shuttle, which began in 2013, has grown from 1,218 trips in FY 2013-14, to 1,362 trips in FY 2015-16 (as of March 1st). As also shown, the Night Rider service generated 20,912 passenger-trips in FY 2015-16 to date (the first season of direct TART operation).

Recent TART Ridership

To gain a current picture of ridership trends, Table 4 presents the FY 14-15 TART ridership next to the FY 15-16 TART ridership between the dates of July and February. This can help to assess whether the decrease in 2015 ridership levels from 2011 ridership levels is due to an outside factor, such as low snowpack. As shown, the decline in ridership continued during the months of July through December. In January and February, however, FY 15-16 ridership has increased from the previous year. In total, between the months of June and February, FY 15-16 had 233,430 passenger-trips, whereas FY 14-15 had 246,319 passenger-trips (a 5 percent decline)

TABLE 4: TART FY 14/15 and FY 15/16 Ridership To-Date

	2014/15 YTD	2015/16 YTD	% Change
July	28,792	25,397	-12%
August	26,550	23,012	-13%
September	20,036	18,422	-8%
October	17,638	15,333	-13%
November	15,257	13,663	-10%
December	41,399	37,417	-10%
January	51,901	52,907	2%
February	44,746	47,279	6%
Total	**246,319**	**233,430**	-5%

TART Ridership by Month

Table 5 and Figure 1 present the monthly daytime ridership by route. This reflects the relative strength of the winter ridership (December through March), peaking for all routes in January.

The summer months of July and August are also relatively high, particularly on the routes along the Tahoe lakeshore. Note that 267 Route service was not operated in the spring and fall seasons in 2015.

TABLE 5: TART Monthly Ridership by Route

Calendar Year 2015

	Route				
	West Shore	North Shore	Nevada	89	267
January	5,950	18,398	3,777	14,172	9,131
February	4,780	15,518	3,429	12,628	7,988
March	3,596	13,306	3,530	10,444	6,169
April	2,123	7,898	2,444	5,477	536
May	2,211	7,474	2,344	4,196	0
June	2,778	9,214	3,007	4,461	0
July	3,829	10,912	3,542	4,830	2,284
August	3,299	10,042	3,158	4,314	2,199
September	2,354	8,225	2,621	4,767	455
October	1,827	7,130	2,267	4,109	0
November	1,579	6,349	1,972	3,763	0
December	3,055	12,354	2,928	8,347	6,050

SOURCE: TART

TART Ridership by Day of Week

Table 6 depicts the average TART ridership by day of week for each season on the various fixed route daytime routes. Ridership in the winter and summer was relatively even throughout the week, only fluctuating by about 20 percent. There was more daily variation in the shoulder seasons of spring and fall, which diverge by roughly 30 percent, depending on the day. As shown, average daily ridership was lowest on Sunday during all seasons (ranging from 450 passenger trips in the spring to 1,306 in the fall and winter). During the winter, Tuesday had the highest number of riders (1,575), followed by Monday and Wednesday. In the spring season, Wednesday had the highest number or riders (654), followed by Monday and Thursday. Summer ridership was highest on Thursday and Friday (with 909 and 936 riders, respectively). Fall's busiest ridership days were Monday and Wednesday, each with 666 passenger-trips.

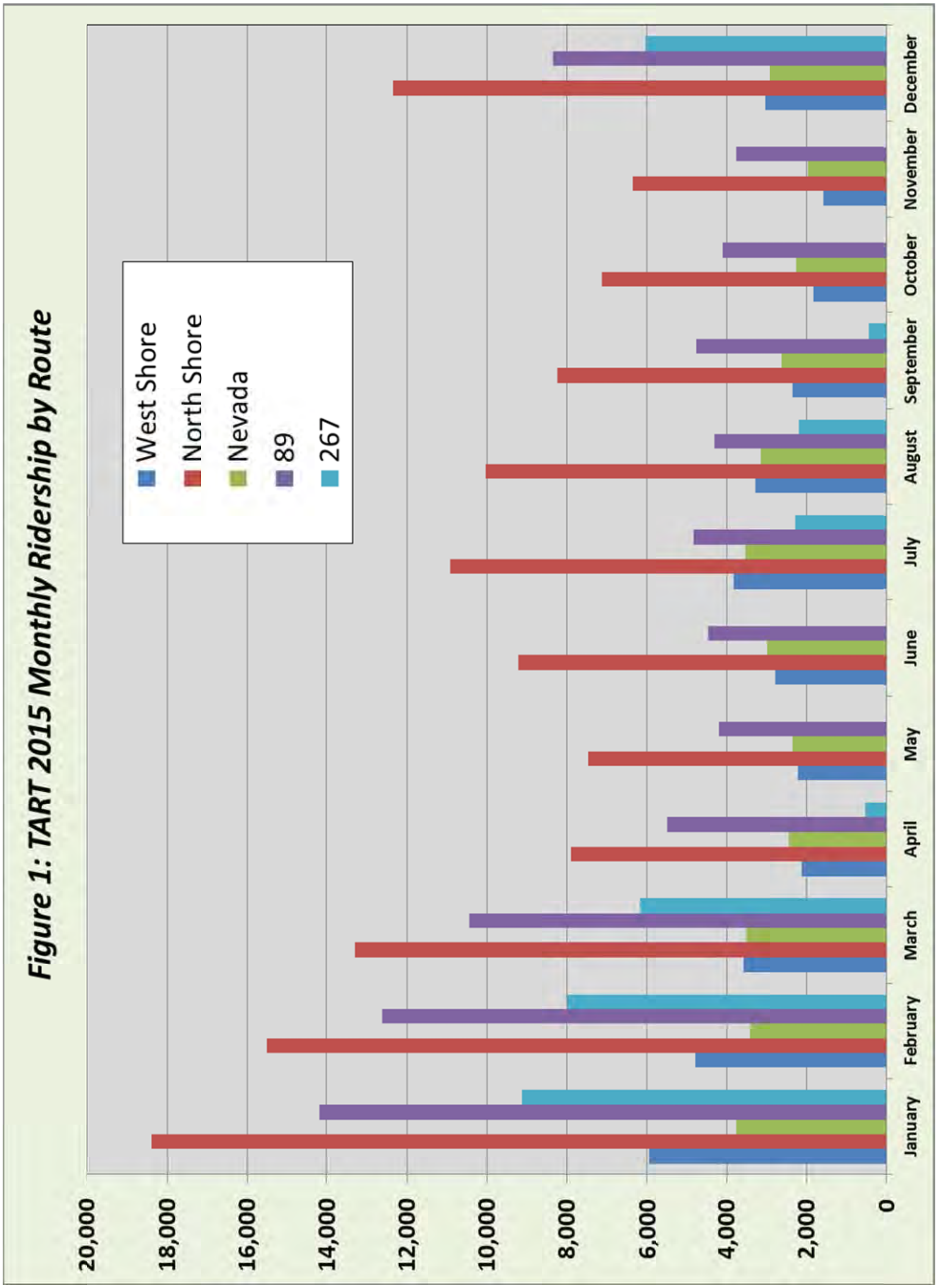

Figure 1: TART 2015 Monthly Ridership by Route

TABLE 6: TART Ridership by Route by Day of Week by Season

Winter 2014/15 to Fall 2016

	Fixed Route Daytime Routes					
	West Shore	North Shore	Nevada	89	267	TOTAL
Winter						
Sunday	146	462	95	339	264	1,306
Monday	178	530	124	448	256	1,535
Tuesday	157	560	126	479	253	1,575
Wednesday	164	563	126	445	241	1,539
Thursday	156	531	112	409	256	1,463
Friday	171	532	126	403	268	1,499
Saturday	143	517	97	345	270	1,371
Spring						
Sunday	67	224	66	101	0	458
Monday	84	281	90	172	0	628
Tuesday	74	269	88	173	0	604
Wednesday	83	297	91	182	0	654
Thursday	89	277	86	168	0	620
Friday	77	287	99	142	0	605
Saturday	71	240	76	120	0	507
Summer						
Sunday	96	364	90	164	46	760
Monday	118	399	114	205	44	879
Tuesday	108	411	119	197	42	877
Wednesday	106	423	122	211	36	898
Thursday	116	417	124	211	41	909
Friday	125	442	119	202	47	936
Saturday	116	405	105	184	60	870
Fall						
Sunday	58	229	62	102	0	450
Monday	71	283	85	228	0	666
Tuesday	71	273	86	211	0	642
Wednesday	66	282	97	221	0	666
Thursday	68	272	82	213	0	635
Friday	77	319	89	177	0	662
Saturday	71	267	76	137	15	565

Winter season -- December 14th to April 5th

Summer season -- July 1st to Sept 7th

As also illustrated in the table, the West Shore, North Shore, Nevada, and Highway 89 routes had the highest ridership levels on weekdays. These high weekday trends suggest that the bulk of winter ridership is generated by local residents. In contrast, the Highway 267 route had the highest ridership on Saturdays.

TART Ridership by Hour by Route by Season

Daily boarding data was analysis for a two week period in peak winter (January), peak summer (August) and offseason (October) in order to identify the average boardings for each season by route over each hour of the day. The results are presented in Table 7 and Figure 2. As indicated, hourly passenger activity is substantially higher in winter than the other seasons. Ridership in winter is particularly concentrated in the commute periods (6:00 AM to 9:00 AM, and 4:00 PM to 6:00 PM), and in particular along the North Shore, SR 89 and SR 267 routes. All three of these routes have hourly boardings exceeding 53 passengers. While not all passengers may have been onboard at any one time, these figures compared with the maximum seating capacity of a TART bus (38 passengers) indicates that standees are a common occurrence on these three routes during bus morning and afternoon periods. It should be noted that a “tripper” bus (a second bus on the same schedule) is often operated along the North Shore and SR 89 Routes to address this issue. In comparison, the West Shore Route and Incline Village Route in winter, as well as all of the routes in summer and off-season, carry passenger loads within the seating capacity on all runs.

Resort Employee Program

A significant proportion of TART daytime riders are part of the “Resort Employee Ride” Program, by which major resort employers are charged directly for the rides by their employees. As shown in Table 8, over the most recent available 12-month period (March 2015 through February 2016), 103,333 passengers have boarded as part of this program. Comparing this most recent data with that of previous years, current ridership is down 10 percent in comparison with Fiscal Year 2013-14 ridership, and down 17 percent in comparison with Fiscal Year 2014-15 ridership.

Night Service Ridership by Route by Run by Season

Table 9 presents the TART Night Service total and average daily ridership by route, run and season during the winter and summer of 2015. As shown, during the winter, the Squaw Valley – Crystal Bay route had the highest ridership (with 13,213 total passenger-trips or an average of 118 daily passenger-trips), followed by the Crystal Bay – Squaw Valley route (with 12,930 total passenger-trips or an average of 115 daily passenger-trips). In contrast, the Crystal Bay – Northstar route experienced the lowest winter ridership, with 2,376 total passenger-trips or an average of 21 daily passenger-trips. The winter runs with the highest ridership included the Squaw Valley – Crystal Bay 7:00 PM and 9:00 PM runs (with respectively 2,521 and 2,506 passenger-trips), as well as the Crystal Bay – Squaw Valley 8:00 PM and 10:00 PM runs (with respectively 2,375 and 2,356 passenger-trips). The run with the highest average daily ridership

TABLE 7: Ridership by Route by Hour by Season

Hr Start	WINTER						SUMMER						OFFSEASON				
	West Shore	North Shore	Incline Village	Tahoe City-Truckee	N. Stateline-Truckee	TOTAL	West Shore	North Shore	Incline Village	Tahoe City-Truckee	N. Stateline-Truckee	TOTAL	West Shore	North Shore	Incline Village	Tahoe City-Truckee	TOTAL
6:00 AM	1.4	74.9	19.4	10.0	0.0	105.7	3.2	30.1	8.7	1.6	0.0	43.6	0.4	20.0	7.6	1.2	29.3
7:00 AM	24.7	76.7	7.1	37.0	56.1	201.7	18.5	29.6	7.4	11.3	4.1	70.9	9.9	30.2	6.5	14.4	61.1
8:00 AM	13.7	30.2	6.1	25.2	26.7	101.9	4.6	33.9	11.5	10.7	10.4	71.1	3.9	23.1	5.5	9.5	42.1
9:00 AM	13.8	20.6	6.9	18.9	22.0	82.3	6.0	25.4	5.6	10.6	5.2	52.8	3.0	12.2	4.8	6.7	26.7
10:00 AM	10.6	20.8	6.5	21.5	21.1	80.5	8.2	23.6	9.1	9.3	6.5	56.6	3.4	16.0	5.6	8.3	33.3
11:00 AM	7.3	22.5	5.3	17.4	16.4	69.0	6.1	21.1	6.3	12.5	5.9	51.9	4.1	11.1	4.7	8.7	28.6
12:00 PM	6.0	26.3	7.5	20.9	17.4	78.0	6.4	18.8	7.6	10.8	6.1	49.7	3.3	14.0	5.6	9.6	32.5
1:00 PM	7.4	26.7	7.0	21.5	18.2	80.8	12.7	16.6	7.8	12.5	6.7	56.3	4.9	19.3	5.2	12.1	41.5
2:00 PM	9.8	33.6	6.9	43.3	22.3	115.9	8.7	32.3	6.8	17.6	10.0	75.4	5.7	22.0	7.6	34.8	70.1
3:00 PM	12.7	29.4	10.8	50.8	33.5	137.2	13.6	32.4	13.1	19.4	6.4	85.0	7.0	23.5	9.1	18.6	58.1
4:00 PM	21.7	45.5	9.9	62.6	59.0	198.7	15.4	30.9	8.8	21.5	8.4	85.1	10.4	23.4	7.7	14.2	55.7
5:00 PM	22.6	63.1	10.8	17.3	53.5	167.3	10.5	28.3	9.1	6.1	6.5	60.4	4.4	21.1	5.2	6.3	37.1
6:00 PM	2.7	40.5	5.2	0.0	0.0	48.4	3.5	18.2	3.9	0.0	0.0	25.7	0.9	4.0	1.3	0.0	6.3
7:00 PM	0.0	0.0	1.6	0.0	0.0	1.6	0.0	0.0	1.6	0.3	0.0	1.9	0.0	0.0	0.0	0.0	0.0
TOTAL	154.4	510.7	111.0	346.3	346.1	1468.6	117.5	341.2	107.3	144.1	76.3	786.4	61.5	239.9	76.5	144.5	522.4

Source: TART GFI farebox data for 2 week periods January 11-24, 2016, July 27-August 9, 2015, and October 1-14, 2015

Figure 2: TART Daytime Ridership by Hour by Season

TABLE 8: TART Resort Employee Ride Program Ridership

March 2015 Through February 2016

	BOARDINGS BY EMPLOYER					
Month	Squaw Valley Ski Corp	Village at Squaw Valley	Resort at Squaw Creek	Northstar California	Homewood Mtn Resort	TOTAL
July	1,959	752	345	365	698	4,119
August	1,929	685	214	188	632	3,648
September	1,349	531	210	67	275	2,432
October	1,129	416	209	69	116	1,939
November	1,567	515	99	40	39	2,260
December	6,875	749	171	5,107	990	13,892
January	11,294	753	211	10,149	2,395	24,802
February	7,224	596	126	9,322	2,263	19,531
March	12,557	839	251	5,597	475	19,719
April	3,326	481	232	1,001	128	5,168
May	1,641	298	174	338	107	2,558
June	1,683	456	233	312	581	3,265
TOTAL	**52,533**	**7,071**	**2,475**	**32,555**	**8,699**	**103,333**
Historical Data						
FY 2013-14	*55,739*	*13,553*	*3,068*	*32,564*	*9,629*	*114,553*
FY 2014-15	*77,100*	*9,486*	*2,744*	*26,838*	*8,178*	*124,346*

SOURCE: TART

was the Squaw Valley – Crystal Bay 7:00 PM run, with 23 passengers. Several of the Tahoe City – Tahoma, Tahoma – Tahoe City, and Crystal Bay – Northstar runs had an average of only 3-5 passengers.

Summer ridership on the Night Service was significantly lower than in the winter. Similar to the winter, summer Night Service ridership was highest on the Squaw Valley – Crystal Bay route, with 5,780 total passenger-trips or 85 daily passenger-trips. The Crystal Bay – Squaw Valley route also had relatively high summer ridership, with 5,283 total passenger-trips or 78 daily passenger-trips. The Crystal Bay – Northstar route had the lowest summer ridership, with 1,178 total passenger-trips or 17 daily passenger-trips. The summer runs with the highest ridership included the Squaw Valley – Crystal Bay 7:00 PM run (with 1,014 passenger-trips), as well as the Crystal Bay – Squaw Valley 10:00 PM run (with 1,053 passenger-trips). Both of these runs also had the highest average daily ridership, each providing an average of 15 passenger-trips per day. During the hours of 12:00 AM and 1:00 AM, the Tahoma – Tahoe City route had the lowest average daily ridership, with only 1 rider per run. Furthermore, several of the Crystal Bay – Northstar runs had an average of only 2 daily passenger-trips.

ADA Ridership by Month Hour of Day and Day of Week

Fiscal Year 2014-15 ADA trip logs indicate that a total of 428 one-way passenger trips were provided. Of these, 28 required the use of a wheelchair accessible vehicle (operated directly by

TABLE 9: Night Rider Ridership by Route by Run by Season

	Start Time	Ridership	Start Time	Ridership	Start Time	Ridership	Start Time	Ridership	Start Time	Ridership	Start Time	Ridership	Start Time	Ridership	Total Psgrs	
Total Season Ridership																
Winter - 12/15/14 to 4/5/15																
SV - Crystal Bay	7:00 PM	2,521	8:00 PM	1,397	9:00 PM	2,506	10:00 PM	1,963	11:00 PM	1,956	12:00 AM	1,283	1:00 AM	1,587	13,213	
Crystal Bay - SV	7:00 PM	1,815	8:00 PM	2,375	9:00 PM	2,029	10:00 PM	2,356	11:00 PM	1,540	12:00 AM	1,446	1:00 AM	1,369	12,930	
TC - Tahoma	6:30 PM	1,102	7:30 PM	341	8:30 PM	692	9:30 PM	838	10:30 PM	714	11:30 PM	541	12:30 AM	612	4,840	
Tahoma - TC	7:00 PM	383	8:00 PM	567	9:00 PM	485	10:00 PM	604	11:00 PM	498	12:00 AM	413	1:00 AM	653	3,603	
NSTR - Crystal Bay	6:30 PM	950	7:30 PM	984	8:30 PM	1,113	9:30 PM	1,298	10:30 PM	879	11:30 PM	355	-	0	5,579	
Crystal Bay - NSTR	7:00 PM	316	8:00 PM	449	9:00 PM	395	10:00 PM	421	11:00 PM	386	12:00 AM	409	-	0	2,376	
Summer - 7/1/15 to 9/6/15																
Squaw Valley - Crystal Bay	7:00 PM	1,014	8:00 PM	757	9:00 PM	926	10:00 PM	903	11:00 PM	896	12:00 AM	749	1:00 AM	535	5,780	
Crystal Bay - Squaw Valley	7:00 PM	671	8:00 PM	966	9:00 PM	829	10:00 PM	1,053	11:00 PM	568	12:00 AM	741	1:00 AM	455	5,283	
Tahoe City - Tahoma	6:30 PM	275	7:30 PM	226	8:30 PM	321	9:30 PM	287	10:30 PM	308	11:30 PM	238	12:30 AM	180	1,835	
Tahoma - Tahoe City	7:00 PM	250	8:00 PM	265	9:00 PM	239	10:00 PM	444	11:00 PM	182	12:00 AM	98	1:00 AM	51	1,529	
Northstar - Crystal Bay	6:30 PM	206	7:30 PM	252	8:30 PM	468	9:30 PM	384	10:30 PM	270	11:30 PM	133	-	0	1,713	
Crystal Bay - Northstar	7:00 PM	127	8:00 PM	145	9:00 PM	258	10:00 PM	146	11:00 PM	205	12:00 AM	297	-	0	1,178	
Average Daily Ridership																Ridership per Vehicle-Hour
Winter - 12/15/14 to 4/5/15																
SV - Crystal Bay	7:00 PM	23	8:00 PM	12	9:00 PM	22	10:00 PM	18	11:00 PM	17	12:00 AM	11	1:00 AM	14	118	16.9
Crystal Bay - SV	7:00 PM	16	8:00 PM	21	9:00 PM	18	10:00 PM	21	11:00 PM	14	12:00 AM	13	1:00 AM	12	115	16.5
TC - Tahoma	6:30 PM	10	7:30 PM	3	8:30 PM	6	9:30 PM	7	10:30 PM	6	11:30 PM	5	12:30 AM	5	43	12.3
Tahoma - TC	7:00 PM	3	8:00 PM	5	9:00 PM	4	10:00 PM	5	11:00 PM	4	12:00 AM	4	1:00 AM	6	32	9.2
NSTR - Crystal Bay	6:30 PM	8	7:30 PM	9	8:30 PM	10	9:30 PM	12	10:30 PM	8	11:30 PM	3	-		50	14.2
Crystal Bay - NSTR	7:00 PM	3	8:00 PM	4	9:00 PM	4	10:00 PM	4	11:00 PM	3	12:00 AM	4	-		21	6.1
Summer - 7/1/15 to 9/6/15																
Squaw Valley - Crystal Bay	7:00 PM	15	8:00 PM	11	9:00 PM	14	10:00 PM	13	11:00 PM	13	12:00 AM	11	1:00 AM	8	85	12.1
Crystal Bay - Squaw Valley	7:00 PM	10	8:00 PM	14	9:00 PM	12	10:00 PM	15	11:00 PM	8	12:00 AM	11	1:00 AM	7	78	11.1
Tahoe City - Tahoma	6:30 PM	4	7:30 PM	3	8:30 PM	5	9:30 PM	4	10:30 PM	5	11:30 PM	4	12:30 AM	3	27	7.7
Tahoma - Tahoe City	7:00 PM	4	8:00 PM	4	9:00 PM	4	10:00 PM	7	11:00 PM	3	12:00 AM	1	1:00 AM	1	22	6.4
Northstar - Crystal Bay	6:30 PM	3	7:30 PM	4	8:30 PM	7	9:30 PM	6	10:30 PM	4	11:30 PM	2	-		25	7.2
Crystal Bay - Northstar	7:00 PM	2	8:00 PM	2	9:00 PM	4	10:00 PM	2	11:00 PM	3	12:00 AM	4	-		17	4.9

TART staff), while 400 were provided by the non-wheelchair accessible taxi service. As shown in Table 10, these trips occurred relatively uniformly over the year, with a high of 42 trips in February and a low of 24 in May. The ridership by day of week was highest on Thursday (an average of 2.0) and lowest on Saturday (an average of 0.3). While the service is available around the clock, all trips were provided between 6:00 AM and 6:00 PM, with the majority (65 percent) occurring between 11:00 AM and 4:00 PM. Thursday, August 14th was the busiest day of the FY 2014-15 year, with 8 ADA rides.

TABLE 10: Summary of ADA Ridership by Month, Day and Hour

Fiscal Year 2014/15

By Month

	Wheelchair	Non-Wheelchair	Total #	Total %
Jul-14	2	30	32	7%
Aug-14	0	41	41	10%
Sep-14	2	23	25	6%
Oct-14	0	39	39	9%
Nov-14	0	39	39	9%
Dec-14	2	54	56	13%
Jan-15	4	35	39	9%
Feb-15	4	38	42	10%
Mar-15	8	21	29	7%
Apr-15	4	23	27	6%
May-15	2	22	24	6%
Jun-15	0	35	35	8%
Total	28	400	428	

By Hour

	#	%
6:00 AM	1	0%
7:00 AM	4	1%
8:00 AM	14	3%
9:00 AM	21	5%
10:00 AM	35	8%
11:00 AM	53	12%
12:00 PM	52	12%
1:00 PM	61	14%
2:00 PM	64	15%
3:00 PM	51	12%
4:00 PM	39	9%
5:00 PM	16	4%
6:00 PM	15	4%

Average By Day of Week

Sunday	0.4
Monday	1.7
Tuesday	1.4
Wednesday	1.4
Thursday	2.0
Friday	1.1
Saturday	0.3
Overall	1.2

Busiest Single Day

Thursday, August 14 -- 8 Rides

ADA Origin-Destination Summary

The Fiscal Year 2014-15 passenger logs were also analyzed to identify one-way trip origin-destination patterns, as shown in in Table 11. As shown, the most prevalent trip was from Kings Beach to Truckee, accounting for 65 total trips, or 15.22 percent of total FY 14-15 ADA trips. Other common trips (with 30 or more annual trips) were from Truckee to Kings Beach (59 trips or 13.82 percent), Tahoe City to Tahoma (32 trips or 7.49 percent), and Tahoma to Tahoe City (30 trips or 7.03 percent). As shown, Truckee was the most common origin and destination, as the starting point for 138 trips, and the end point for 128 trips. Overall, 59 percent of all trips had one or both trip ends in Truckee. Kings Beach was the second most common origin and destination, with 86 trips originating in Kings Beach, and 98 trips ending in Kings beach. Tahoma and Tahoe City were other popular origins and destinations.

Onboard Passenger Surveys

Surveys were conducted on all of the TART fixed routes (including the Night Rider service) to better understand passenger activity, ridership patterns, and overall perception of the system. The surveys were distributed onboard between the dates of March 14th and March 24th, 2016. A total of 264 surveys were completed by TART passengers. Detailed response data is presented in Appendix A. Key findings of this survey are as follows:

- 70 percent of riders were travelling roundtrip.
- In assessing the mode of travel to the bus, 78 percent of respondents walked from their origin, followed by 8 percent who transferred from another bus.
- 76 percent of respondents were walking to their destination, followed by the 11 percent of respondents who were transferring to another bus.
- Most respondents were traveling for work (52 percent), recreational/social purposes (31 percent) and personal business (7 percent).
- Out of the respondents, 46 percent are full-time residents, 39 percent are seasonal residents, and 11 percent are overnight visitors.
- Among the permanent residents, the majority (77 percent) live in Placer County, followed by Truckee (12 percent) and Incline Village/Crystal Bay (8 percent).
- When asked why they used TART services, the majority (51.79 percent) have no car available. Other common reasons for using TART include convenience (16 percent), inability to drive (14 percent) and money saving (10 percent).

TABLE 11: SUMMARY OF TART ADA TRIPS - July 2014 through June 2015

One-Way Passenger Trips

	Tahoma	Tahoe City	Tahoe Vista	Carnelian Bay	Dollar Hill	Kings Beach	Incline Village	Squaw Valley	Northstar	Truckee	TOTAL
Tahoma		30	3			1	1	8		25	68
Tahoe City	32					9	20	3		2	66
Tahoe Vista	3										3
Carnelian Bay						4					4
Dollar Hill										1	1
Kings Beach	1	13		4	1	11	3			65	98
Incline Village	1	18				2		1			22
Squaw Valley	5	1					1			29	36
Northstar										1	1
Truckee	23	4				59		26	1	15	128
TOTAL	65	66	3	4	1	86	25	38	1	138	427
Total Both Trip Ends	0	0	0	0	0	11	0	0	0	15	

Percent of All Trips

	Tahoma	Tahoe City	Tahoe Vista	Carnelian Bay	Dollar Hill	Kings Beach	Incline Village	Squaw Valley	Northstar	Truckee	TOTAL
Tahoma		7.0%	0.7%			0.2%	0.2%	1.9%		5.9%	15.9%
Tahoe City	7.5%					2.1%	4.7%	0.7%		0.5%	15.5%
Tahoe Vista	0.7%										0.7%
Carnelian Bay						0.9%					0.9%
Dollar Hill										0.2%	0.2%
Kings Beach	0.2%	3.0%		0.9%	0.2%	2.6%	0.7%			15.2%	23.0%
Incline Village	0.2%	4.2%				0.5%		0.2%			5.2%
Squaw Valley	1.2%	0.2%					0.2%			6.8%	8.4%
Northstar										0.2%	0.2%
Truckee	5.4%	0.9%				13.8%		6.1%	0.2%	3.5%	30.0%
TOTAL	15.2%	15.5%	0.7%	0.9%	0.2%	20.1%	5.9%	8.9%	0.2%	32.3%	100.0%
Total Both Trip Ends	0.0%	0.0%	0.0%	0.0%	0.0%	2.6%	0.0%	0.0%	0.0%	3.5%	

- 47 percent of the respondents ride TART daily, 26 percent ride 2-4 days per week, and 11 percent were riding for their first time.

- When asked how long they've been using TART, the most common answer (for 39 percent of the respondents) was less than 6 months. 26 percent of respondents have been riding TART for more than 3 years, and another 17 percent have been riding for 1-3 years.

- A car was not available for the trip for 76 percent of respondents.

- Had it not been for TART, the majority (47 percent) or respondents would have gotten a ride to complete the trip. Other common transportation alternatives included taking a taxi and walking. 12 percent of the respondents would not have made the trip without available TART services.

- 51 percent of the respondents are ages 25-61, and 40 percent of respondents are ages 19-24.

- More respondents were male than female (61 versus 39 percent).

- Almost half (41 percent) of respondents use the TART website as their primary source of transit information, followed by printed guides/schedules (19 percent) and bus drivers (16 percent).

Passengers were asked to rank transit service characteristics of TART on a scale of "Very Poor" to "Excellent." The results are shown in Figure 3. In general, the majority of passengers have a positive opinion of TART, with 71 percent indicating an overall experience that is either "excellent" or "good". By category, "Driver Courtesy" received the highest rating, with 85 percent of the riders rating it at "Good" to "Excellent." The "Service Frequency," "On Time" and "Hours of Service" received the lowest ratings. In particular, 20 percent of respondents indicated "poor" or "very poor" regarding service frequency, along with 18 percent for hours of service and 17 percent for on-time performance.

Passengers were asked to identify the most the importance of improving various aspects of TART on a scale from "Not Important" to "Very Important." The results are shown in Figure 4. As illustrated, the addition of evening service in the Fall/Spring, as well as more frequent service, were the two areas identified as most pertinent for improvement to the TART system. In contrast, respondents were not as concerned about improving the TART system through eliminating fares, improving bus stops, or adding Wi-Fi service to the buses.

Riders were also asked to respond to the question: *What single most important improvement would you suggest for bus service?* A summary of these responses, shown in Table 12, indicates that the most common requests (21.2 percent) was for more frequent service,

Figure 3: Rider Opinion of TART Transit Service on a Scale from Very Poor to Excellent

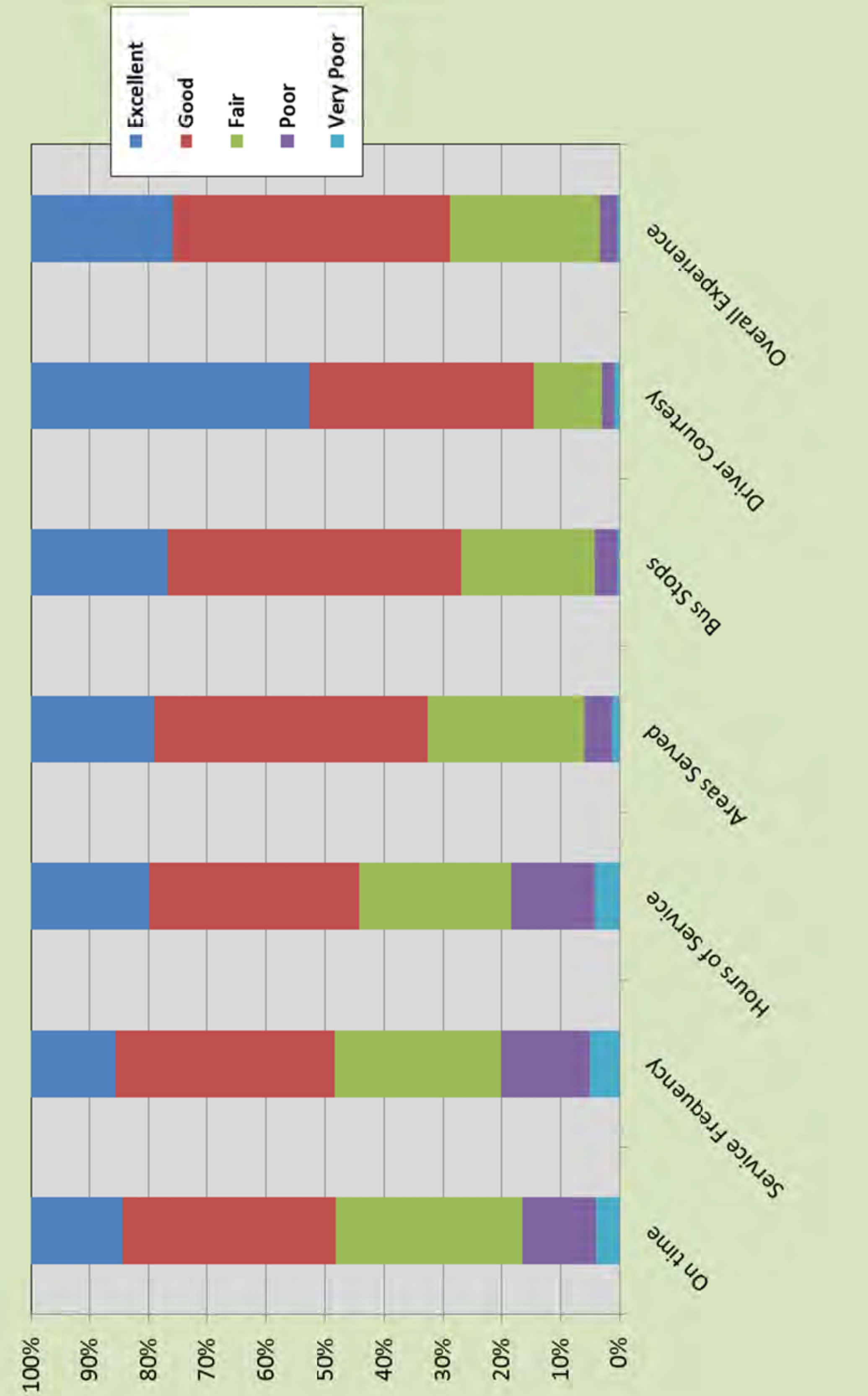

Figure 4: How important are each of the following in improving TART?

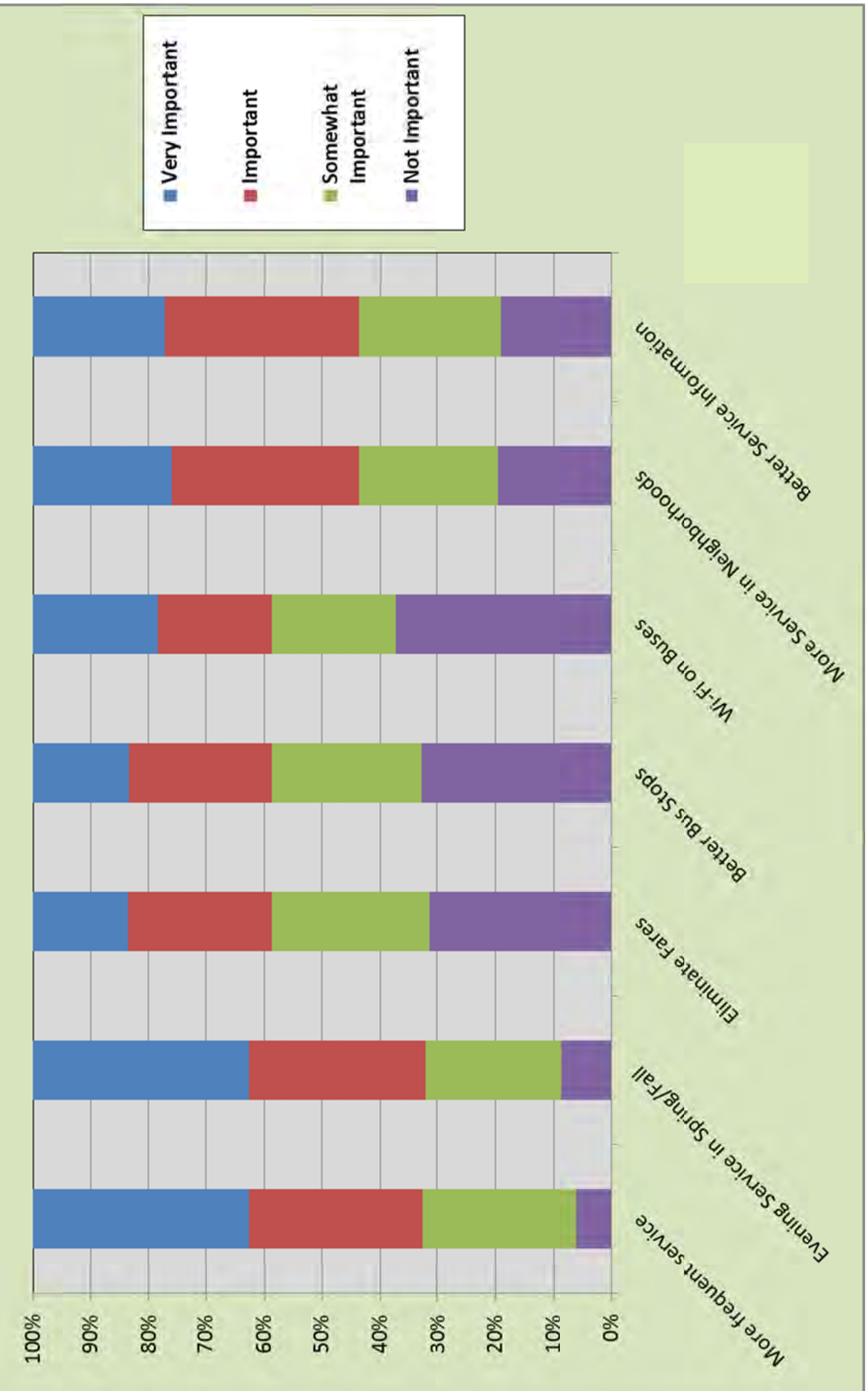

TABLE 12: TART Winter 2016 Onboard Survey Passenger Comments

Comment/Request	# Respondents	% Respondents
More frequent service	36	21.2%
Improve on-time performance	34	20.0%
Year-round service on Night Rider routes	16	9.4%
More and/or later evening buses	10	5.9%
Nightrider service in Truckee	6	3.5%
Travel through neighborhoods	6	3.5%
Earlier AM buses	5	2.9%
Improve real-time information	5	2.9%
Improve bus stops	5	2.9%
Provide on-board wifi service	4	2.4%
Additional buses	4	2.4%
Provide Night Rider service to Incline Village	4	2.4%
Improve driver attitude	4	2.4%
Connectivity to South Lake Tahoe	4	2.4%
Improve cleanliness	3	1.8%
Eliminate problems with buses not stopping	3	1.8%
Better drivers	2	1.2%
Connectivity to Reno	2	1.2%
Provide 24-hour service	2	1.2%
Provide direct service between Tahoe City and Northstar	2	1.2%
Provide more stops	2	1.2%
Free fares	2	1.2%
Earlier AM bus to Truckee	1	0.6%
Run 267 routes all night long	1	0.6%
Provide change for fares	1	0.6%
Provide ski racks	1	0.6%
Provide transit information at hotels and resorts	1	0.6%
Free transfers	1	0.6%
Provide 24-hour customer service	1	0.6%
Service to Tahoe Donner	1	0.6%
Improve schedule clarity on website	1	0.6%
Total	**170**	**100.0%**

followed by improving on-time performance (20.0 percent) and year-round Night Rider service (9.4 percent).

Finally, a cross-tabulation of the survey data was conducted to identify the individual passenger trip origin-destination pairs, as shown in Table 13. Popular trip patterns (20 or more responses) were for travel between Kings Beach and Northstar, Tahoe City and Squaw Valley, as well as for trips within Kings Beach. Detailed trip patterns are as follows:

TABLE 13: Passenger Origin/Destination -- TART 2016 Fixed Route Winter Survey

Trip Origin	Trip Destination: Alpine Meadows	Carnelian Bay	Crystal Bay	Homewood	Incline Village	Kings Beach	Northstar	Squaw Valley	Sunnyside	Tahoe City	Tahoe Vista	Tahoma	Truckee	No Answer
Number of Total Responses														
Alpine Meadows												2	1	
Carnelian Bay					1		2			1				
Crystal Bay			1	1		4	4	1	1	1		1	2	
Homewood	1					2		1		1				
Incline Village			1		2		3	2		1		1		
Kings Beach	1		5		2	10	16	12	1	5		1	3	
Northstar		1	1	1	2	6	3		1	1	2		3	
Squaw Valley	3		2		6	2		1	1	14		1	3	
Sunnyside	1		1	2	1			8		3				
Tahoe City	3	2	5	2		5	3	10	2	9		1		2
Tahoe Vista		1				2	4	2			2		2	
Tahoma						1	2	1		4		1	1	
Truckee				3		4	9	8				1	5	
Other (please specify)							1							
Percent of All Responses														
Alpine Meadows												0.8%	0.4%	
Carnelian Bay					0.4%		0.8%			0.4%				
Crystal Bay			0.4%	0.4%		1.5%	1.5%	0.4%	0.4%	0.4%		0.4%	0.8%	
Homewood	0.4%					0.8%		0.4%		0.4%				
Incline Village			0.4%		0.8%		1.1%	0.8%		0.4%		0.4%		
Kings Beach	0.4%		1.9%		0.8%	3.8%	6.1%	4.6%	0.4%	1.9%		0.4%	1.1%	
Northstar		0.4%	0.4%	0.4%	0.8%	2.3%	1.1%		0.4%	0.4%	0.8%		1.1%	
Squaw Valley	1.1%		0.8%		2.3%	0.8%		0.4%	0.4%	5.3%		0.4%	1.1%	
Sunnyside	0.4%		0.4%	0.8%	0.4%			3.1%		1.1%				
Tahoe City	1.1%	0.8%	1.9%	0.8%		1.9%	1.1%	3.8%	0.8%	3.4%		0.4%		0.8%
Tahoe Vista		0.4%				0.8%	1.5%	0.8%			0.8%		0.8%	
Tahoma						0.4%	0.8%	0.4%		1.5%		0.4%	0.4%	
Truckee				1.1%		1.5%	3.4%	3.1%				0.4%	1.9%	
Other (please specify)							0.4%							

- Of all trips passing through the Tahoe City area (excluding trips to/from Tahoe City), 21 are between the West Shore and the SR 89 Route, 16 are between the North Shore and the Squaw Valley/Alpine Meadows area, and 15 are between the West Shore and the North Shore. Overall, this indicates little need to reconfigure the routes from the current arrangement by which the West Shore and North Shore have through service, while the SR 89 Route terminates in Tahoe City.

- For trips on the SR 89 Route, 5 percent are within Truckee, 24 percent are between Truckee and Squaw Valley/Alpine Meadows, 8 percent are within Squaw Valley/Alpine Meadows, 55 percent are between Squaw Valley/Alpine Meadows and Tahoe City (or beyond), and 8 percent are between Truckee and Tahoe City (or beyond). Overall the service between Tahoe City and Squaw Valley accommodates 63 percent of all passenger-trips on this route.

- For the SR 267 Route, 3 percent of passenger-trips are within Truckee, 16 percent between Truckee and Northstar, 4 percent within Northstar, 65 percent between Northstar and Kings Beach/Crystal Bay (or beyond) and 12 percent are between Truckee and Crystal Bay (or beyond). This indicates that 69 percent of passenger-trips occur on the segment between Northstar and Crystal Bay.

<u>Comparison with 2003 TART Fixed Route Onboard Survey</u>

A previous TART on-board survey was conducted in March of 2003 as part of the 2004 TART Systems Plan Update. Each run on every route was surveyed as part of this input process. A comparison of the two surveys indicates the following key findings:

- In both surveys, the greatest proportions of respondents were Placer County residents, with 57 percent Placer residents in 2003 and 77 percent Placer residents in 2016.

- A total of 77 percent of respondents walked to the bus in both of the surveys.

- In 2003, 55 percent of the respondents rode TART daily, and in 2016, 47 percent rode TART daily.

- The proportion of passenger traveling for work dropped from 71 percent in the 2003 survey to 52 percent in the 2016 survey, while recreational/social travel grew from 15 percent to 31 percent.

- 88 percent of the 2003 respondents had used TART for more than 6 months, whereas only 51 percent of 2016 respondents had used TART for more than 6 months.

- In 2016, 13 percent of respondents were area visitors, exceeding the 5 percent of visiting respondents in 2003.

- In 2003, 80 percent of the respondents were utilizing TART because they did not own a vehicle, whereas only 52 percent of the 2016 respondents did now own a vehicle.

- A lesser proportion of respondents were ages 25-61 in 2003 (44 percent) than in 2016 (51 percent).

- In both surveys, the proportion of male respondents slightly outweighed the female respondents.

Capital Inventory

Vehicle Fleet

Table 14 presents Placer County TART's current bus fleet. It consists of a total of 17 buses, of which 14 are powered by compressed natural gas and the remaining 3 by diesel fuel. The majority of the buses are 35- to 40-feet in length, with seating capacity of 30 to 38 passengers. All buses are wheelchair accessible, and are outfitted with bike racks in the non-winter months. Of note, the fleet was recently improved with the addition of four new Gillig buses, branded in the new TART logo.

TABLE 14: TART Bus Fleet Inventory

As of 3/9/16

Bus #	Make	Mileage	Fuel	Year	Length	Capacity	Title	Replacement Date
0010	Gillig	813,578	Diesel	2000	35	35	Placer County	2016
0120	Orion V	613,150	CNG	2001	35	35	Placer County	2017
0424	Orion V	541,414	CNG	2004	35	35	Placer County	2017
0425	Orion V	514,521	CNG	2004	35	35	Placer County	2018
0426	Orion V	528,565	CNG	2004	35	35	Placer County	2018
0627	Orion V	493,116	CNG	2006	40	38	Placer/TTD	2020
0628	Orion V	447,171	CNG	2006	40	38	Placer/TTD	2020
0629	Orion V	428,948	CNG	2006	40	38	Placer/TTD	2020
0630	Orion V	451,896	CNG	2006	40	38	Placer/TTD	2020
1516	Gillig	4,618	CNG	2015	40	35	Placer County	2028
1517	Gillig	10,608	CNG	2015	40	35	Placer County	2028
1518	Gillig	10,272	Diesel	2015	40	35	Placer County	2028
1519	Gillig	9,133	Diesel	2015	40	35	Placer County	2028
201	Ford F550	136,500	CNG	2012	30	30	TTD LEASE	2022
3314	NABI	242,191	CNG	2009	40	35	TTD LEASE	2022
3315	NABI	265,576	CNG	2009	40	35	TTD LEASE	2022
3316	NABI	210,576	CNG	2009	40	35	TTD LEASE	2022

Note: All buses are wheelchair accessible, with 2 wheelchair positions

Bus Stops

The Placer County TART program serves a total of 178 individual bus stops:
135 on the Mainline Route, 24 on the SR 89 Route excluding the stop on the Mainline Route (including 10 in Truckee) and 19 on the SR 267 Route excluding those on the other routes (of which 10 are in Truckee or unincorporated Nevada County). As shown in Table 15, 32 of these stops have transit shelters (including 4 in Truckee and 4 in Washoe County).

The key passenger facility is the Tahoe City Transit Center in Tahoe City. This facility provides a total of six bus bays, interior and exterior waiting areas, park-and-ride parking, and bicycle lockers.

TABLE 15: TART Shelter Locations

Route Segment / Location	Roadway	Location
Eastbound -- Tahoma to Incline Village		
Tahoma Post Office/Lodge	89	Tahoma
Hw. 89 @ Westshore Café	89	Homewood
Hw. 89 @ Sunnyside	89	Sunny Side
Tahoe City Y	28	Tahoe City
Tahoe City / Light House Center Pier	28	Tahoe City
Hw. 28 @ Dollar Hill Dr./ @ Dollar Hill	28	Dollar Hll
Patton Landing/ Carnelian Bay	28	Carnelian Bay
The Old Post Office Restaurant	28	Carnelian Bay
Tahoe Vista Recreational Area	28	Tahoe Vista
North Tahoe Conference Center	28	Kings Beach
Crystal Bay / State Line	28	Crystal Bay
Westbound -- Incline Village To Tahoma		
Hw. 28 After Village Blvd	28	Incline Village
Hw. 28 Christmas Tree Village Shopping Center	28	Incline Village
Hw. 28 After Northwood Blvd	28	Incline Village
Crystal Bay / State Line	28	Crystal Bay
Hw 28 At Chevron Between Bear And Deer (New 11/2015)	28	Kings Beach
Safeway Bus Shelter	28	Kings Beach
Hw 28 At Pino Grande	28	Tahoe Vista
Hw 28 At National Ave	28	Tahoe Vista
The Old Post Office Restaurant	28	Carnelian Bay
Hw 28. @ Carnelian Woods	28	Carnelian Bay
Hw 28 Before Fabian Way	28	Dollar Hill
Hw 28 At Dollar Hill Driver/ Lake Forest	28	Dollar Hill
Tahoe City Y	28	Tahoe City
Hw. 89 @ Sunnyside	89	Sunny Side
Truckee -- Tahoe City		
7-11 Bus Shelter	89	Squaw Valley
Squaw Valley & Squaw Road Intersection Near Fire Station	89	Squaw Valley
Olympic Village Inn Clocktower	Squaw Valley Road	Squaw Valley
Highway 89 Southbound Near Deerfield Drive	89	Truckee
Highway 89 Northbound Near Mousehole	89	Truckee
Donner Pass Road @ Safeway Shopping Ctr Southbound	Donner Pass Road	Truckee
Truckee -- North Stateline		
Brockway Road Northbound @ Park	Brockway Road	Truckee

Operating Facility

TART buses operate out of the Cabin Creek facility, located off of State Route 89 five miles north of Squaw Valley and three miles south of Truckee. This facility includes office and training space, vehicle maintenance and storage facilities, and a high-capacity CNG fueling facility.

Financial Information

Existing Operating Costs

Table 16 presents the current annual operating costs for Placer County TART service. As shown, costs total $4,290,922 per year. Overall, personnel costs (salaries and benefits) make up the bulk of the costs. In comparison, fuel/lubricant costs equal only 10 percent of total costs. The professional/specialized service costs include seasonal extra drivers, as well as outside facility maintenance costs.

Operating Cost Model

These operating costs, along with the service quantities, are used to develop a cost model for FY 2015/16. Expense line items are allocated to one of three categories – fixed, revenue vehicle-hours, and revenue vehicle-miles – that most closely reflects how changes in service levels impact costs. For example, fuel costs are a function of vehicle-miles, driver salaries are a function of vehicle-hours, while office supplies are fixed. Summing the costs in each category and dividing by the annual service quantities, the resulting cost model is as follows:

FY 2016/17 Annual Operating/Administrative Costs =

$60.62 X Revenue Vehicle-Hours + $1.50 X Revenue Vehicle-Miles + $1,166,455

Operating Revenues

The operating revenues sources for Placer County TART services for the 2015/16 fiscal year are shown in Table 17. This reflects that individual sources are generated through various jurisdictions, such as the Tahoe Regional Planning Agency (TRPA) for services with the Tahoe Basin, Placer County Transportation Planning Agency (PCTPA) for services in Placer County outside the Tahoe Basin, the Town of Truckee for a portion of routes serving Truckee, and the Washoe Regional Transportation Commission for services in Nevada. Overall, Local Transportation Funds generate the largest proportion, totaling 39 percent of all revenues. Placer County's Transient Occupancy Tax (TOT) revenues, allocated through the North Lake Tahoe Resort Association, total 23 percent of operating revenues. The Federal Transit Administration's Section 5311 Rural Transit Program is also an important source, totaling 15 percent of all operating revenues.

TABLE 16: TART FY 2015-16 Operating Budget and Cost Model

Cost Item	Total (3)	Cost Model Variable: Fixed	Cost Model Variable: Revenue Vehicle-Hour	Cost Model Variable: Revenue Vehicle-Mile
Salaries and Wages	$204,100	$204,100		
Overtime & Call Back	$63,000		$63,000	
Salaries & Wages-Oper	$1,048,700		$1,048,700	
Extra Help-Oper	$36,000		$36,000	
Cafeteria Plans (Non-PERS)	$57,700			
P.E.R.S.	$251,300		$251,300	
F.I.C.A.	$92,900		$92,900	
Other Postemployment Benefits	$122,300	$122,300		
Employee Group Ins	$173,811		$173,811	
Workers Comp Insurance	$29,800		$29,800	
Retired Employee Group Insurance	$83,996	$83,996		
Clothes & Personal Supplies	$8,000		$8,000	
Communication Services - Telephone	$23,000	$23,000		
Refuse Disposal	$7,000	$7,000		
General Liability Insurance	$128,400			$128,400
Parts	$9,400			$9,400
Maintenance - Equipment	$650,000			$650,000
Maintenance - Computer Equip	$1,800	$1,800		
Employee Benefits Systems (1)	$24,200	$4,114	$12,826	$7,260
Materials - Bldgs & Impr	$40,000	$40,000		
Membership/Dues	$2,200	$2,200		
PC Acquisition	$400	$400		
Printing	$7,000	$7,000		
Office Supplies & Exp	$2,000	$2,000		
Postage	$1,100	$1,100		
Operating Materials	$7,800		$7,800	
Administration	$168,900	$168,900		
Professional/Specialized Services - Purchased	$427,200	$187,700	$239,500	
Professional/Specialized Services - County	$167,500	$167,500		
Countywide System Charges	$14,800	$14,800		
Fuels & Lubricants	$237,300			$237,300
Special Dept Expense	$49,960	$49,960		
Training	$3,500		$3,500	
Travel & Transportation	$500	$500		
County Vehicle Mileage	$40,000		$40,000	
Utilities	$45,000	$45,000		
Drug & Alcohol Testing	$3,800		$3,800	
Transfer Out A-87 Costs (2)	$56,555	$33,084.68	$14,987	$8,483
TOTAL	$4,290,922	$1,166,455	$2,025,924	$1,040,843
Annual Revenue Vehicle-Hours of Service	**33,418**			
Annual Revenue Vehicle-Miles of Service	**695,845**			

FY 2015-16 Cost Equation	$1,166,455	Fixed Costs +
	$60.62	per Revenue Vehicle-Hour +
	$1.50	per Revenue Vehicle-Mile

Note 1: Allocated to cost category based on proportion of salary costs
Note 2: Allocated half to fixed and remainder based on proportion of salary costs
Note 3: Excludes $20,000 budgeted for taxi subsidy program
SOURCE: Placer County

TABLE 17: TART FY 2015/16 Budget Operating Revenues		
Funding Source		% of Total
Local Transportation Funds		
Placer County Transportation Agency	$1,003,600	22%
Tahoe Regional Planning Agency	$677,727	15%
Truckee -- for 89 Route	$65,570	1%
Truckee -- for 267 Route	$35,990	1%
State Transportation Assistance		
Placer County Transportation Agency	$92,840	2%
Tahoe Regional Planning Agency	$164,878	4%
Truckee Air Pollution Control District Funds	$62,360	1%
Truckee Tahoe Airport	$62,500	1%
Low Carbon Transit Operations Program	$38,608	1%
Private Funding	$50,000	1%
Transient Occupancy Tax		
Baseline Service	$530,100	12%
Ski Shuttle Service	$21,200	0%
Summer TART Enhancement	$171,900	4%
Night Rider (Winter and Summer)	$326,800	7%
Federal Transit Administration Section 5311 Rural		
Through Nevada Dept of Transportation	$352,564	8%
Through Placer County Transportation Agency	$290,000	6%
Through Tahoe Regional Planning Agency	$54,710	1%
Washoe Regional Transportation Commission	$168,546	4%
Farebox	$403,000	9%
Interest	$3,000	0%
TOTAL	$4,575,893	100%
SOURCE: Placer County		

As reflected in this table, funding for services beyond Placer County's jurisdiction is an important element in the overall program. Funding agreements with the other jurisdictions are in turn important factors. In general terms, sources allocated through Nevada (Washoe RTC and FTA 5311 funding administered by the Nevada Department of Transportation) offset the operating subsidy requirements for TART service east of the state line. Funding levels allocated to the Town of Truckee are defined as half of the subsidy needs generated by the Highway 89 Route service between Truckee and Squaw Valley Road and half of the subsidy needs generated by the Highway 267 Route service between Truckee and Northstar Drive. Though the Mainline Route travels slightly into El Dorado County (to Sugar Pine Point State Park), no subsidy funds are received for this route segment.

CONNECTING TRANSPORTATION SERVICES

Truckee TART Services

Beyond the services operated by Placer County, the other element of the coordinated Tahoe Truckee Area Regional Transit network is operated by the Town of Truckee. During the spring, summer and fall, the fixed route element consists of a single bus providing hourly service Monday through Saturday between Donner Lake on the west and the Truckee-Tahoe Airport on the east, from 9:05 AM to 5:05 PM. In winter, service hours are expanded to 6:05 AM to 6:13 PM, days of service are expanded to seven days a week, and the service area is expanded to include the Donner Summit area. Over the entire year, Dial-A-Ride service is also available within Town limits during the hours of fixed route operation.

Amtrak

Amtrak is a national railroad service that provides services to more than 500 destinations in 46 states. Rail service is provided daily to the Truckee Train Station, with the eastbound stop (to Chicago) scheduled for 2:38 PM and the westbound stop (to Emeryville) scheduled for 9:37 AM. In addition, Amtrak Thruway bus service is operated between Sparks, Nevada and Sacramento, for connections to the Capital Corridor rail service to the Bay Area. Truckee passengers can board westbound buses at 8:40 AM, 12:05 PM, and 3:25 PM, and can deboard eastbound buses at 1:00 PM, 3:35 PM, and 6:45 PM. Trips must include travel by connecting rail service.

Greyhound

Greyhound Lines, Inc. is a national bus transportation service with 3,000 stops in North America. As part of the route between Sacramento and Reno, Greyhound buses serve the Truckee Train Station westbound at 9:25 AM and 6:15 PM and eastbound at 12:05 PM, 3:50 PM and 8:45 PM.

Private Winter Skier Shuttle Services

The major winter resorts in the region also provide private shuttle services:

- **Homewood Mountain Resort** operates door-to-door service for residences in the area between Chambers Landing and Timberland, as well as scheduled service 5 times per day at Granlibakken, Sunnyside, and PDQ Market.

- **Squaw Valley / Alpine Meadows** provide continual service between the two base areas from 8:30 AM to 4:30 PM. In addition, shuttle services from the remote Alpine Meadows lot at Deer Park (near the base of Alpine Meadows Road) is provided as necessary.

- **Northstar California** operates an extensive demand-response service within the resort area, as well as bus service connecting the Village with the remote Castle View parking area near SR 267. In addition, a run is operated at 8:00 AM from the Hyatt Regency in Incline Village to Northstar Village via Kings Beach and Tahoe Vista, with a return run departing Northstar Village at 5:15 PM.

- **Diamond Peak Ski Area** provides shuttle service every half-hour between the ski hill and the Hyatt Regency, as well three runs per day that serve other portions of Incline Village. Transfers with TART are available at the Hyatt Regency.

Emerald Bay Trolley

The Tahoe Transportation District has for many years operated a summer-only trolley replica service between the Y area of South Lake Tahoe and Emerald Bay. Depending on funding availability, this service has extended in some summers as far north as Tahoma or Homewood, providing connections with TART. In 2013, the service extended to the Tahoe City Transit Center. In 2015, service consisted of a total of 8 daily runs between 9:00 AM and 7:45 PM, as far north as Homewood, though TTD intends to serve Tahoe City again in 2016.

East Shore Express

The Tahoe Transportation District also operates a shuttle bus service connecting Sand Harbor with an intercept parking lot at the old Incline Village Elementary school site on SR 28 and Southwood Boulevard (west). Service is operated every 20 minutes from 9:00 AM to 6:00 PM, on weekends between June 6th and June 28h, and then daily until Labor Day. This service is part of a coordinated parking/access plan for the popular state park.

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TART Service Scenarios

Building on the enhancements identified in the Vision Plan and considering recent estimates of potential operating funding availability, three operating scenarios were developed for review. All of these have the following elements in common:

- Improvements to evening service, including rescheduling of evening services to eliminate the existing schedule gaps between daytime and evening service, and implementation of evening service in the spring and fall off-seasons for at least some routes.

- Expansion of routes with half-hourly service frequency during peak seasons, and parallel elimination of the Skier Shuttle.

- Additional administrative, dispatch and mechanic staff.

- Contracting with the Town of Truckee's Dial-A-Ride contractor to provide wheelchair accessible ADA trips.

- Expansion of the marketing budget.

Additional information about these common elements is presented in Chapter 5.

The three service scenarios vary in two key respects: (1) whether evening service and half-hourly service on the SR 267 and SR 89 Routes are extended beyond Squaw Valley Road and Northstar Drive to Truckee and (2) whether transit fares paid directly by the passenger are eliminated.

SCENARIO 1: Free Fare throughout the TART Service Area and Service Enhancements South of Squaw Valley Road and Northstar Drive Only

Under this scenario, passengers would be able to board any TART bus (including in Washoe County and Truckee) at no fare. Peak season hourly evening service would be provided as far north as Squaw Valley and Northstar (as at present), and off-season hourly evening service would also be provided as far north as Squaw Valley and Northstar until roughly 9:00 PM. This offseason evening schedule is shown in Table 18. In addition, daytime half-hourly service would be provided year-round on the Mainline Route between Tahoma and Incline Village, on the SR 89 Route between Tahoe City and Squaw Valley, and on the SR 267 Route between Crystal Bay and Northstar (with the current hourly year-round daytime service provided north of Squaw Valley and Northstar to Truckee). Additional winter peak period runs would be provided to accommodate the increase in ridership generated by the elimination of fares. An analysis of the operational, cost, and ridership impacts of this scenario is presented in Table 19.

TABLE 18: Year-Round Evening Service Schedule -- Service Enhancements South of Squaw Valley Road and Northstar Drive Only											
Additional Runs After End of Existing Service											
	Last Existing Departure	Evening Runs: **Year-Round**/*Peak Summer and Winter Only*									
Crystal Bay (1)	*6:25 PM*	--	--	**7:00 PM**	**8:00 PM**	**9:00 PM**	*10:00 PM*	*11:00 PM*	*12:00 AM*	*1:00 AM*
Kings Beach		--	--	**7:03 PM**	**8:03 PM**	**9:03 PM**	*10:03 PM*	*11:03 PM*	*12:03 AM*	*1:03 AM*
Tahoe City	*4:50 PM*	**5:30 PM**	**6:30 PM**	**7:30 PM**	**8:30 PM**	**9:30 PM**	*10:30 PM*	*11:30 PM*	*12:30 AM*	*1:30 AM*
Squaw Valley		**6:00 PM**	**7:00 PM**	**8:00 PM**	**9:00 PM**	10:00 PM	*11:00 PM*	*12:00 AM*	*1:00 AM*	*2:00 AM*
Squaw Valley	*6:05 PM*	--	--	**7:00 PM**	**8:00 PM**	*9:00 PM*	*10:00 PM*	*11:00 PM*	*12:00 AM*	*1:00 AM*
Tahoe City	*6:31 PM*	--	--	**7:30 PM**	**8:30 PM**	*9:30 PM*	*10:30 PM*	*11:30 PM*	*12:30 AM*	*1:30 AM*
Kings Beach		--	--	**7:55 PM**	**8:55 PM**	*9:55 PM*	*10:55 PM*	*11:55 PM*	*12:55 AM*	*1:55 AM*
Crystal Bay		--	--	**8:00 PM**	**9:00 PM**	*10:00 PM*	*11:00 PM*	*12:00 AM*	*1:00 AM*	*2:00 AM*
Tahoe City	*5:32 PM*	--	**6:30 PM**	**7:30 PM**	**8:30 PM**	*9:30 PM*	*10:30 PM*	*11:30 PM*	*12:30 AM*	--
Tahoma	*6:10 PM*	--	**7:00 PM**	**8:00 PM**	**9:00 PM**	*10:00 PM*	*11:00 PM*	*12:00 AM*	*1:00 AM*	--
Tahoe City		--	**7:30 PM**	**8:30 PM**	**9:30 PM**	*10:30 PM*	*11:30 PM*	*12:30 AM*	*1:30 AM*	--
Crystal Bay	*5:00 PM*	--	**6:00 PM**	**7:00 PM**	**8:00 PM**	**9:00 PM**	*10:00 PM*	*11:00 PM*	*12:00 AM*	*1:00 AM*
Kings Beach		--	**6:05 PM**	**7:05 PM**	**8:05 PM**	**9:05 PM**	*10:05 PM*	*11:05 PM*	*12:05 AM*	*1:05 AM*
Northstar	*5:21 PM*	--	**6:25 PM**	**7:25 PM**	**8:25 PM**	**9:25 PM**	*10:25 PM*	*11:25 PM*	*12:25 AM*	*1:25 AM*
Kings Beach		--	**6:50 PM**	**7:50 PM**	**8:50 PM**	*9:50 PM*	*10:50 PM*	*11:50 PM*	*12:50 AM*	*1:50 AM*
Crystal Bay		--	**6:55 PM**	**7:55 PM**	**8:55 PM**	*9:55 PM*	*10:55 PM*	*11:55 PM*	*12:55 AM*	*1:55 AM*
Note 1: Existing 6:25 PM westbound Mainline departures lays over in Crystal Bay for 35 minutes.										

SCENARIO 2: Free Fare and Service Enhancements throughout the TART Service Area

This option differs from the previous scenario in that the service improvements provided only as far north as Squaw Valley and Northstar in the first scenario (evening service in peak seasons and off-peak seasons, and half-hourly service frequency) would instead be extended on both the SR 89 Route and the SR 267 Route to Truckee. The evening service schedule during peak seasons is shown in Table 20. In light of the lower traffic levels and general lack of weather delays during the off-seasons, it would be possible to provide the early evening off-season evening service on the SR 89 and SR 267 Routes using three buses operating on a three-hour headway combining the two routes (rather than two buses apiece on the two individual routes), as shown in Table 21. The resulting service quantities, costs, and ridership are shown in Table 22.

SCENARIO 3: Maintain Current Daytime Fares and Provide Service Enhancements throughout the TART Service Area

This final scenario provides the full extent of the service enhancements (consistent with Scenario 2) but keeps the existing TART fares on the daytime services. The additional winter “tripper” runs needed to provide adequate capacity would not be needed, though the existing tripper runs between Incline Village and Squaw Valley would still be needed, even with half-hourly service. Rather than the loss of revenue associated with the elimination of fares, the

TABLE 19: TART Service Expansion Scenario -- Expansion South of Squaw Valley Road & Northstar Drive Only, Free Fare 4/6/2016

Excluding Skier Shuttle

Season	Season / Service Period / Service Area	Frequency: Existing	Frequency: Plan	Change in Annual: Revenue Vehicle-Hours	Change in Annual: Revenue Vehicle-Miles	Change in Annual: Operating Cost	Change in Annual: Peak Buses	Total With Plan: Revenue Veh-Hrs	Total With Plan: Peak Buses	Total With Plan: Marginal Operating	Ridership Analysis: Existing Ridership	Plan Ridership Factors (1 = No Change): Headway	Route	Span	Days	Overall	Ridership with Plan	Increase in Ridership
SUMMER (June 15 Thru Sept 27)	**Day: 6:30 AM - 6:30 PM**																	
	Tahoe City -- Truckee	Hourly	30 Min	1,455	28,124	$130,300	1	2,976	3	$270,000	10,309	1.30	1.00	1.00	1.23	1.60	16,443	6,134
	Truckee -- Crystal Bay	Hourly	30 Min	1,480	29,231	$133,400	1	2,976	3	$266,300	4,938	1.32	1.00	1.00	1.23	1.62	8,004	3,066
	Tahoe City -- Crystal Bay	30 Min	30 Min	550	12,508	$52,100	0	2,046	2	$193,600	23,137	1.00	1.00	1.00	1.23	1.23	28,407	5,270
	West Shore	Hourly	30 Min	1,323	28,637	$123,000	1	2,139	2	$198,900	7,801	1.46	1.00	1.00	1.23	1.80	14,023	6,222
	Crystal Bay -- Incline Village	30 Min	30 Min	313	6,528	$28,700	0	1,163	1	$106,800	7,372	1.00	1.00	1.00	1.23	1.23	9,051	1,679
	Evening: 6:30 PM - 2:00 AM																	
	Tahoe City -- Squaw Valley	Hourly	Hourly	268	3,895	$22,100	0	744	1	$65,800	3,744	1.00	1.00	1.21	1.23	1.49	5,582	1,838
	Northstar -- Crystal Bay	Hourly	Hourly	328	7,187	$30,600	0	736	1	$66,900	2,891	1.00	1.00	1.33	1.23	1.64	4,733	1,842
	Tahoe City -- Crystal Bay	Hourly	Hourly	175	3,980	$16,600	0	651	1	$61,600	7,319	1.00	1.00	1.00	1.23	1.23	8,986	1,667
	West Shore	Hourly	Hourly	175	3,788	$16,300	0	651	1	$60,500	3,364	1.00	1.00	1.00	1.23	1.23	4,130	766
WINTER (Dec 13 to Apr 17)	**Day: 6:30 AM - 6:30 PM**																	
	Tahoe City -- Truckee (1)	Hourly	30 Min	1,624	30,737	$144,400	2	4,176	4	$378,900	32,169	1.30	1.00	1.00	1.00	1.30	41,792	9,623
	Truckee -- Crystal Bay (1)	Hourly	30 Min	1,624	32,489	$147,000	2	4,176	4	$373,700	23,962	1.32	1.00	1.00	1.00	1.32	31,636	7,673
	Tahoe City -- Crystal Bay (1)	Hourly	30 Min	1,856	42,210	$175,700	1	3,480	3	$329,400	68,148	1.46	1.00	1.00	1.00	1.46	99,775	31,627
	West Shore	Hourly	30 Min	1,276	27,620	$118,700	1	2,668	2	$248,100	14,248	1.46	1.00	1.00	1.00	1.46	20,860	6,612
	Crystal Bay -- Incline Village	30 Min	30 Min	0	0	$0	0	1,450	1	$133,200	8,646	1.00	1.00	1.00	1.00	1.00	8,646	0
	Evening: 6:30 PM - 2:00 AM																	
	Tahoe City -- Squaw Valley	Hourly	Hourly	116	299	$7,500	0	928	1	$82,100	11,987	1.00	1.00	1.21	1.00	1.21	14,556	2,569
	Northstar -- Crystal Bay	Hourly	Hourly	222	5,440	$21,600	0	918	1	$83,400	7,955	1.00	1.00	1.33	1.00	1.33	10,607	2,652
	Tahoe City -- Crystal Bay	Hourly	Hourly	0	0	$0	0	812	1	$76,800	14,156	1.00	1.00	1.00	1.00	1.00	14,156	0
	West Shore (2)	Hourly	Hourly	0	0	$0	0	812	1	$75,500	8,443	1.00	1.00	1.00	1.00	1.00	8,443	0
SPRING / FALL	**Day: 6:30 AM - 6:30 PM**																	
	Tahoe City -- Truckee	Hourly	Hourly	-550	-11,489	-$50,500	0	3,432	2	$315,300	26,963	1.00	1.00	1.00	0.86	0.86	23,239	-3,724
	Truckee -- Crystal Bay	Hourly	Hourly	-550	-10,360	-$48,800	0	3,432	2	$304,800	12,915	1.00	1.00	1.00	0.86	0.86	11,131	-1,784
	Tahoe City -- Crystal Bay	Hourly	30 Min	1,210	27,518	$114,500	0	3,744	2	$354,300	46,434	1.46	1.00	1.00	0.86	1.26	58,593	12,159
	West Shore	Hourly	Hourly	-300	-6,494	-$27,900	0	1,872	1	$174,100	12,626	1.00	1.00	1.00	0.86	0.86	10,882	-1,744
	Crystal Bay -- Incline Village	30 Min	30 Min	-313	-6,528	-$28,700	0	1,950	1	$179,100	14,456	1.00	1.00	1.00	0.86	0.86	12,459	-1,997
	Evening: 6:30 PM - 9:30 PM																	
	Tahoe City -- Squaw Valley	--	Hourly	468	8,705	$41,400	1	468	1	$41,400	0	--	--	--	--	--	3,200	3,200
	Northstar -- Crystal Bay	--	Hourly	533	10,767	$48,400	1	533	1	$48,400	0	--	--	--	--	--	3,100	3,100
	Tahoe City -- Crystal Bay	--	Hourly	390	8,870	$36,900	1	390	1	$36,900	0	--	--	--	--	--	4,800	4,800
	West Shore	--	Hourly	468	10,130	$43,500	1	468	1	$43,500	0	--	--	--	--	--	2,700	2,700
TOTAL				14,142	293,791	$1,296,800	3	49,791	14	$4,569,300	373,984						480,000	105,949
						Existing Employee Ridership				103,333								
						Existing Riders Directly Paying Fare				270,651								
						Impact of Elimination of Fares				50%	Existing Not Directly Paying Fare =						188,300	
						Total											668,300	
						Increase over Existing											*294,316*	

Note 1: Includes two additional AM and two additional PM runs to address vehicle overcrowding between Tahoe City and Squaw Valley, Tahoe City and North Stateline, and Northstar and North Stateline.

TABLE 20: Peak Season Evening Service Schedule -- Service Enhancements to Truckee

Additional Runs After End of Existing Service

	Last Existing Departure	Evening Runs: Peak Summer and Winter Only								
Crystal Bay (1)	*6:25 PM*	--	--	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM	12:00 AM	1:00 AM
Kings Beach		--	--	7:03 PM	8:03 PM	9:03 PM	10:03 PM	11:03 PM	12:03 AM	1:03 AM
Tahoe City	*5:32 PM*	--	6:30 PM	7:30 PM	8:30 PM	9:30 PM	10:30 PM	11:30 PM	12:30 AM	1:30 AM
Tahoma	*6:10 PM*	--	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM	12:00 AM	1:00 AM	--
Tahoe City	*6:31 PM*	--	7:30 PM	8:30 PM	9:30 PM	10:30 PM	11:30 PM	12:30 AM	1:30 AM	--
Kings Beach		--	7:55 PM	8:55 PM	9:55 PM	10:55 PM	11:55 PM	12:55 AM	1:55 AM	--
Crystal Bay		--	8:00 PM	9:00 PM	10:00 PM	11:00 PM	12:00 AM	1:00 AM	2:00 AM	--
Tahoe City	*4:50 PM*	5:30 PM	6:30 PM	7:30 PM	8:30 PM	9:30 PM	10:30 PM	11:30 PM	12:30 AM	1:30 AM
Squaw Valley	*5:04 PM*	5:44 PM	6:44 PM	7:44 PM	8:44 PM	9:44 PM	10:44 PM	11:44 PM	12:44 AM	1:44 AM
Truckee (Arr)		6:10 PM	7:10 PM	8:10 PM	9:10 PM	10:10 PM	11:10 PM	12:10 AM	1:10 AM	2:10 AM
Truckee (Dep)	*5:30 PM*	6:30 PM	7:30 PM	8:30 PM	9:30 PM	10:30 PM	11:30 PM	12:30 AM	1:30 AM	--
Squaw Valley	*6:05 PM*	6:52 PM	7:52 PM	8:52 PM	9:52 PM	10:52 PM	11:52 PM	12:52 AM	1:52 AM	--
Tahoe City	*6:31 PM*	7:15 PM	8:15 PM	9:15 PM	10:15 PM	11:15 PM	12:15 AM	1:15 AM	2:15 AM	--
Crystal Bay	*5:00 PM*	--	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM	12:00 AM	1:00 AM
Kings Beach		--	6:05 PM	7:05 PM	8:05 PM	9:05 PM	10:05 PM	11:05 PM	12:05 AM	1:05 AM
Northstar	*5:25 PM*	--	6:25 PM	7:25 PM	8:25 PM	9:25 PM	10:25 PM	11:25 PM	12:25 AM	1:25 AM
Truckee (Arr)			6:50 PM	7:50 PM	8:50 PM	9:50 PM	10:50 PM	11:50 PM	12:50 AM	1:50 AM
Truckee (Dep)	*5:00 PM*	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM	12:00 AM	1:00 AM	--
Northstar	*5:21 PM*	6:21 PM	7:21 PM	8:21 PM	9:21 PM	10:21 PM	11:21 PM	12:21 AM	1:21 AM	--
Kings Beach		6:46 PM	7:46 PM	8:46 PM	9:46 PM	10:46 PM	11:46 PM	12:46 AM	1:46 AM	--
Crystal Bay		6:51 PM	7:51 PM	8:51 PM	9:51 PM	10:51 PM	11:51 PM	12:51 AM	1:51 AM	--

Note 1: Existing 6:25 PM westbound Mainline departures lays over in Crystal Bay for 35 minutes.

TABLE 21: Offseason Evening Service Schedule -- Service Enhancements to Truckee

Additional Runs After End of Existing Service

	Last Existing Departure						
Mainline							
Tahoma	*6:10 PM*	--	--	--	7:10 PM	8:10 PM	9:10 PM
Tahoe City	*6:31 PM*	--	--	--	7:31 PM	8:31 PM	9:31 PM
Kings Beach		--	--	--	7:52 PM	8:52 PM	--
Crystal Bay		--	--	--	7:56 PM	8:56 PM	--
Crystal Bay	*6:25 PM*	--	--	7:00 PM	8:00 PM	9:00 PM	--
Kings Beach		--	--	7:03 PM	8:03 PM	9:03 PM	--
Tahoe City	*5:32 PM*	--	6:30 PM	7:30 PM	8:30 PM	9:30 PM	--
Tahoma		--	6:50 PM	7:50 PM	8:50 PM	--	--
Combined 89 / 267							
Tahoe City	*4:50 PM*	--	5:30 PM	6:30 PM	7:30 PM	8:30 PM	9:30 PM
Squaw Valley		--	5:46 PM	6:46 PM	7:46 PM	8:46 PM	9:46 PM
Truckee	*5:00 PM*	--	6:11 PM	7:11 PM	8:11 PM	9:11 PM	--
Northstar		--	6:29 PM	7:29 PM	8:29 PM	--	--
Kings Beach		--	6:49 PM	7:49 PM	8:49 PM	--	--
Crystal Bay		--	6:54 PM	7:54 PM	8:54 PM	--	--
Crystal Bay	*5:00 PM*	5:57 PM	6:57 PM	7:57 PM	8:57 PM	--	--
Kings Beach		6:00 PM	7:00 PM	8:00 PM	9:00 PM	--	--
Northstar		6:20 PM	7:20 PM	8:20 PM	9:20 PM	--	--
Truckee	*5:30 PM*	6:39 PM	7:39 PM	8:39 PM	9:39 PM	--	--
Squaw Valley		6:59 PM	7:59 PM	8:59 PM	--	--	--
Tahoe City		7:20 PM	8:20 PM	9:20 PM	--	--	--

TABLE 22: TART Service Expansion Scenario -- Expansion to Truckee, Free Fare

4/6/2016

Excluding Skier Shuttle

Season	Season / Service Period / Service Area	Frequency: Existing	Frequency: Plan	Change in Annual: Revenue Vehicle-Hours	Change in Annual: Revenue Vehicle-Miles	Change in Annual: Operating Cost	Change in Annual: Peak Buses	Total With Plan: Revenue Veh-Hrs	Total With Plan: Peak Buses	Total With Plan: Marginal Operating	Ridership Analysis: Existing Ridership	Plan Ridership Factors (1 = No Change): Headway	Route	Span	Days	Overall	Ridership with Plan	Increase in Ridership
SUMMER June 15 Thru Sept 27	**Day: 6:30 AM - 6:30 PM**																	
	Tahoe City -- Truckee	Hourly	30 Min	2,385	46,841	$214,700	2	3,906	4	$354,400	10,309	1.46	1.00	1.00	1.23	1.80	18,531	8,222
	Truckee -- Crystal Bay	Hourly	30 Min	2,410	47,172	$216,700	2	3,906	4	$349,500	4,938	1.46	1.00	1.00	1.23	1.80	8,876	3,938
	Tahoe City -- Crystal Bay	30 Min	30 Min	550	12,508	$52,100	0	2,046	2	$193,600	23,137	1.00	1.00	1.00	1.23	1.23	28,407	5,270
	West Shore	Hourly	30 Min	1,323	28,637	$123,000	1	2,139	2	$198,900	7,801	1.46	1.00	1.00	1.23	1.80	14,023	6,222
	Crystal Bay -- Incline Village	30 Min	30 Min	313	6,528	$28,700	0	1,163	1	$106,800	7,372	1.00	1.00	1.00	1.23	1.23	9,051	1,679
	Evening: 6:30 PM - 2:00 AM																	
	Tahoe City -- Squaw Valley	Hourly	Hourly	1,051	18,455	$91,300	1	1,527	2	$135,000	3,744	1.00	1.59	1.21	1.23	2.37	8,860	5,116
	Northstar -- Crystal Bay	Hourly	Hourly	1,051	21,777	$96,300	1	1,459	2	$132,500	2,891	1.00	1.45	1.33	1.23	2.37	6,859	3,968
	Tahoe City -- Crystal Bay	Hourly	Hourly	175	3,980	$16,600	0	651	1	$61,600	7,319	1.00	1.00	1.00	1.23	1.23	8,986	1,667
	West Shore	Hourly	Hourly	175	3,788	$16,300	0	651	1	$60,500	3,364	1.00	1.00	1.00	1.23	1.23	4,130	766
WINTER Dec 13 to Apr 7	**Day: 6:30 AM - 6:30 PM**																	
	Tahoe City -- Truckee (1)	Hourly	30 Min	2,784	54,083	$249,700	3	5,336	5	$484,100	32,169	1.46	1.00	1.00	1.00	1.46	47,098	14,929
	Truckee -- Crystal Bay (1)	Hourly	30 Min	2,784	54,867	$250,800	3	5,336	5	$477,500	23,962	1.46	1.00	1.00	1.00	1.46	35,083	11,121
	Tahoe City -- Crystal Bay (1)	Hourly	30 Min	1,856	42,210	$175,700	2	3,480	3	$329,400	68,148	1.46	1.00	1.00	1.00	1.46	99,775	31,627
	West Shore	Hourly	30 Min	1,276	27,620	$118,700	1	2,668	2	$248,100	14,248	1.46	1.00	1.00	1.00	1.46	20,860	6,612
	Crystal Bay -- Incline Village	30 Min	30 Min	0	0	$0	0	1,450	1	$133,200	8,646	1.00	1.00	1.00	1.00	1.00	8,646	0
	Evening: 6:30 PM - 2:00 AM																	
	Tahoe City -- Squaw Valley	Hourly	Hourly	1,092	18,459	$93,800	1	1,904	2	$168,400	11,987	1.00	1.59	1.21	1.00	1.93	23,105	11,118
	Northstar -- Crystal Bay	Hourly	Hourly	1,123	23,639	$103,500	1	1,819	2	$165,300	7,955	1.00	1.45	1.33	1.00	1.93	15,372	7,417
	Tahoe City -- Crystal Bay	Hourly	Hourly	0	0	$0	0	812	1	$76,800	14,156	1.00	1.00	1.00	1.00	1.00	14,156	0
	West Shore (2)	Hourly	Hourly	0	0	$0	0	812	1	$75,500	8,443	1.00	1.00	1.00	1.00	1.00	8,443	0
SPRING / FALL	**Day: 6:30 AM - 6:30 PM**																	
	Tahoe City -- Truckee	Hourly	Hourly	-550	-11,489	-$50,500	0	3,432	2	$315,300	26,963	1.00	1.00	1.00	0.86	0.86	23,239	-3,724
	Truckee -- Crystal Bay	Hourly	Hourly	-550	-10,360	-$48,800	0	3,432	2	$304,800	12,915	1.00	1.00	1.00	0.86	0.86	11,131	-1,784
	Tahoe City -- Crystal Bay	Hourly	Hourly	1,210	27,518	$114,500	0	3,744	1	$354,300	46,434	1.46	1.00	1.00	0.86	1.26	58,593	12,159
	West Shore	Hourly	Hourly	-300	-6,494	-$27,900	0	1,872	1	$174,100	12,626	1.00	1.00	1.00	0.86	0.86	10,882	-1,744
	Truckee -- Donner Summit		--	0	0	$0		0	0	$0	--	--	--	--	0.86	--	0	0
	Crystal Bay -- Incline Village	30 Min	30 Min	-313	-6,528	-$28,700	0	1,950	1	$179,100	14,456	1.00	1.00	1.00	0.86	0.86	12,459	-1,997
	Evening: 6:30 PM - 9:30 PM																	
	Tahoe City -- Squaw Valley	--	Hourly	831	15,451	$73,500	2	831	1.5	$73,500	0	--	--	--	--	--	4,300	4,300
	Northstar -- Crystal Bay	--	Hourly	831	16,780	$75,500	2	831	1.5	$75,500	0	--	--	--	--	--	3,500	3,500
	Tahoe City -- Crystal Bay	--	Hourly	390	8,870	$36,900	1	390	1	$36,900	0	--	--	--	--	--	4,800	4,800
	West Shore	--	Hourly	468	10,130	$43,500	1	468	1	$43,500	0	--	--	--	--	--	2,700	2,700
TOTAL				22,364	454,441	$2,035,900	9	58,014	16	$5,308,100	373,984						512,000	137,882
								Existing Employee Ridership		103,333								
								Existing Riders Directly Paying		270,651								
								Impact of Elimination of Fares		50%	Existing Not Directly Paying Fare =						204,300	
								Total									716,300	
								Increase over Existing									*342,316*	

Note 1: Includes two additional AM and two additional PM runs to address vehicle overcrowding between Tahoe City and Squaw Valley, Tahoe City and North Stateline, and Northstar and North Stateline.

increase in ridership generated by the service improvements would increase fare revenues. Service, cost and ridership analysis for this scenario is presented in Table 23.

COMPARISON OF SCENARIOS

Table 24 presents a summary of the three scenarios, reflecting the trade-offs between the options:

- The potential ridership ranges from a low of 136,400 additional passenger boardings per year (Scenario 3) up to 340,200 (Scenario 2). Scenario 1 is much closer to the higher end of this range than the lower, at 294,200. Compared with existing ridership, these increases range from a 36 percent increase up to a 91 percent increase.

- The increase in the size of the TART program (as measured in annual vehicle-hours of service) ranges from a 39 percent increase under Scenario 1 through a 60 percent increase under Scenario 3 to a 61 percent increase under Scenario 2.

- The estimated annual operating cost (in round terms) ranges from $5.6 Million (Scenario 1) to $6.3 Million (Scenario 2). This reflects a $1.3 Million increase under Scenario 1, a $2.0 Million increase under Scenario 2 and a $1.7 Million increase under Scenario 3.

- Considering the loss in farebox revenues under the first two scenarios and the growth in farebox revenues under the third, the net impact on annual operating subsidy is an increase of $1.7 Million under Scenario 1, $2.4 Million under Scenario 2 and $1.6 Million under Scenario 3.

- In comparison with the current peak of 10 TART buses in operation, Scenario 1 would require 4 additional buses, Scenario 3 would require 5, and Scenario 2 would require 6.

- A key performance measure of a transit plan is the marginal productivity – the marginal growth in ridership for every new vehicle-hour of service operated. This measure varies significantly from a low of 6.4 passengers added for every new hour of service for Scenario 3 through 15.6 for Scenario 2 to 21.0 for Scenario 1. Put another way, every new hour of service added under Scenario 1 generates more than 3 times the ridership increase as a new hour of service added under Scenario 3 (thanks in large part to the ridership benefit of the elimination of fares).

- Another key measure is the marginal subsidy per marginal new passenger-trip. This is particularly important as it relates the key public "input" -- subsidy dollars – with the key desired "output" – new ridership. As shown, an additional $5.77 in subsidy is required for every additional transit rider gained under Scenario 1, compared with $6.94 under Scenario 2 and $11.67 under Scenario 3.

TABLE 23: TART Service Expansion Operating, Cost and Ridership Impacts

4/6/2016

Excluding Skier Shuttle

Season	Season / Service Period / Service Area	Frequency: Existing	Frequency: Plan	Change in Annual: Revenue Vehicle-Hours	Change in Annual: Revenue Vehicle-Miles	Change in Annual: Operating Cost	Total With Plan: Revenue Veh-Hrs	Total With Plan: Peak Buses	Total With Plan: Marginal Operating	Ridership Analysis: Existing Ridership	Plan Ridership Factors (1 = No Change): Headway	Route	Span	Days	Overall	Ridership with Plan	Increase in Ridership
SUMMER June 27 Thru Sept 15	**Day: 6:30 AM - 6:30 PM**																
	Tahoe City -- Truckee	Hourly	30 Min	2,385	46,841	$214,700	3,906	4	$354,400	10,309	1.46	1.00	1.00	1.23	1.80	18,531	8,222
	Truckee -- Crystal Bay	Hourly	30 Min	2,410	47,172	$216,700	3,906	4	$349,500	4,938	1.46	1.00	1.00	1.23	1.80	8,876	3,938
	Tahoe City -- Crystal Bay	30 Min	30 Min	550	12,508	$52,100	2,046	2	$193,600	23,137	1.00	1.00	1.00	1.23	1.23	28,407	5,270
	West Shore	Hourly	30 Min	1,323	28,637	$123,000	2,139	2	$198,900	7,801	1.46	1.00	1.00	1.23	1.80	14,023	6,222
	Crystal Bay -- Incline Village	30 Min	30 Min	313	6,528	$28,700	1,163	1	$106,800	7,372	1.00	1.00	1.00	1.23	1.23	9,051	1,679
	Evening: 6:30 PM - 2:00 AM																
	Tahoe City -- Squaw Valley	Hourly	Hourly	1,051	18,455	$91,300	1,527	2	$135,000	3,744	1.00	1.59	1.21	1.23	2.37	8,860	5,116
	Northstar -- Crystal Bay	Hourly	Hourly	1,051	21,777	$96,300	1,459	2	$132,500	2,891	1.00	1.45	1.33	1.23	2.37	6,859	3,968
	Tahoe City -- Crystal Bay	Hourly	Hourly	175	3,980	$16,600	651	1	$61,600	7,319	1.00	1.00	1.00	1.23	1.23	8,986	1,667
	West Shore (2)	Hourly	Hourly	175	3,788	$16,300	651	1	$60,500	3,364	1.00	1.00	1.00	1.23	1.23	4,130	766
WINTER Dec 13 to Apr 7	**Day: 6:30 AM - 6:30 PM**																
	Tahoe City -- Truckee	Hourly	30 Min	2,552	49,414	$228,600	5,104	4.5	$463,100	32,169	1.46	1.00	1.00	1.00	1.46	47,098	14,929
	Truckee -- Crystal Bay	Hourly	30 Min	2,552	50,391	$230,100	5,104	4.5	$456,700	23,962	1.46	1.00	1.00	1.00	1.46	35,083	11,121
	Tahoe City -- Crystal Bay	Hourly	30 Min	1,392	31,658	$131,700	3,016	3	$285,400	68,148	1.46	1.00	1.00	1.00	1.46	99,775	31,627
	West Shore	Hourly	30 Min	1,276	27,620	$118,700	2,668	2	$248,100	14,248	1.46	1.00	1.00	1.00	1.46	20,860	6,612
	Crystal Bay -- Incline Village	30 Min	30 Min	0	0	$0	1,450	1	$133,200	8,646	1.00	1.00	1.00	1.00	1.00	8,646	0
	Evening: 6:30 PM - 2:00 AM																
	Tahoe City -- Squaw Valley	Hourly	Hourly	1,092	18,459	$93,800	1,904	2	$168,400	11,987	1.00	1.59	1.21	1.00	1.93	23,105	11,118
	Northstar -- Crystal Bay	Hourly	Hourly	1,123	23,639	$103,500	1,819	2	$165,300	7,955	1.00	1.45	1.33	1.00	1.93	15,372	7,417
	Tahoe City -- Crystal Bay	Hourly	Hourly	0	0	$0	812	1	$76,800	14,156	1.00	1.00	1.00	1.00	1.00	14,156	0
	West Shore (2)	Hourly	Hourly	0	0	$0	812	1	$75,500	8,443	1.00	1.00	1.00	1.00	1.00	8,443	0
SPRING / FALL	**Day: 6:30 AM - 6:30 PM**																
	Tahoe City -- Truckee	Hourly	Hourly	-550	-11,489	-$50,500	3,432	2	$315,300	26,963	1.00	1.00	1.00	0.86	0.86	23,239	-3,724
	Truckee -- Crystal Bay	Hourly	Hourly	-550	-10,360	-$48,800	3,432	2	$304,800	12,915	1.00	1.00	1.00	0.86	0.86	11,131	-1,784
	Tahoe City -- Crystal Bay	Hourly	Hourly	1,210	27,518	$114,500	3,744	1	$354,300	46,434	1.46	1.00	1.00	0.86	1.26	58,593	12,159
	West Shore	Hourly	Hourly	-300	-6,494	-$27,900	1,872	1	$174,100	12,626	1.00	1.00	1.00	0.86	0.86	10,882	-1,744
	Crystal Bay -- Incline Village	30 Min	30 Min	-313	-6,528	-$28,700	1,950	1	$179,100	14,456	1.00	1.00	1.00	0.86	0.86	12,459	-1,997
	Evening: 6:30 PM - 9:30 PM																
	Tahoe City -- Squaw Valley	--	Hourly	831	15,451	$73,500	831	1.5	$73,500	0	--	--	--	--	--	4,300	4,300
	Northstar -- Crystal Bay	--	Hourly	831	16,780	$75,500	831	1.5	$75,500	0	--	--	--	--	--	3,500	3,500
	Tahoe City -- Crystal Bay	--	Hourly	390	8,870	$36,900	390	1	$36,900	0	--	--	--	--	--	4,800	4,800
	West Shore	--	Hourly	468	10,130	$43,500	468	1	$43,500	0	--	--	--	--	--	2,700	2,700
TOTAL				21,436	434,744	$1,950,100	57,086	15	$5,222,300	373,984						512,000	137,882
											Subtotal: Evening						*45,352*
											Subtotal: Daytime						*92,530*
											Average Daytime Fare						$1.26
											Change in Fare Revenue						$116,600

TABLE 24: TART Scenario Impacts at Full Implementation

	Scenario		
	1. Free Fare, Service Expansion South of Squaw Valley & Northstar Only	2. Free Fare, Service Expansion to Truckee	3. Fares Remain, Service Expansion to Truckee
Change in Annual Ridership	294,200	340,900	136,400
% Change in Annual Ridership	78%	91%	36%
Change in Annual Revenue Vehicle-Hours	13,982	21,849	21,436
% Growth in Annual Revenue Vehicle-Hours	39%	61%	60%
Annual Operating Cost	$5,584,900	$6,324,000	$6,153,000
Change in Annual Operating Cost	$1,294,000	$1,963,700	$1,709,000
Change in Fare Revenues	-$403,000	-$403,000	$116,600
Change in Annual Operating Subsidy	$1,697,000	$2,366,700	$1,592,400
Peak Buses	14	16	15
Change in Peak Buses	4	6	5
Marginal Passengers per Revenue Vehicle Hour	21.0	15.6	6.4
Marginal Subsidy per Passenger	$5.77	$6.94	$11.67

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TART Systems Plan for Eastern Placer County

The following plan builds upon the substantial work conducted over the last four years through the regional Transit Vision effort, and is based upon the evaluation of current conditions discussed in previous chapters. Reasonably foreseeable operating funding is not sufficient to fully fund all Transit Vision improvements. Therefore, this plan is segmented into a "financially constrained" elements (those that can be funded with the reasonably foreseeable funding sources), and "financially unconstrained" elements. An overall map of planned enhancements is presented in Figure 5.

FINANCIALLY CONSTRAINED SERVICE PLAN

The following service improvements are planned under the financially constraints. Note that as service improvements are dependent on development of new funding sources, the schedule for specific improvements may vary from the optimal case presented in this document.

Fixed Route Service Improvements

Increase Peak Season Service Frequency

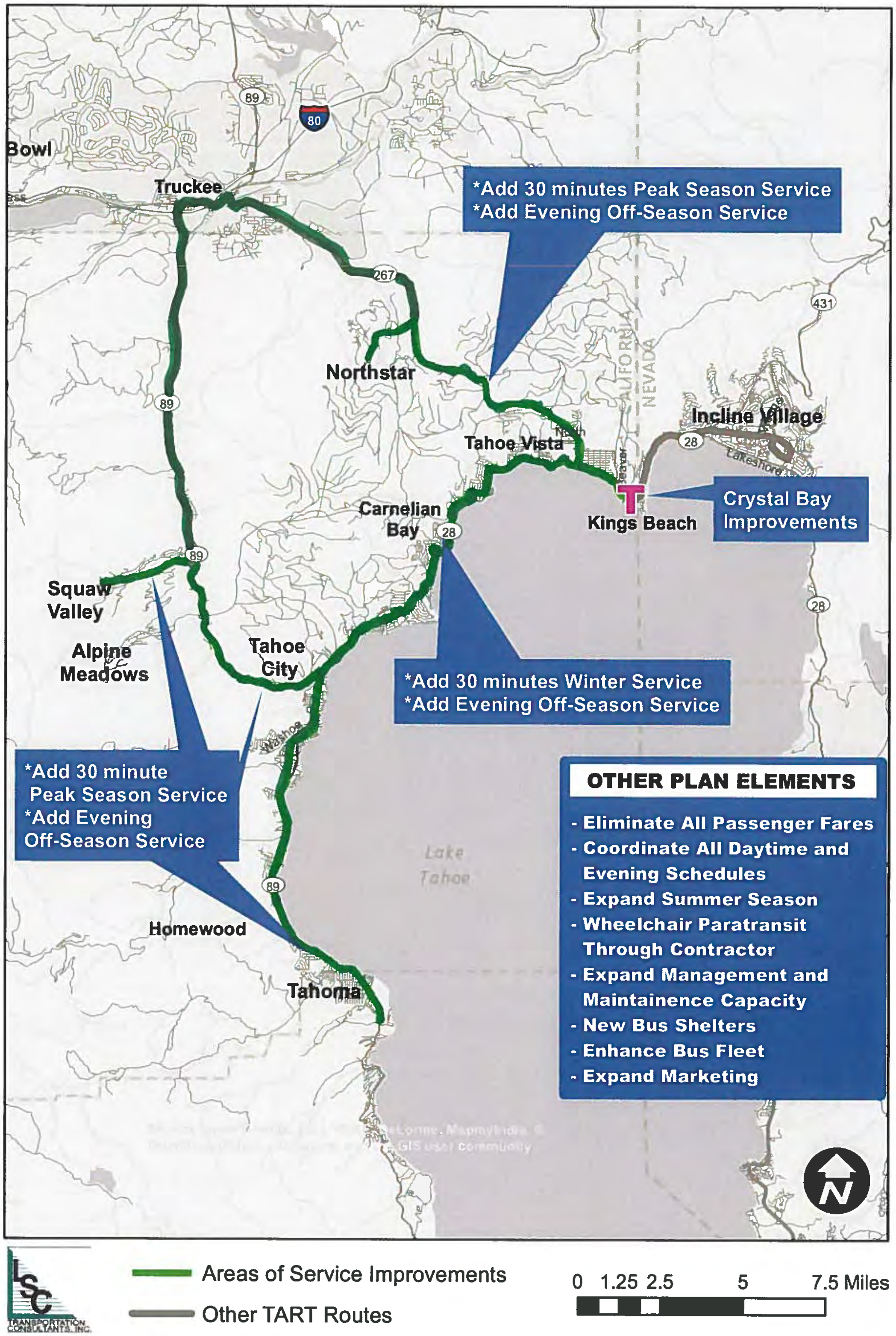
With the exception of service in Washoe County (year round) and on the North Shore between Tahoe City and Crystal Bay (summer only), TART service operates only on hourly frequency. The need to wait substantial lengths of time for many individual's trips and the long wait for the next bus if an individual misses a bus makes this low frequency of service a substantial detriment to the overall convenience and attractiveness of service, particularly to visitors. During the summer and winter seasons, consistent half-hourly service frequency will be provided during the daytime on all TART Mainline service (including the North and West Shores), along SR 89 between Tahoe City and Truckee, and along SR 267 between Crystal Bay and Truckee. As an implementation step, service improvements on the SR 89 Route may be implemented between Tahoe City and Squaw Valley in an initial phase, as well as service improvements on the SR 267 Route between Crystal Bay and Northstar.

Implementation of this service enhancement will be as follows:

- Starting in the winter of 2016/17, daytime service frequency between Tahoe City and Crystal Bay will be expanded to half-hourly. One run in the morning and afternoon peak periods will be "skipped" so that the bus can instead be used to serve Squaw Valley, providing one-seat trips between Squaw Valley and Incline Village at these key times.

- Half-hourly service will be expanded to include the SR 89 Route between Tahoe City and Squaw Valley and the SR 267 Route between Crystal Bay and Northstar as well as the West Shore Route in both winter and summer starting with the winter of 2017/18.

Figure 5
TART Systems Plan



- Half-hourly service will be extended north from Squaw Valley to Truckee as well as north from Northstar to Truckee in both summer and winter, starting with the winter of 2018/19.

As part of this strategy, the existing Skier Shuttle program will be eliminated (as the additional capacity will be provided by the new half-hourly winter runs). Some of the new half-hourly winter runs will be inter-lined between the North Shore and SR 89 corridors (rather than the North Shore and West Shore corridors) in order to provide convenient one-seat service between the North Shore and Squaw Valley/Alpine Meadows without the need to transfer in Tahoe City.

Increase North Shore Service Frequency in Off Seasons

The North Shore Route between Tahoe City and Crystal Bay has the highest ridership of the TART routes, year-round. Providing half-hourly service in the off-seasons, coupled with the previous improvement and the existing half-hourly summer service, will provide consistent and cost-effective year-round service on this key route. Off-season half-hourly service between Tahoe City and Crystal bay will be initiated in the fall of 2017.

Expand the Days of Summer Service Levels

The peak summer season will be expanded from the current 68 days (June 27 to Labor Day) to 93 days (June 15 through September 15), starting with the summer of 2017. This reflects growing activity earlier in the summer and later into the fall.

Improved Evening Service Including Off-Season Evening Service for TART Service Areas South of Squaw Valley and Northstar.

At present, evening service is limited to the summer and winter seasons only. The lack of evening service in the off-seasons limits residents to travel for work, shopping and recreation in the evening. Employees unable to travel home from work by transit in the off seasons are less likely to use transit services throughout the year. As shown in Table 18, above, evening service will be provided in the spring and fall seasons until roughly 9:00 PM (depending upon the specific run), for TART services south of Squaw Valley Road and Northstar Drive, starting in the fall of 2017.

In addition, the current evening service schedule was developed for a separate contracted service, and results in gaps in service between the end of daytime service and the beginning of evening service. With operation of both services by TART, these existing gaps will be filled, and the evening service schedule modified to provide a more consistent and convenient service south of Squaw Valley and Northstar. Finally, one additional late night hour of service is provided on the SR 267 service, to be consistent with the span of service on the Mainline and SR 89 service. These improvements will be implemented in the winter of 2017/18.

Additional Morning 267 Route Northbound Run

With the growth in ridership on the 267 Route, there is demand for a 6:00 AM northbound departure in the winter. This run will be added starting in the winter of 2016/17.

Summary

In summary, the operational, cost and ridership impacts of these financially constrained service improvements as follows:

- The service improvements will add an estimated 22,400 vehicle-hours of TART service per year. This is equivalent to a 67 percent expansion in TART service.
- An additional three buses will be operating at peak times.
- Total operating costs at full implementation (at current cost rates) will increase by $1,857,000 per year.
- The overall productivity of TART services, as measured by the passenger-trips served for every vehicle-hour of revenue service, will decrease from 11.2 to 8.9, reflecting the additional services in less productive service periods.

Detailed year-by-year ridership forecasts are shown in Table 25. Total annual ridership will increase by 120,800 passenger-trips per year, which is a 32 percent increase over current ridership.

It should be noted that there will also be some ridership benefits not reflected in these figures. For instance, evening off-season service will allow some persons to work year-round at positions that they currently cannot access by transit due to the lack of off-season service, which will in turn increase ridership during the peak seasons.

Provide Wheelchair-Accessible Paratransit Service through Town of Truckee Contractor

At present, all complementary paratransit trips required under the Americans with Disabilities Act for TART service are provided through a contract with Blue Mountain Taxi. While the large majority (93 percent) of passengers does not use a wheelchair, 7 percent require a wheelchair-accessible vehicle. As the taxis are not wheelchair accessible, this requires TART staff to use a county vehicle to provide the trip. This is an inefficient use of limited staff time.

The County will negotiate with the contracted provider of Truckee's Dial-A-Ride service (Paratransit Services, Inc.) to provide these trips that require a wheelchair-accessible vehicle. If needed, the County can provide a van to the contractor. A review of the 14-15 ADA service logs indicates that only 28 one-way wheelchair user trips were provided over the year. All of these were for travel between Kings Beach and Truckee. As each trip would require approximately

TABLE 25: TART Short-Range Transit Improvements Ridership Forecasts

All Figures in Thousands

Plan Element	FY 16-17	FY 17-18	FY 18-19	FY 19-20	FY 20-21
Base Case Ridership [1]	375.4	375.4	375.4	375.4	375.4
Financially Constrained Service Plan Elements					
Expand Summer Season	0.0	0.5	0.5	0.5	0.5
Peak Season Evening Service Expansion: South of Squaw Valley and Northstar	0.0	4.7	11.3	11.3	11.3
Off-Season Evening Service Expansion: South of Squaw Valley and Northstar	0.0	9.1	12.4	13.7	13.7
Additional Morning Winter 267 Run	4.9	4.9	4.9	4.9	4.9
Winter Half-Hourly North Shore Service Frequency	16.1	0.0	0.0	0.0	0.0
Peak Season Half-Hourly Service: South of Squaw Valley and Northstar	0.0	25.1	68.4	68.4	68.4
Winter Half-Hourly Service Frequency Extension to Truckee	0.0	0.0	0.0	8.7	8.7
Summer Half-Hourly Service Frequency Extension to Truckee	0.0	0.0	0.0	1.9	2.7
Off-Season Half-Hourly North Shore Service	5.2	11.5	12.1	12.1	12.1
Elimination of Skier Shuttle	-1.5	-1.5	-1.5	-1.5	-1.5
Total: Financially Constrained Service Plan Elements	24.7	54.3	108.1	120.0	120.8
Total Ridership	400.1	429.7	483.5	495.4	496.2
% Growth	*7%*	*14%*	*29%*	*32%*	*32%*
Financially Unconstrained Service Plan Elements					
Winter Evening Service Extension to Truckee	0.0	0.0	0.0	8.8	11.9
Summer Evening Service Extension to Truckee	0.0	0.0	0.0	3.6	4.8
Off-Season Evening Service Extension to Truckee	0.0	0.0	0.0	1.0	1.3
Elimination of Direct Passenger Fares	0.0	0.0	0.0	204.3	204.3
Total: Financially Unconstrained Service Plan Elements	0.0	0.0	0.0	217.7	222.3
Total All Service Plan Elements	400.1	429.7	483.5	713.1	718.5
% Growth	*7%*	*14%*	*29%*	*90%*	*91%*

Note 1: Base case ridership includes estimated year-round 267 ridership, skier shuttle ridership, and Night Service ridership. No trend in ridership is assumed.

Source: LSC Transportation Consultants, Inc.

one hour to provide (including deadhead travel and passenger loading/unloading time), this is only 28 vehicle-hours per year. At present, the Town's contract with Paratransit Services, Inc. identifies a rate of $38.59 per revenue service hour plus a monthly fixed rate of $19,295.10. These costs do not include fuel and vehicle maintenance (which are provided separately by the Town.) At this rate, the marginal cost of serving existing TART ADA wheelchair users would be $1,080 per year. It would be reasonable that the contractor also be paid for a portion of fixed costs, and for their ability on a stand-by basis. While this would be a matter of negotiation, for purposes of this plan a cost impact of $5,000 per year is included. In addition, the fuel and vehicle maintenance (provided directly by the County) would total approximately $1,300 per year.

As an aside, an option was also considered to shift all ADA trips (including those not requiring a wheelchair-accessible vehicle) to the Truckee contractor. An initial evaluation indicates that this could be a viable option assuming current ridership levels, depending upon negotiated total monthly and hourly rates, and the potential for contractor costs associated with expansion of dispatch hours. TART management should consider this in the future, based upon the results of the ADA service contracting arrangement.

FINANCIALLY UNCONSTRAINED SERVICE PLAN

Service improvements that are included in the plan but are not financially sustainable given reasonably foreseeable funding sources consist of the following.

Free Transit Boardings throughout the TART System

Transit fares paid by the passenger will be eliminated, including for boardings in Truckee and in Washoe County. Instead, TOT funding will be used to "pre-pay" all existing transit fare revenues. This will bring TART in line with the transit programs of other major mountain resort communities, including Mammoth Lakes, Park City, Vail, Summit County (Colorado) and Aspen.

The implementation of "free transit" to the passenger will significantly increase ridership. The additional demand will trigger the need for additional capacity during the busy winter season. A review of ridership boardings indicates that four additional vehicle-hours of service will need to be implemented each on the SR 89 route between Squaw Valley and Tahoe City, on the North Shore between Tahoe City and Crystal Bay, and on the SR 267 route between Northstar and Crystal Bay.

Transit services that have shifted from fare systems to free-fare have generally seen ridership increases on the order of 50 percent. The most recent examples are Corvallis, Oregon (which saw a 43 percent increase in ridership in the first two months after elimination of fares in 2011) and the Mountainline system in Missoula, Montana (which only eliminated fares in January 2015, but which saw a 50 percent increase in ridership after 6 months). Given the convenience of free-fare service to visitors to the Tahoe Region, a 50 percent ridership increase is reasonable, indicating that existing ridership will increase by an estimated 188,300 riders per year.

Evening Service Improvement to Truckee

Once additional funding has been defined, evening service improvements should be extended beyond Squaw Valley Road and Northstar Drive to include 89 and 267 services to Truckee (including off-season evening service).

CAPITAL PLAN

The following capital improvements will be completed over the coming five years. Costs are shown in Table 26.

Fleet Improvement Plan

Of the existing fleet, two buses will require replacement in 2017/18, two in 2018/19 and four in 2020/21. This will provide an ongoing fleet of 14 buses. The financially constrained service plan elements will increase the peak number of buses in operation from the current 8 up to 11. To provide adequate spare buses to efficiently accommodate scheduled maintenance and buses out of service, a fleet of 15 is needed. One additional vehicle will therefore be purchased. A unit price of $534,000 is assumed (based upon the cost of the most recent bus purchases) increasing with inflation. All new buses will be equipped with automatic stop annunciators.

If the additional financially unconstrained improvements are implemented, an additional two buses will be required. Placer County should explore the potential of including electric battery propulsion vehicles in the TART fleet. Recent improvements in battery technology have begun to address the range limitations in electric battery buses to the point where some models can travel 150 to 200 miles between charges, making them feasible for use on some TART service elements. The use of zero-emission vehicles could also expand funding opportunities.

Bus Stop Improvement Plan

Bus stops are an important element of a successful public transit system. Particularly for "choice" riders with access to a car, the comfort and safety perceived by persons waiting at a bus stop can be crucial in passenger's overall perception of the transit program, and can well make or break an individual's decision to be a regular transit user.

A "North Stateline Transit Center" consists of improvements to existing bus stops at North Stateline. This location make for a better transit center/transfer location than Kings Beach, as it provides direct access to North Stateline from the North Shore and 267 corridor without the need to transfer in Kings Beach, it provides direct service across Kings Beach without the need to transfer, it works well with running times for North Shore, Incline Village, and SR267 routes, and it provides a good location to turn buses around, on streets without residences (which

TABLE 26: TART Short Range Transit Capital Plan

All Figures in Thousands

Plan Element	FY 16-17	FY 17-18	FY 18-19(1)	FY 19-20	FY 20-21
FINANCIALLY CONSTRAINED					
Capital Plan Elements					
Buses					
- Replacement Buses	*0*	*2*	*2*	*0*	*4*
- Expansion Buses	*0*	*1*	*0*	*0*	*0*
- Total Buses	*0*	*3*	*2*	*0*	*4*
- Costs	$0.0	$1,604.0	$1,090.0	$0.0	$2,263.2
Bus Stop Improvements	$115.0	$117.2	$119.4	$121.7	$124.0
Crystal Bay Transit Stop Enhancements	$0.0	$60.0	$0.0	$0.0	$0.0
Total: Capital Plan Elements	*$115.0*	*$1,781.2*	*$1,209.4*	*$121.7*	*$2,387.3*
Capital Plan Revenues					
FTA 5311	*$0.0*	*$102.2*	*$10.0*	*$0.0*	*$200.0*
FTA 5339 Through Caltrans	*$0.0*	*$30.0*	*$319.4*	*$0.0*	*$300.0*
FTA 5339 Through NDOT	*$0.0*	*$227.4*	*$200.0*	*$0.0*	*$345.0*
FTA 5307	*$0.0*	*$427.0*	*$0.0*	*$0.0*	*$0.0*
Washoe County	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*
Placer County Traffic Fee Program - Tahoe	*$19.0*	*$177.0*	*$35.0*	*$21.7*	*$600.0*
Placer County LTF	*$0.0*	*$0.0*	*$545.0*	*$0.0*	*$576.0*
Transient Occupancy Tax	*$65.0*	*$65.0*	*$65.0*	*$65.0*	*$65.0*
Low Carbon Transit Operations Program	*$31.0*	*$30.0*	*$35.0*	*$35.0*	*$35.0*
Congestion Mitigation Air Quality	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$306.5*
Proposition 1B PTMISEA	*$0.0*	*$722.5*	*$0.0*	*$0.0*	*$0.0*
Total	*$115.0*	*$1,781.1*	*$1,209.4*	*$121.7*	*$2,427.5*
Balance	*$0.0*	*-$0.1*	*$0.0*	*$0.0*	*$40.2*
FINANCIALLY UNCONSTRAINED					
Expansion Buses	*0*	*0*	*2*	*0*	*0*
- Costs	$0.0	$0.0	$1,089.7	$0.0	$0.0

Source: LSC Transportation Consultants, Inc.

could be a problem in Kings Beach). An enhanced shelter should be provided on the north side of SR 28, and bus bays on both sides lengthened to accommodate two buses at a time, on both sides of the highway. (At present, the bus bays are only approximately 50 feet in length, and can only accommodate one bus at a time). The improvements on the north side of SR 28 should be implemented as part of the Boulder Bay development project. On the south side, $80,000 is included in the plan to expand the bus pullout. While just outside of Placer County, these improvements benefit two key TART routes serving Placer County.

TART already has a substantial inventory of bus shelters at key locations. However, new shelters are warranted at the following locations:

- SR 28 Eastbound at Dollar Hill Drive
- SR 28 Eastbound at Coon Street
- SR 28 Westbound at Coon Street
- Northstar Transit Center

Real-time displays of Next Bus information will be provided in five key shelters, including shelters in Squaw Valley, Northstar, Kings Beach and Crystal Bay.

Improvements to Communications System

TART has identified the need for approximately $100,000 of improvements in radio coverage along the transit routes. As this improvement is already budgeted and funded, it is not included in this plan.

MANAGEMENT PLAN

The expansion of the TART program will require expansion in management, dispatch and maintenance capacity.

Expand Management/Dispatch Capacity

At present, the administrative staff onsite at the Cabin Creek Facility consists of a total of four full-time personnel: one Administrative Dispatcher, two Senior Bus Drivers, and one Transportation Supervisor. (In addition, administrative staff based in Auburn also provides management services.) With the expansion in the hours of service (in the off-seasons) as well as the overall scope of the TART transit program, there is the need for one additional Administrative Dispatcher, as well as a Senior Transportation Systems Supervisor. This will increase administrative costs a total of $247,000 per year, including salary and benefits.

Expand Maintenance Capacity

The expansion in hours of service and fleet size will require additional Mechanic hours. In addition, there is a current need for additional maintenance capacity to more efficiently schedule preventive maintenance. Overall, 12 hours per week of additional Mechanic hours are included in the plan, consisting of a full workday on Saturday and four additional hours during the work week.

Expand Marketing

Current marketing budgets for TART services are below the transit industry standard of 3 percent of total operating budget. Particularly for a resort system striving to attract visitors, marketing is an important means to generate increased use. An expansion of marketing budget of $50,000 per year (rising with inflation) is included in this plan.

FINANCIAL PLAN

<u>Operating</u>

The impacts of this plan on year-by-year operating costs are shown in Table 27. These figures assume the implementation schedule discussed above. The impact of this plan on annual operating costs rise up to $2,040,700 by FY 2020/21. Beyond the continuation of existing operating funding sources (including Town of Truckee funding for SR 89 and SR 267 services per the current agreement), key operating funding sources are discussed below and shown in Table 28.

Reasonably Foreseeable New Funding Sources

FTA Section F307 Urbanized Area Grant Funds

Through efforts of the Tahoe Transportation District, the Tahoe Metropolitan Planning Organization (TMPO) was designated as a valid recipient of Federal Transit Administration (FTA) Section 5307 Urban Grant Funds, as part of the Fixing America's Surface Transportation (FAST) Act. At present, the final administrative procedures for TMPO funding are being worked out, which will impact the ultimate funding levels, but discussions to date indicate that on the order of $3.0 Million per year in 5307 funding will be available to the Tahoe Region as a whole. Based upon historic allocation methodologies, this will result in roughly $1.0 Million for North Shore transit program. As the provision of "urban" funding will reduce the region's ability to access "rural" funding, the net impact of this new funding source will be an increase in federal transit funding for the TART program of approximately $600,000 per year. These funds will be used for service expansion within the Tahoe Basin.

Expanded County Service Area Funding

At present, TART benefits from funds collected through a series of Zones of Benefit (ZOB) established in under a County Service Area in the Martis Valley area as a result of the Martis Valley Area Plan. These ZOBs add a fee of (currently equal to $36.36 per single family residence, as an example) to annual property tax bills for new development since establishment of the fee in this area. To help fund expansion of transit services triggered in part due to new

TABLE 27 : TART Short Range Transit Plan Operating/Administrative Costs

All Figures in Thousands

Plan Element	FY 16-17	FY 17-18	FY 18-19	FY 19-20	FY 20-21
Base Case Operating Costs	$4,360.29	$4,444.00	$4,529.33	$4,616.31	$4,704.98
Financially Constrained Plan Elements					
Expand Summer Season	$13.5	$85.2	$86.8	$88.4	$90.1
Peak Season Evening Service Expansion: South of Squaw Valley and Northstar	$0.0	$54.9	$121.4	$123.7	$126.1
Off-Season Evening Service Expansion: South of Squaw Valley and Northstar	$0.0	$176.7	$180.1	$183.5	$187.0
Additional Morning Winter 267 Run	$10.6	$10.8	$11.0	$11.2	$11.4
Winter Half-Hourly North Shore Service Frequency	$107.4	$0.0	$0.0	$0.0	$0.0
Peak Season Half-Hourly Service: South of Squaw Valley and Northstar	$0.0	$289.5	$722.4	$736.1	$750.2
Winter Half-Hourly Service Frequency Extension to Truckee	$0.0	$0.0	$221.3	$225.5	$229.8
Summer Half-Hourly Service Frequency Extension to Truckee	$0.0	$0.0	$28.6	$180.9	$184.3
Off-Season Half-Hourly North Shore Service	$55.4	$118.9	$121.2	$123.5	$125.8
Elimination of Skier Shuttle	($33.5)	($34.2)	($34.8)	($35.5)	($36.2)
Additional Administrative/Dispatch Staff	$0.0	$251.9	$257.0	$262.1	$267.4
Contracted ADA Wheelchair Trips	$6.3	$6.4	$6.5	$6.7	$6.8
Expanded Marketing	$50.0	$51.0	$52.0	$53.1	$54.1
Additional Mechanic Capacity	$0.0	$41.3	$42.1	$43.0	$43.8
Total: Financially Constrained Service Plan Elements	$209.7	$1,052.6	$1,815.6	$2,002.2	$2,040.7
Total With Financially Constrained Plan Elements	*$4,570.0*	*$5,496.6*	*$6,344.9*	*$6,618.5*	*$6,745.7*
Percent Increase over Base Case	*4.8%*	*23.7%*	*40.1%*	*43.4%*	*43.4%*
Financially Unconstrained Plan Elements					
Winter Evening Service Extension to Truckee	$0.0	$0.0	$0.0	$181.4	$184.8
Summer Evening Service Extension to Truckee	$0.0	$0.0	$0.0	$145.5	$148.3
Off-Season Evening Service Extension to Truckee	$0.0	$0.0	$0.0	$63.8	$65.1
Elimination of Transit Fares - Added Winter Runs	$0.0	$0.0	$0.0	$184.4	$187.9
Total: Financially Unconstrained Service Plan Elements	$0.0	$0.0	$0.0	$575.1	$586.1
Total Plan Elements	$209.7	$1,052.6	$1,815.6	$2,577.3	$2,626.8
Total Costs With All Plan Elements	$4,570.0	$5,496.6	$6,344.9	$7,193.6	$7,331.7

Inflation assumed of 2.0% for labor/contracts and 1.5% for supplies/fuel.
Source: LSC Transportation Consultants, Inc.

TABLE 28: TART Transit Short-Range Operating Financial Plan

All Figures in Thousands

	FY 16-17	FY 17-18	FY 18-19	FY 19-20	FY 20-21
Financially Constrained Financial Plan					
Financially Constrained Operating Costs (From Table 27)	$4,570.0	$5,496.6	$6,344.9	$6,618.5	$6,745.7
Operating Revenues					
Fare Revenues	$436.0	$488.9	$597.2	$718.8	$841.4
Local Transportation Funds					
Placer County Transportation Agency	$1,033.7	$1,064.7	$1,096.7	$1,129.6	$1,163.4
Tahoe Regional Planning Agency	$698.1	$719.0	$740.6	$762.8	$785.7
Truckee -- for 89 Route	$67.5	$69.6	$71.7	$73.8	$76.0
Truckee -- for 267 Route	$37.1	$38.2	$39.3	$40.5	$41.7
State Transportation Assistance					
Placer County Transportation Agency	$92.8	$92.8	$92.8	$92.8	$92.8
Tahoe Regional Planning Agency	$164.9	$164.9	$164.9	$164.9	$164.9
Local Option Sales Tax Revenues	$0.0	$734.4	$749.1	$764.1	$779.4
Truckee Air Pollution Control District Funds	$63.6	$64.9	$66.2	$67.5	$68.9
Truckee Tahoe Airport	$63.8	$65.0	$66.3	$67.7	$69.0
Low Carbon Transit Operations Program	$39.4	$40.2	$41.0	$41.8	$42.6
Private Funding	$51.0	$52.0	$53.1	$54.1	$55.2
Transient Occupancy Tax	$823.3	$450.6	$958.3	$995.9	$866.6
Federal Transit Administration Section 5311 Rural					
Through Placer County Transportation Agency	$250.0	$250.0	$260.0	$260.0	$270.0
Federal Transit Administration Section 5307 Urban - NV	$350.0	$357.0	$364.1	$371.4	$378.9
Federal Transit Administration Section 5307 Urban - CA	$173.0	$612.0	$624.2	$636.7	$649.5
Washoe Regional Transportation Commission	$171.9	$175.4	$178.9	$182.4	$186.1
County Service Area Funding	$51.0	$54.0	$58.0	$71.0	$91.0
Development Agreements	$0.0	$0.0	$119.70	$119.70	$119.7
Interest	$3.0	$3.0	$3.0	$3.0	$3.0
TOTAL	$4,570.0	$5,496.6	$6,344.9	$6,618.5	$6,745.7
Financially Constrained Operating Funding Balance	$0.0	$0.0	$0.0	$0.0	$0.0
Financially Unconstrained Subsidy Requirements					
Financially Unconstrained Additional Operating Costs	$0.0	$0.0	$0.0	$575.1	$586.1
Elimination of Transit Fares - Impact on Subsidy Requirements	$0.0	$0.0	$0.0	$718.8	$841.4
Total Additional Subsidy Required to Achieve Full Plan	$0.0	$0.0	$0.0	$1,293.9	$1,427.4

Source: LSC Transportation Consultants, Inc.

development, Placer County will establish similar ZOBs in the Squaw Valley / Alpine Meadows area and the Tahoe Basin portion of Placer County. Some of these may be as a result of reductions in parking requirements. This will result in ongoing revenues generated by new development throughout the eastern Placer County area. As revenues will be a factor of actual new construction, specific revenue forecasts are a matter of conjecture. For purposes of this plan, CSA revenues are assumed to increase from the current level of approximately $50,000 per year, up to $91,000 by the end of this plan period, with funds from new development starting to be generated in Year 3 of the program.

Contributions from Developers

Beyond funds generated by existing and new CSA's, the County will negotiate with individual developers of major projects for "up front" funding of operating expansions. A total of $119,700 in developer agreement funds are included in this plan, starting in Year 3.

Capital

Capital funding is shown in the bottom portion of Table 26, above. As indicated, numerous sources will be used. In total, these funds fully address capital costs, except for a funding shortfall in the second year of the program.

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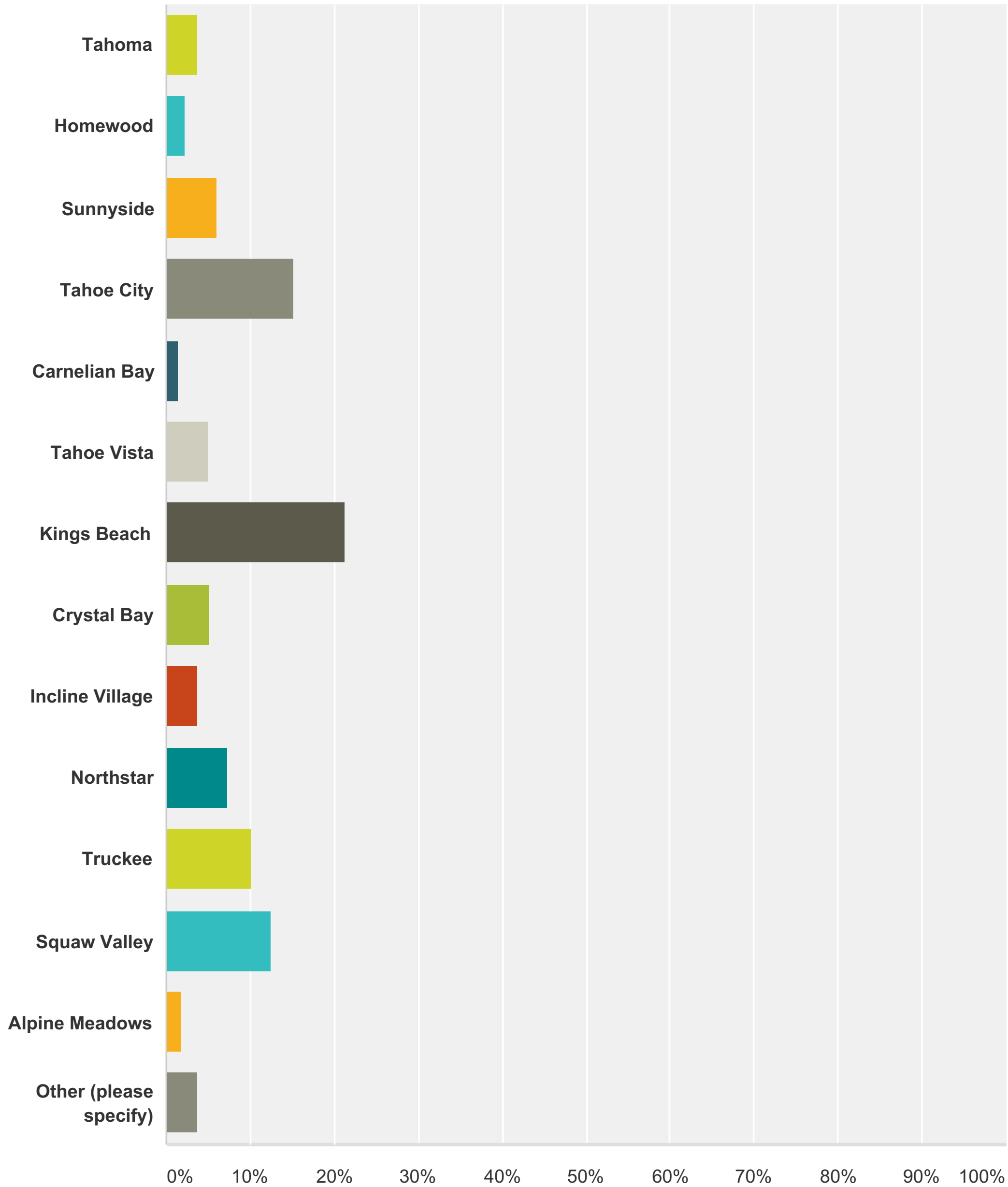
Appendix A

Detailed Transit Passenger Survey Results

Q1 I am coming from:

Answered: 263 Skipped: 1

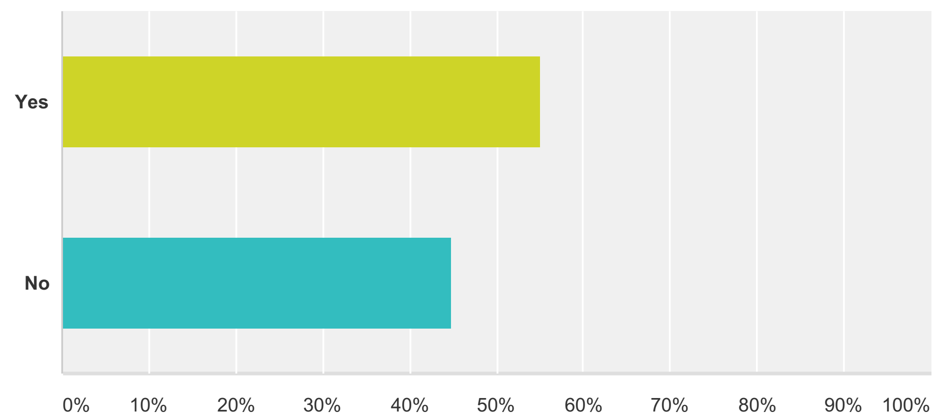


Answer Choices	Responses	
Tahoma	**3.80%**	10
Homewood	**2.28%**	6
Sunnyside	**6.08%**	16
Tahoe City	**15.21%**	40
Carnelian Bay	**1.52%**	4
Tahoe Vista	**4.94%**	13

Kings Beach	**21.29%**	56
Crystal Bay	**5.32%**	14
Incline Village	**3.80%**	10
Northstar	**7.22%**	19
Truckee	**10.27%**	27
Squaw Valley	**12.55%**	33
Alpine Meadows	**1.90%**	5
Other (please specify)	**3.80%**	10
Total		**263**

Q2 Is this home?

Answered: 209 Skipped: 55



Answer Choices	Responses	
Yes	**55.02%**	115
No	**44.98%**	94
Total		**209**

Q3 I got on the bus at:

Answered: 257 Skipped: 7

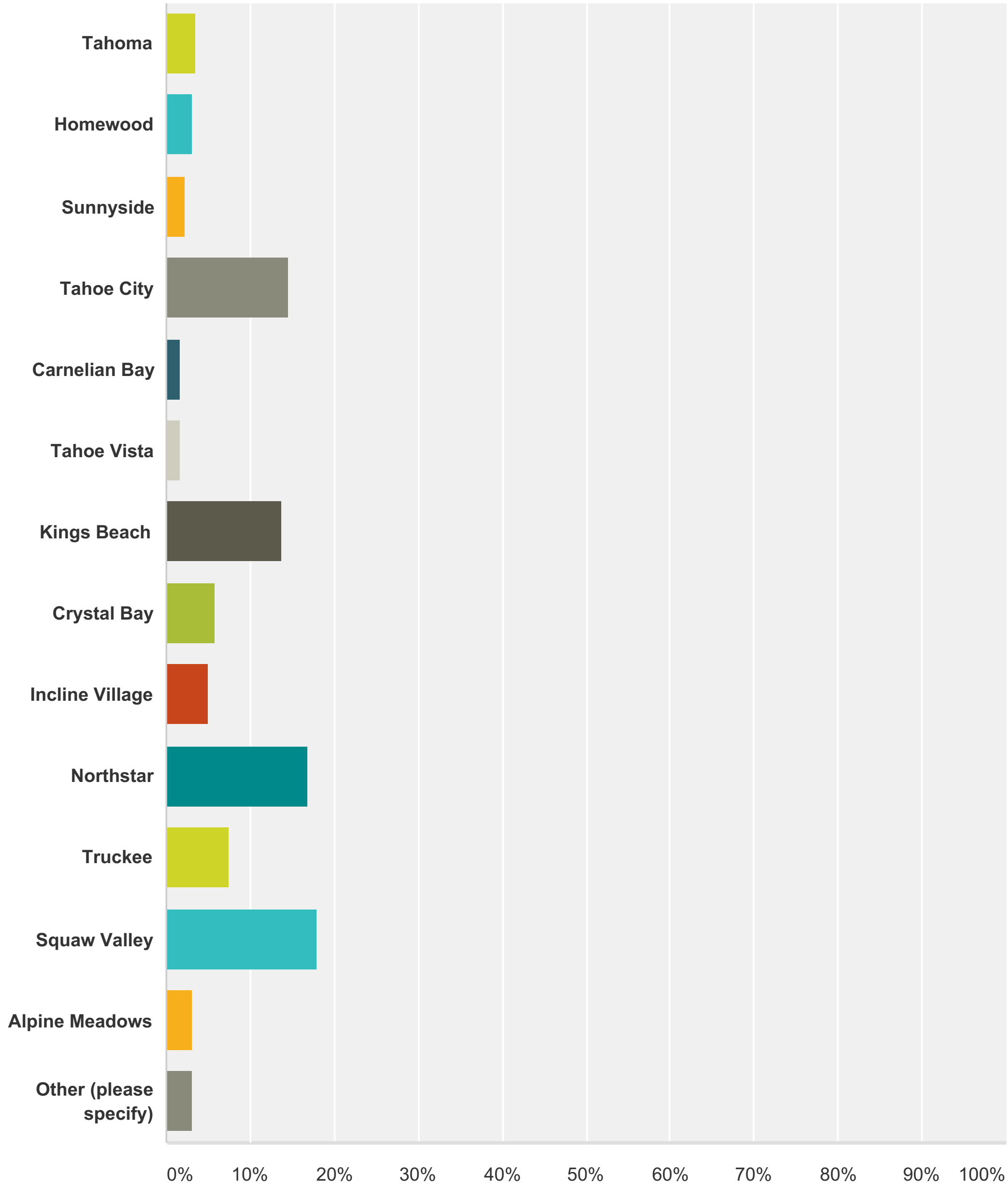
Q4 I am getting off this bus at:

Answered: 253 Skipped: 11

Q5 I am going to:

Answered: 255 Skipped: 9

TART Winter Transit Rider Survey

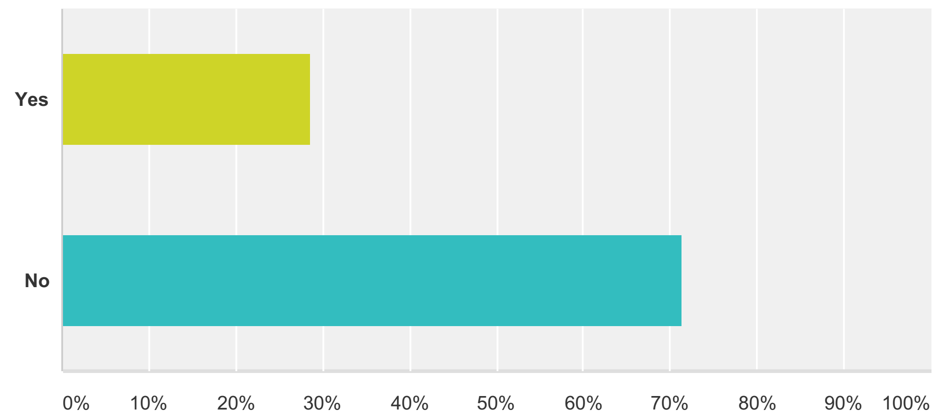


Answer Choices	Responses	
Tahoma	**3.53%**	9
Homewood	**3.14%**	8
Sunnyside	**2.35%**	6
Tahoe City	**14.51%**	37
Carnelian Bay	**1.57%**	4
Tahoe Vista	**1.57%**	4
Kings Beach	**13.73%**	35
Crystal Bay	**5.88%**	15
Incline Village	**5.10%**	13

Northstar	**16.86%**	43
Truckee	**7.45%**	19
Squaw Valley	**18.04%**	46
Alpine Meadows	**3.14%**	8
Other (please specify)	**3.14%**	8

Q6 Is this home?

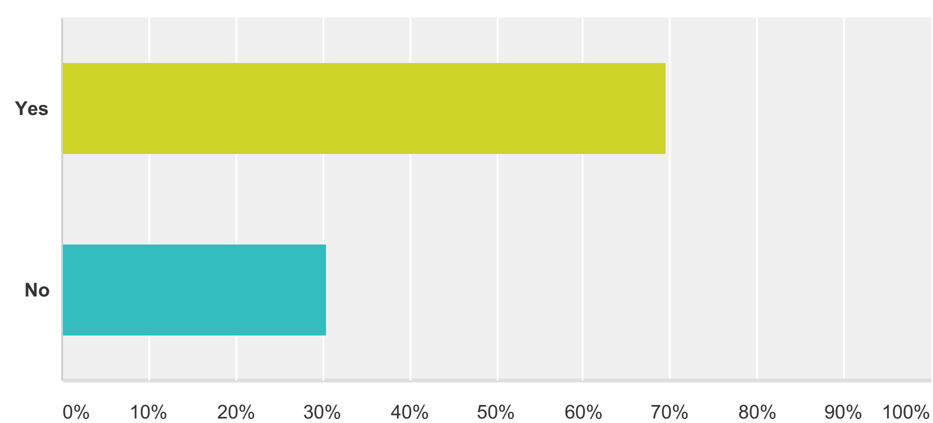
Answered: 147 Skipped: 117



Yes	**28.57%**	42
No	**71.43%**	105

Q7 Will you be traveling roundtrip on TART today?

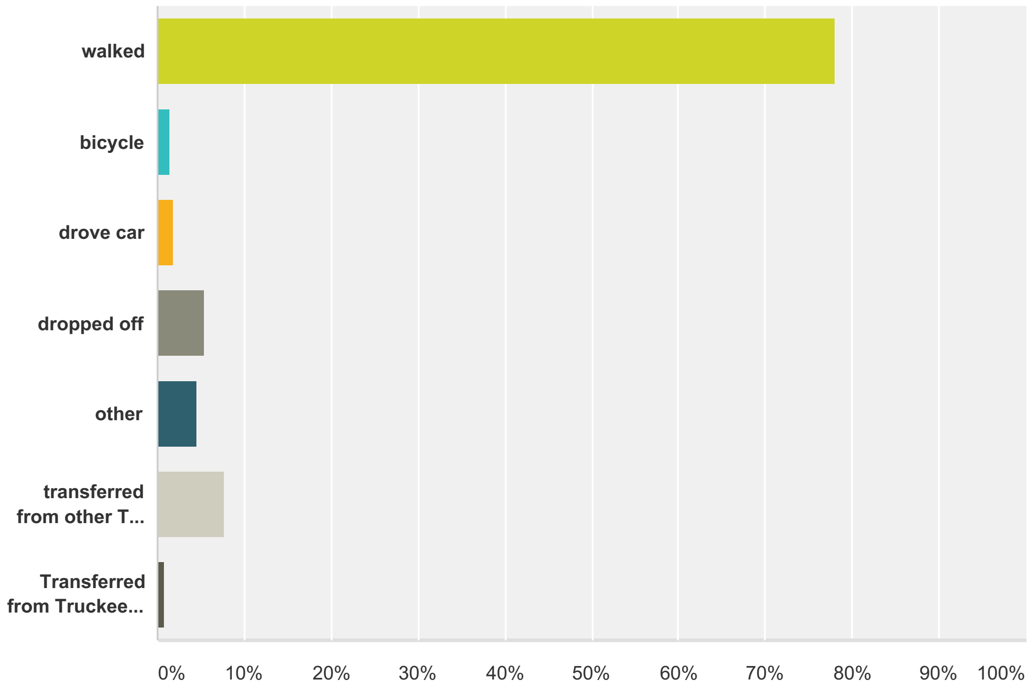
Answered: 237 Skipped: 27



Yes	**69.62%**	165
No	**30.38%**	72

Q8 How did you travel to this bus?

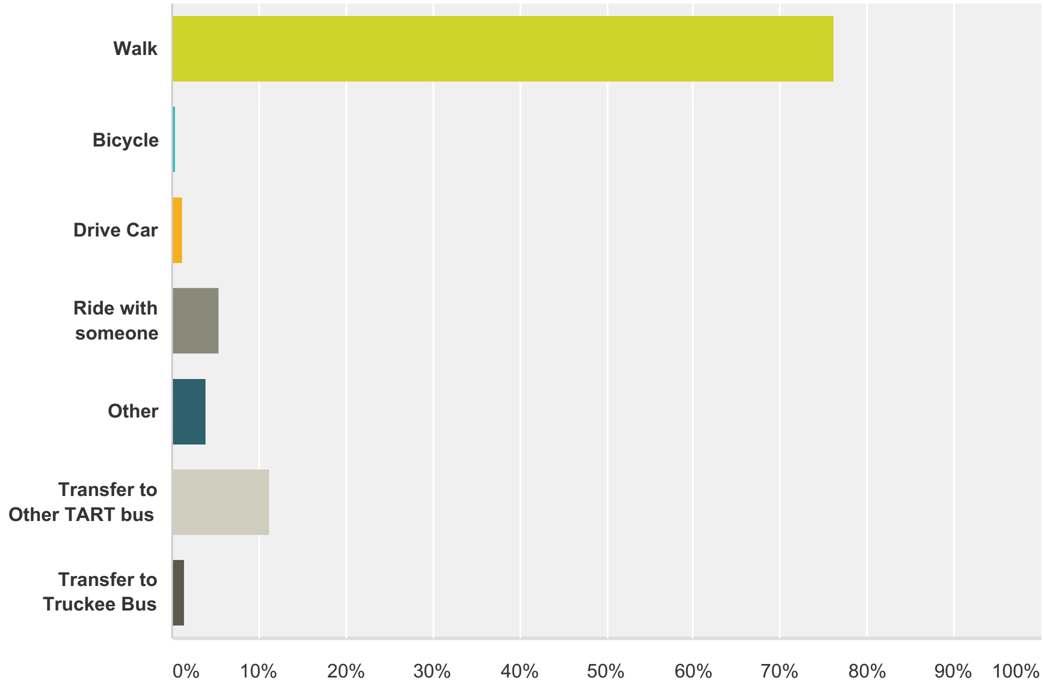
Answered: 259 Skipped: 5



Answer Choices	Responses	
walked	**77.99%**	202
bicycle	**1.54%**	4
drove car	**1.93%**	5
dropped off	**5.41%**	14
other	**4.63%**	12
transferred from other TART bus	**7.72%**	20
Transferred from Truckee Bus	**0.77%**	2
Total		**259**

Q9 After leaving this bus how will you complete your trip?

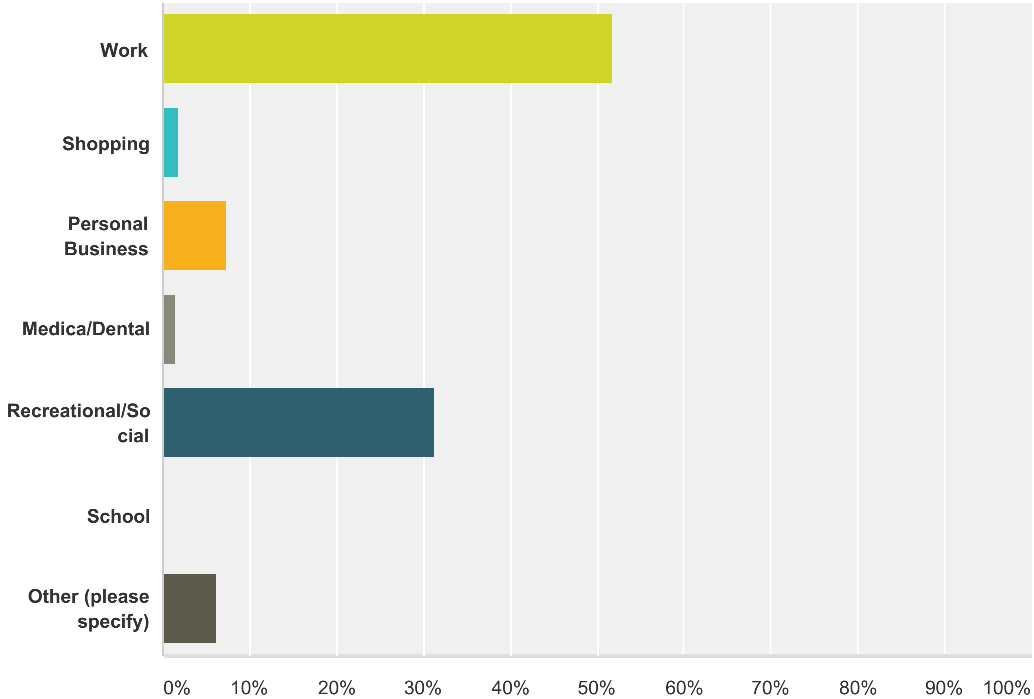
Answered: 257 Skipped: 7



Answer Choices	Responses	
Walk	**76.26%**	196
Bicycle	**0.39%**	1
Drive Car	**1.17%**	3
Ride with someone	**5.45%**	14
Other	**3.89%**	10
Transfer to Other TART bus	**11.28%**	29
Transfer to Truckee Bus	**1.56%**	4
Total		**257**

Q10 What is the purpose of this trip today?

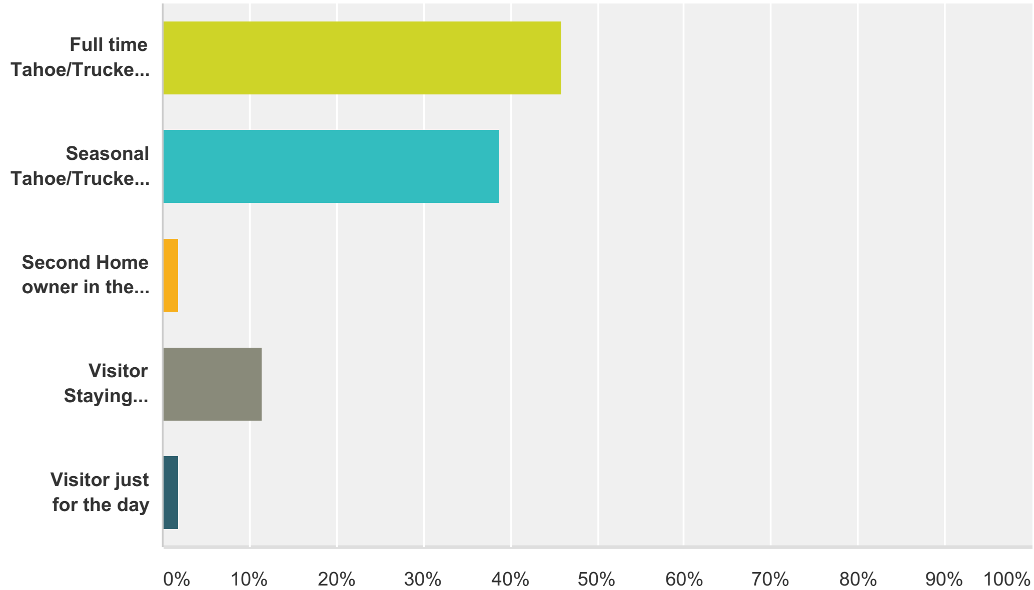
Answered: 259 Skipped: 5



Answer Choices	Responses	
Work	**51.74%**	134
Shopping	**1.93%**	5
Personal Business	**7.34%**	19
Medica/Dental	**1.54%**	4
Recreational/Social	**31.27%**	81
School	**0.00%**	0
Other (please specify)	**6.18%**	16
Total		**259**

Q11 Are you a (specify one):

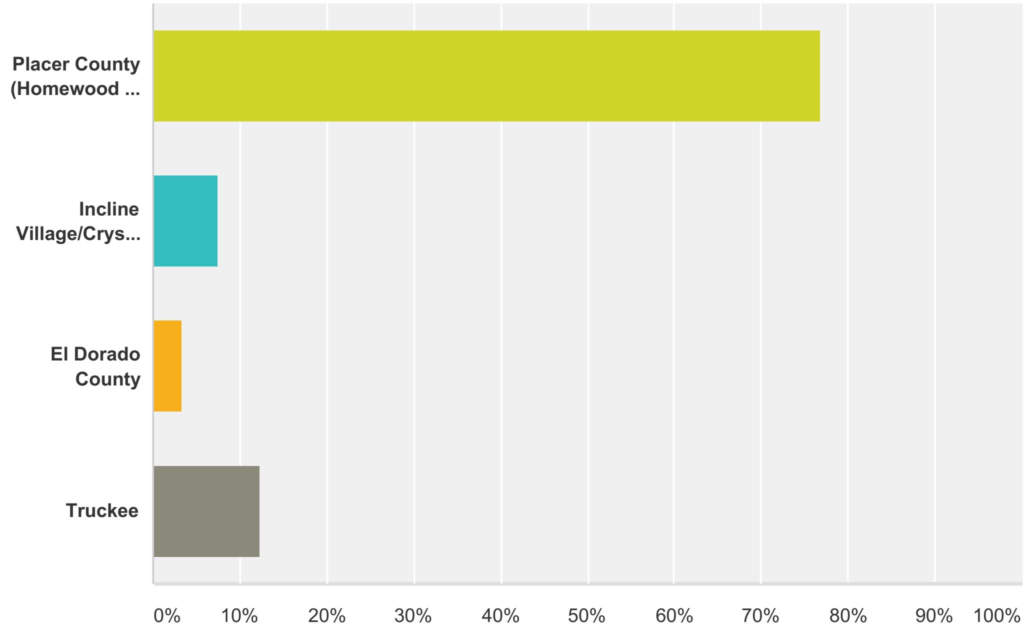
Answered: 253 Skipped: 11



Answer Choices	Responses	
Full time Tahoe/Truckee resident	**45.85%**	116
Seasonal Tahoe/Truckee resident	**38.74%**	98
Second Home owner in the Tahoe/Truckee area	**1.98%**	5
Visitor Staying overnight	**11.46%**	29
Visitor just for the day	**1.98%**	5
Total		**253**

Q12 If you are a resident or worker where do you live in this area (specify one):

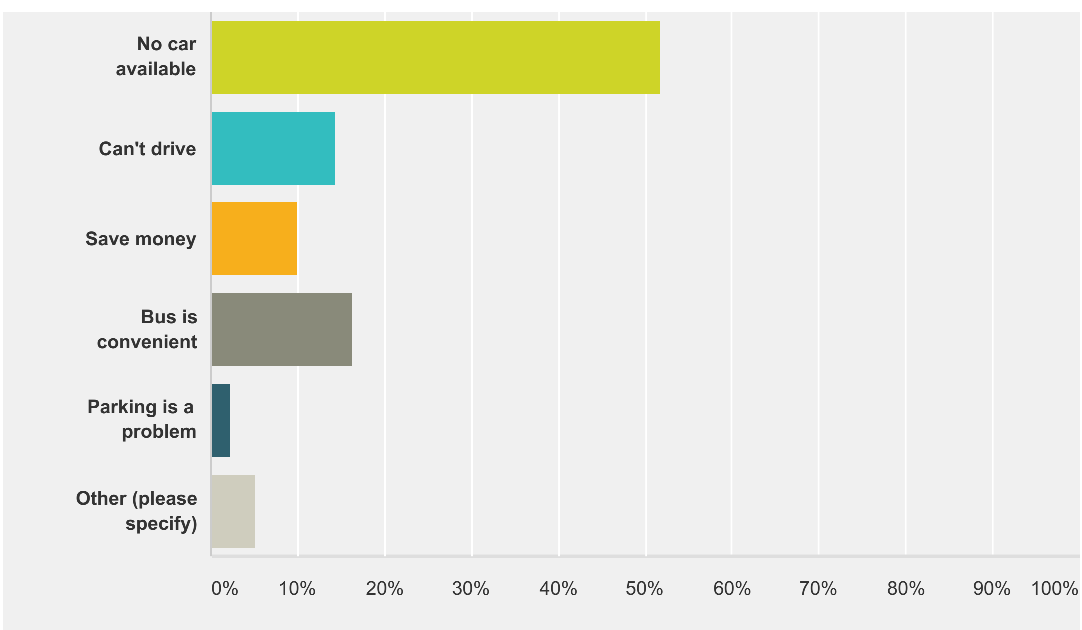
Answered: 211 Skipped: 53



Answer Choices	Responses	
Placer County (Homewood, Sunnyside, Tahoe City, Carn. Bay, Tahoe Vista, Kings Beach, Northstar, Squaw Valley, Alpine Meadows)	**76.78%**	162
Incline Village/Crystal Bay	**7.58%**	16
El Dorado County	**3.32%**	7
Truckee	**12.32%**	26
Total		**211**

Q13 What is the most important reason you use TART?

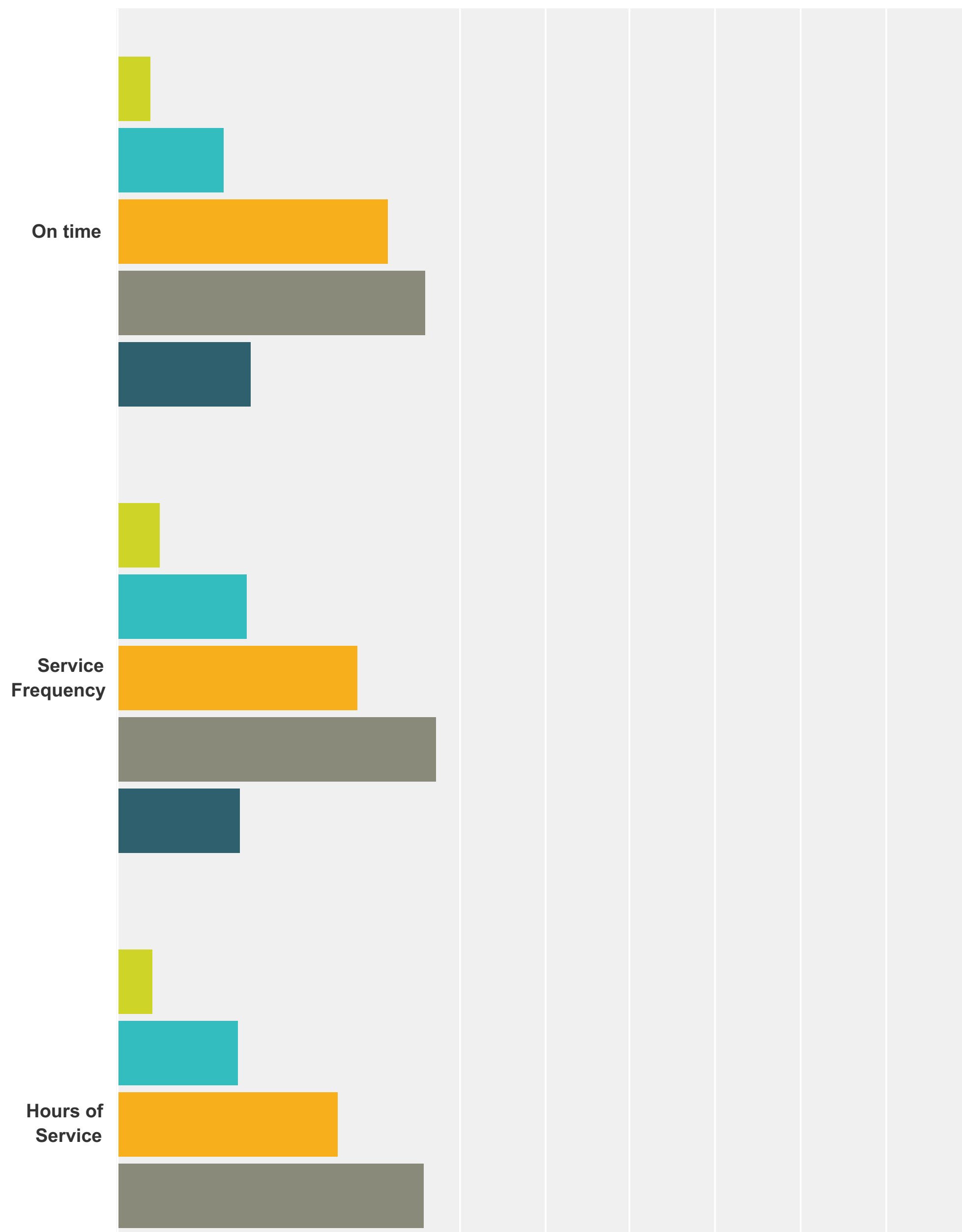
Answered: 251 Skipped: 13

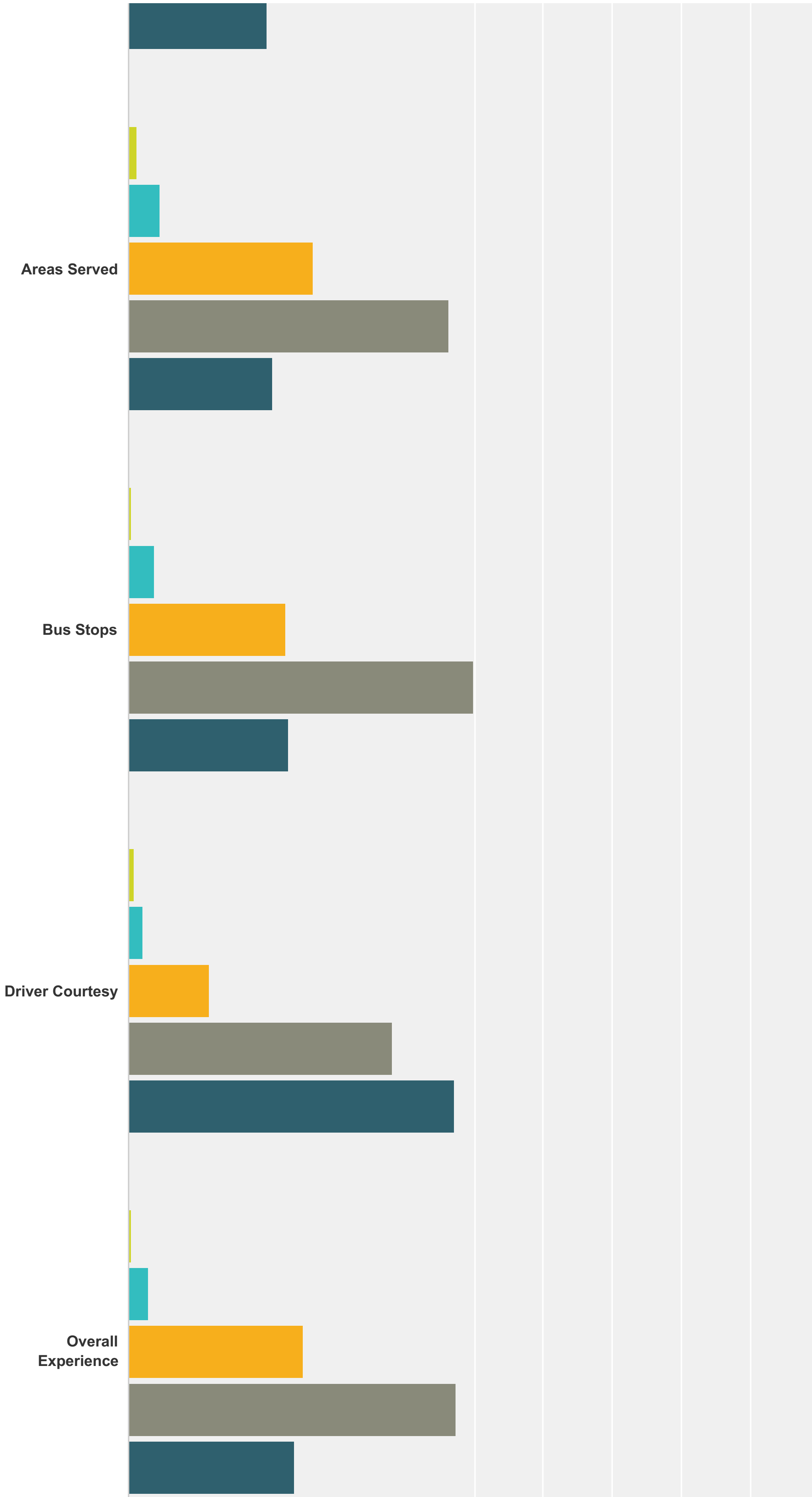


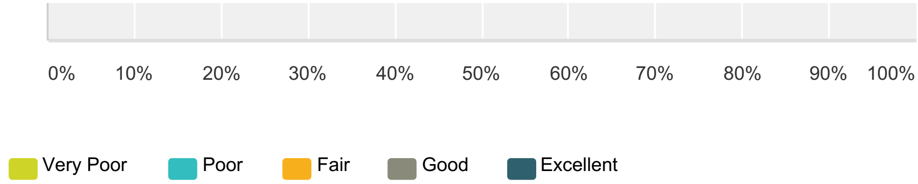
Answer Choices	Responses	
No car available	51.79%	130
Can't drive	14.34%	36
Save money	9.96%	25
Bus is convenient	16.33%	41
Parking is a problem	2.39%	6
Other (please specify)	5.18%	13
Total		**251**

Q14 Please Rate TART service for each of the following:

Answered: 253 Skipped: 11



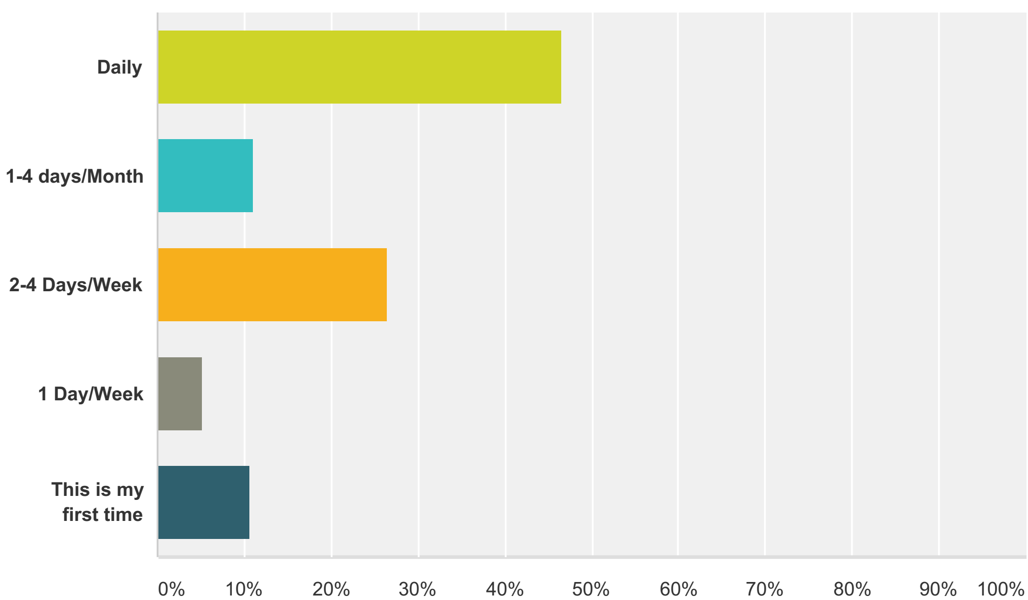

Areas Served
Bus Stops
Driver Courtesy
Overall Experience



	Very Poor	Poor	Fair	Good	Excellent	Total
On time	**4.02%** 10	**12.45%** 31	**31.73%** 79	**36.14%** 90	**15.66%** 39	249
Service Frequency	**4.92%** 12	**15.16%** 37	**28.28%** 69	**37.30%** 91	**14.34%** 35	244
Hours of Service	**4.17%** 10	**14.17%** 34	**25.83%** 62	**35.83%** 86	**20.00%** 48	240
Areas Served	**1.26%** 3	**4.60%** 11	**26.78%** 64	**46.44%** 111	**20.92%** 50	239
Bus Stops	**0.41%** 1	**3.72%** 9	**22.73%** 55	**50.00%** 121	**23.14%** 56	242
Driver Courtesy	**0.81%** 2	**2.03%** 5	**11.79%** 29	**38.21%** 94	**47.15%** 116	246
Overall Experience	**0.41%** 1	**2.90%** 7	**25.31%** 61	**47.30%** 114	**24.07%** 58	241

Q15 How often do you ride TART?

Answered: 253 Skipped: 11

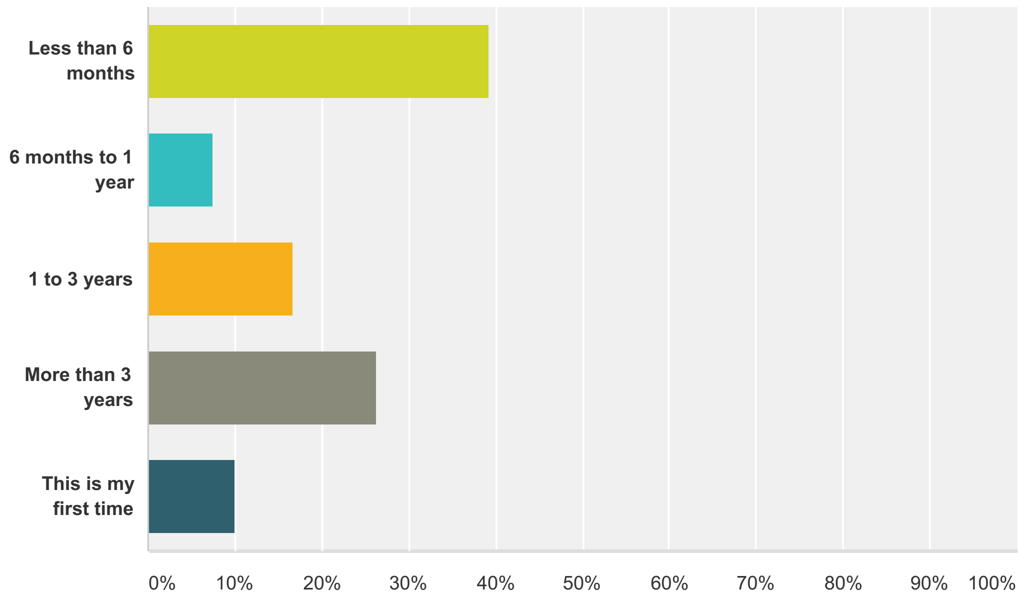


Answer Choices	Responses	
Daily	**46.64%**	118
1-4 days/Month	**11.07%**	28
2-4 Days/Week	**26.48%**	67

1 Day/Week	**5.14%** 13
This is my first time	**10.67%** 27
Total	**253**

Q16 How long have you been using TART?

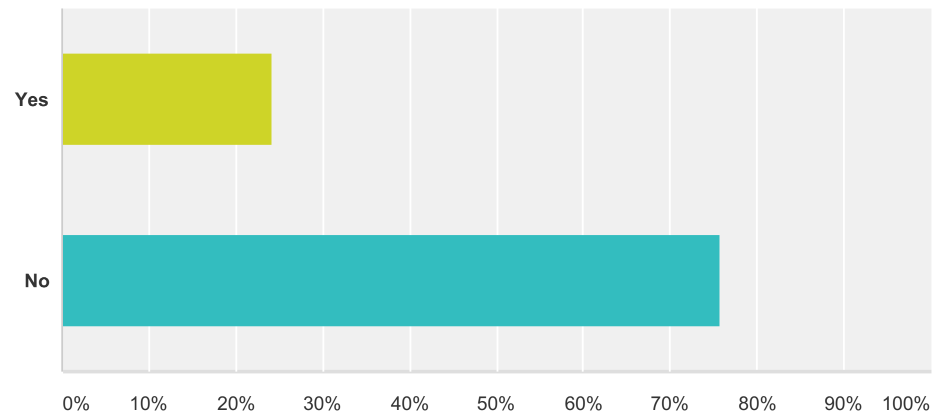
Answered: 250 Skipped: 14



Answer Choices	Responses	
Less than 6 months	**39.20%**	98
6 months to 1 year	**7.60%**	19
1 to 3 years	**16.80%**	42
More than 3 years	**26.40%**	66
This is my first time	**10.00%**	25
Total		**250**

Q17 Was a car available for this trip?

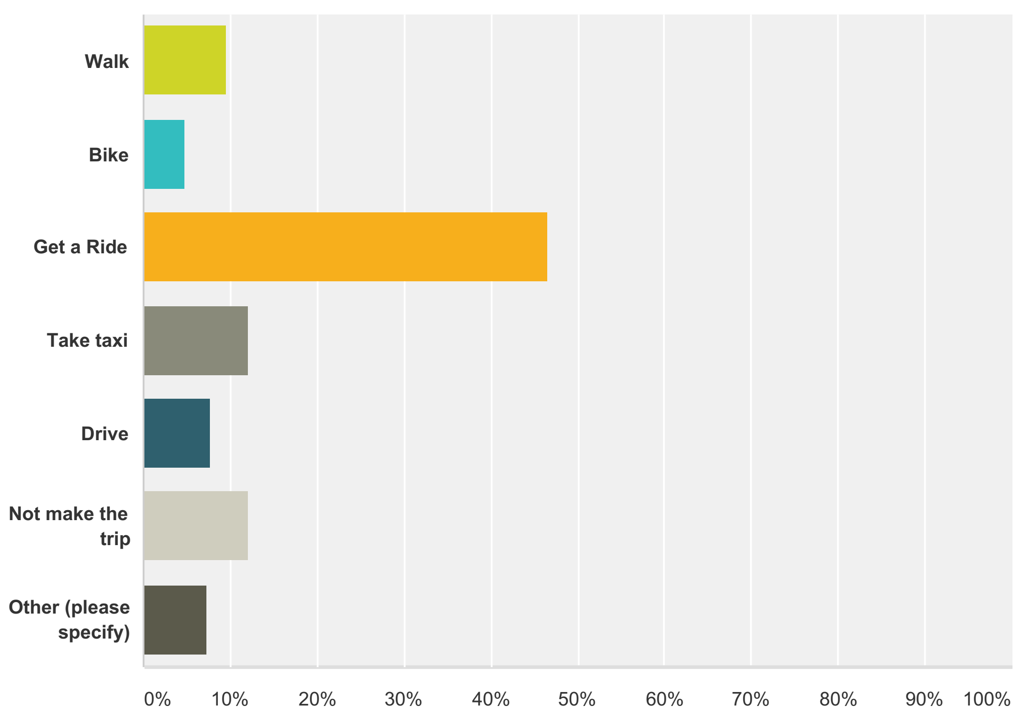
Answered: 228 Skipped: 36



Yes	**24.12%** 55
No	**75.88%** 173

Q18 If the TART service were not available how would you make this trip?

Answered: 249 Skipped: 15

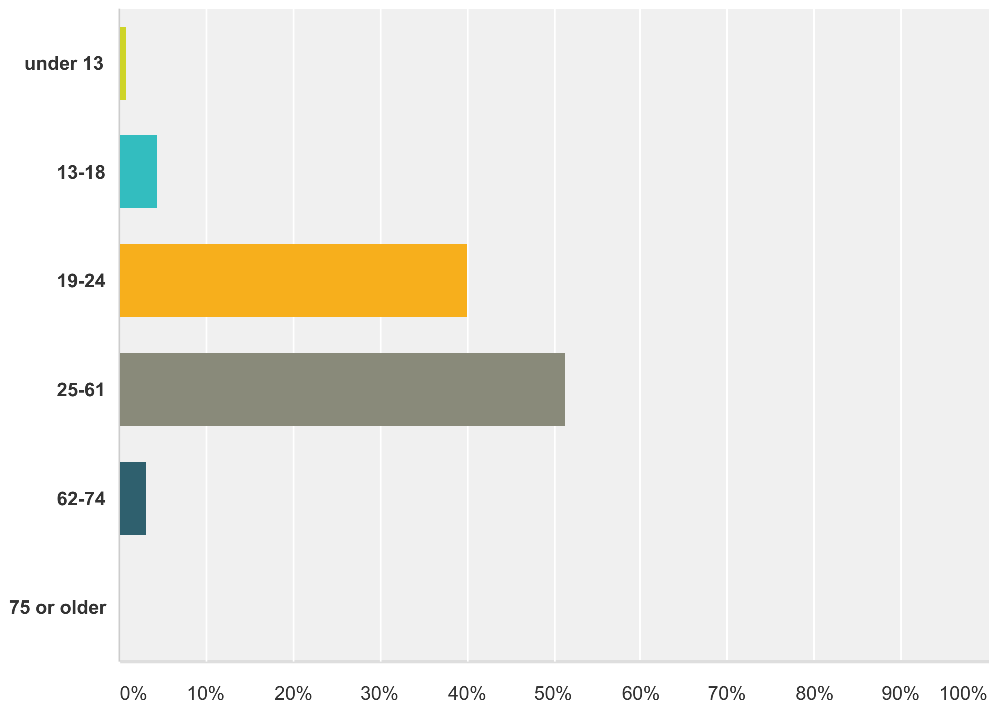


Answer Choices	Responses
Walk	**9.64%** 24
Bike	**4.82%** 12

Get a Ride	**46.59%**	116
Take taxi	**12.05%**	30
Drive	**7.63%**	19
Not make the trip	**12.05%**	30
Other (please specify)	**7.23%**	18
Total		**249**

Q19 What is your age?

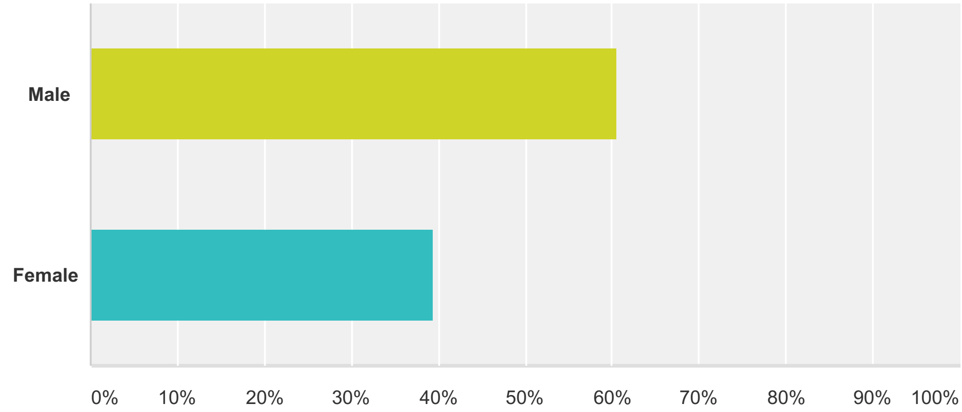
Answered: 249 Skipped: 15



Answer Choices	Responses	
under 13	**0.80%**	2
13-18	**4.42%**	11
19-24	**40.16%**	100
25-61	**51.41%**	128
62-74	**3.21%**	8
75 or older	**0.00%**	0
Total		**249**

Q20 What is your gender?

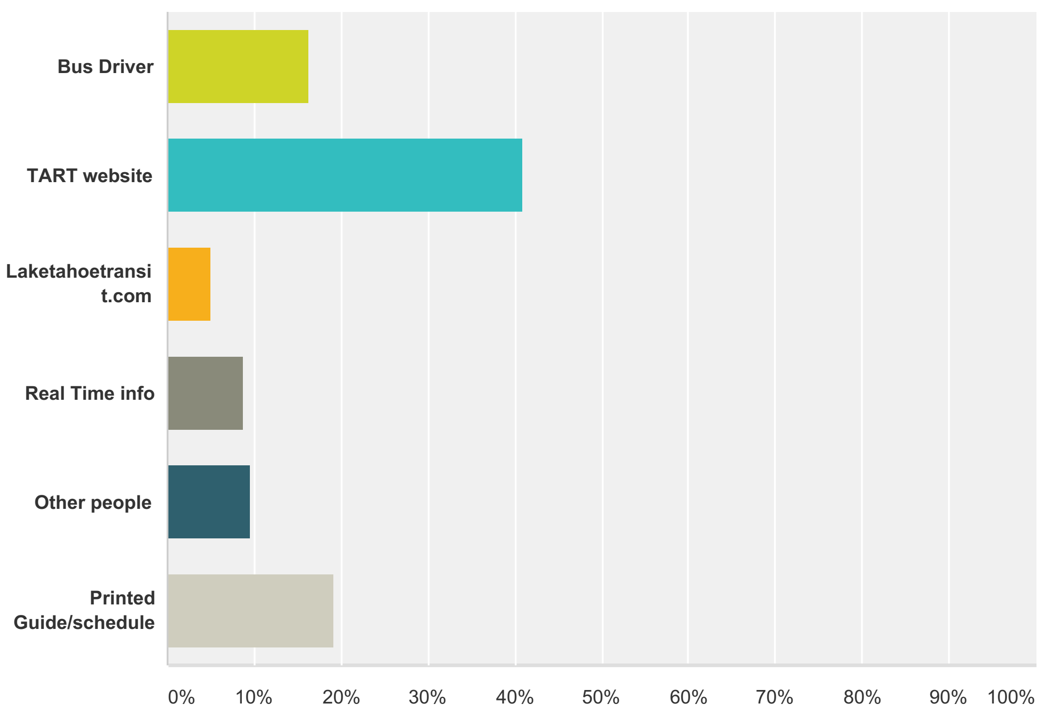
Answered: 236 Skipped: 28



Male	**60.59%**	143
Female	**39.41%**	93

Q21 What is your primary source of transit information?

Answered: 239 Skipped: 25

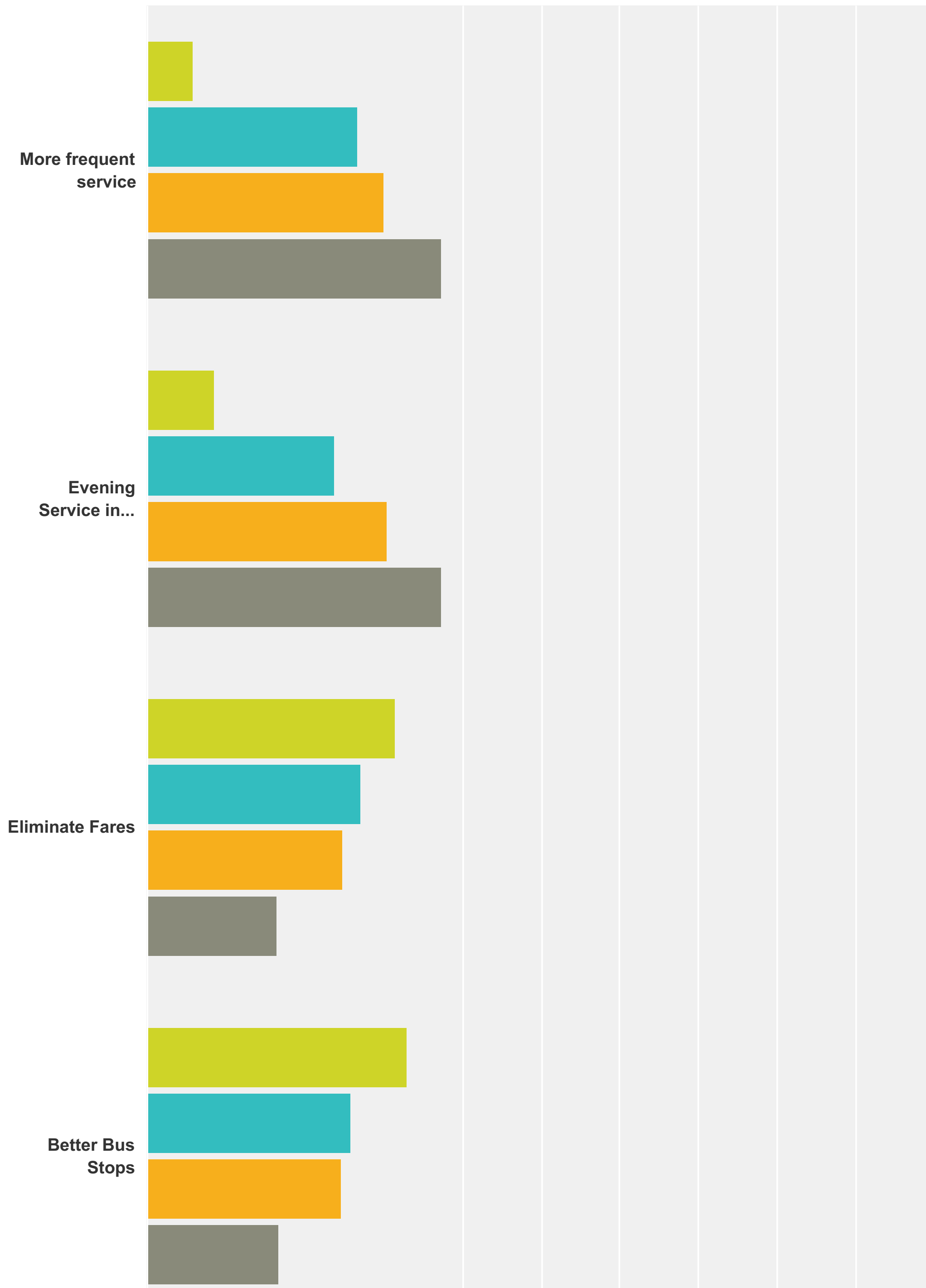


Answer Choices	Responses	
Bus Driver	**16.32%**	39
TART website	**41.00%**	98

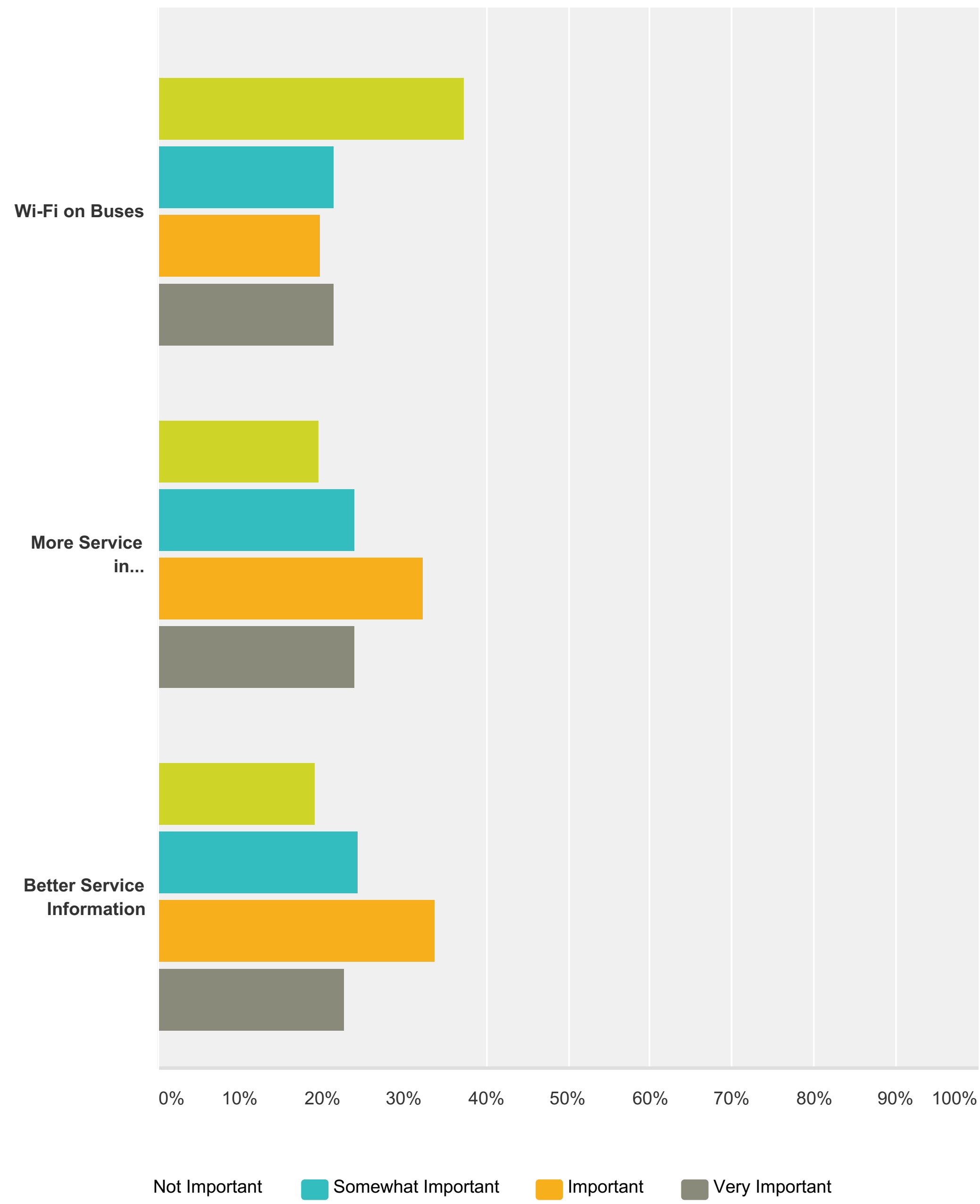
Laketahoetransit.com	**5.02%**	12
Real Time info	**8.79%**	21
Other people	**9.62%**	23
Printed Guide/schedule	**19.25%**	46
Total		**239**

Q22 How important are each of the following in improving TART?

Answered: 247 Skipped: 17



TART Winter Transit Rider Survey



	Not Important	Somewhat Important	Important	Very Important	Total
More frequent service	**5.93%** 14	**26.69%** 63	**30.08%** 71	**37.29%** 88	236
Evening Service in Spring/Fall	**8.47%** 20	**23.73%** 56	**30.51%** 72	**37.29%** 88	236
Eliminate Fares	**31.56%** 71	**27.11%** 61	**24.89%** 56	**16.44%** 37	225
Better Bus Stops	**32.89%** 75	**25.88%** 59	**24.56%** 56	**16.67%** 38	228
Wi-Fi on Buses	**37.28%** 85	**21.49%** 49	**19.74%** 45	**21.49%** 49	228
More Service in Neighborhoods	**19.65%** 45	**24.02%** 55	**32.31%** 74	**24.02%** 55	229

Better Service Information	**19.11%** 43	**24.44%** 55	**33.78%** 76	**22.67%** 51	225

Q23 What is the single most important improvement for bus service?

Answered: 182 Skipped: 82

Q24 Survey

Answered: 264 Skipped: 0

Q25 Route

Answered: 264 Skipped: 0

Q26 Route/Highway

Answered: 210 Skipped: 54

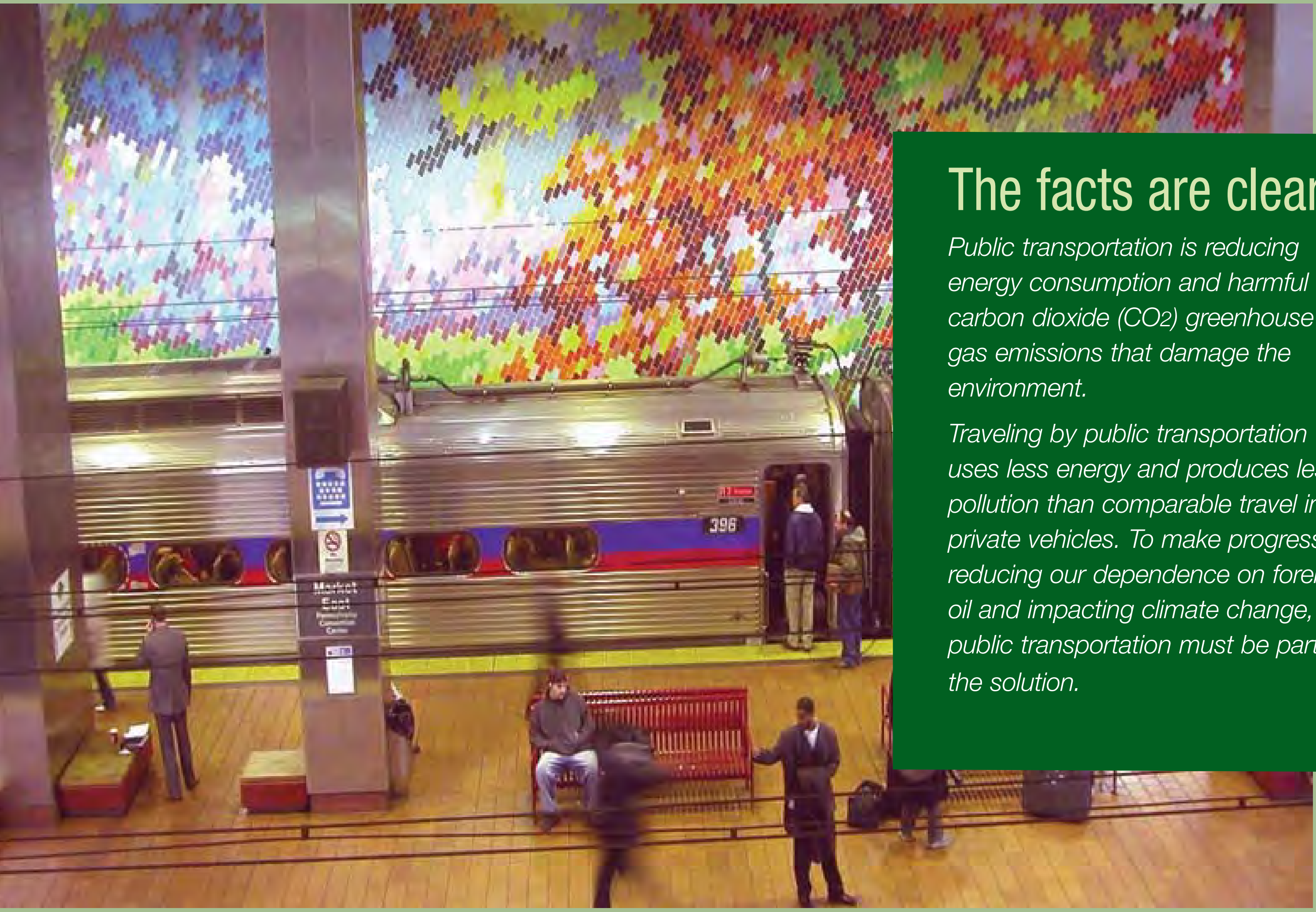
Q27 Leave

Answered: 264 Skipped: 0

Q28 Arrive

Answered: 264 Skipped: 0

Public Transportation Reduces Greenhouse Gases and Conserves Energy



The facts are clear

Public transportation is reducing energy consumption and harmful carbon dioxide (CO_2) greenhouse gas emissions that damage the environment.

Traveling by public transportation uses less energy and produces less pollution than comparable travel in private vehicles. To make progress in reducing our dependence on foreign oil and impacting climate change, public transportation must be part of the solution.

The Benefits of Public Transportation

AMERICAN PUBLIC TRANSPORTATION ASSOCIATION

Using Public Transportation Reduces Greenhouse Gases and Conserves Energy

The transportation sector produces one-third of all greenhouse gas emissions in the United States.[1]

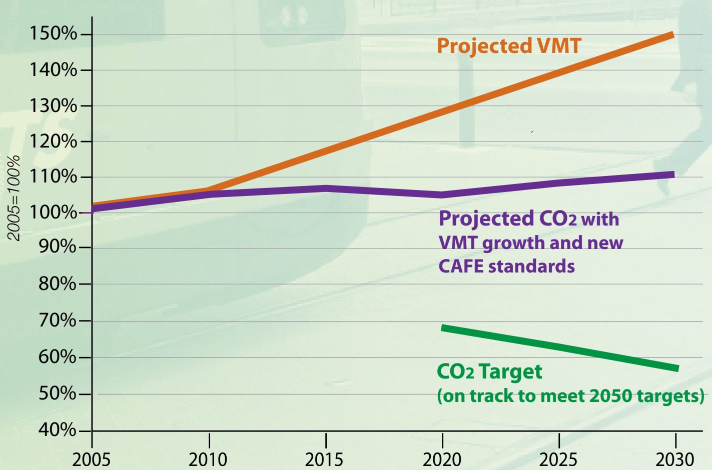
Between 1990 and 2006, emissions in the transportation sector increased by more than 25%, representing almost half of the total national growth in greenhouse gas emissions during this period.

- Approximately 85% of transportation sector emissions are related to the surface transportation system.[1]
- An effective strategy to reduce greenhouse gas emissions must include improved fuel economy, reduced carbon content in fuels, and reductions in the growth of vehicle miles of travel.

By reducing *the growth in vehicle miles of travel, easing congestion and supporting more efficient land use patterns, public transportation can reduce harmful CO_2 emissions by 37 million metric tons annually. These savings represent the beginning of public transportation's potential contribution to national efforts to reduce greenhouse gas emissions and promote energy conservation.*[2]

Projected increases in vehicle miles of travel will negate any improvements in fuel economy resulting from recently approved changes in Corporate Average Fuel Economy (CAFE) standards. Increased investment in, and use of, public transportation can mitigate this trend. Experts indicate we need to reduce total CO_2 emissions to 60%-80% of 1990 levels by 2050.[2]

CO_2 Reduction Targets Cannot Be Met with Recently Enacted CAFE Standards



Projected emissions from cars and light trucks assuming newly adopted nationwide vehicle and fuel standards and current projected VMT growth.
Source: Growing Cooler Report [2]

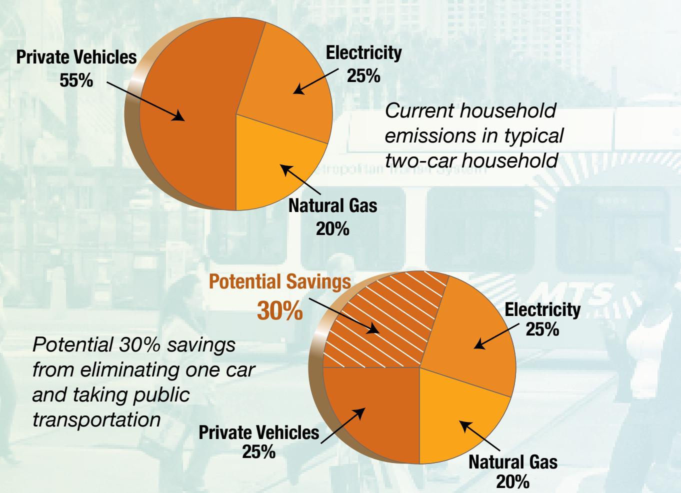
Benefits of a Strategy that Embraces Public Transportation

Public transportation use reduces travel by private vehicles.

Those who choose to ride public transportation reduce their carbon footprint and conserve energy by eliminating travel that would have otherwise been made in a private vehicle. The result is fewer vehicle miles of travel and reduced emissions.

A single person, commuting alone by car, who switches a 20-mile round trip commute to existing public transportation, can reduce his or her annual CO_2 emissions by 4,800 pounds per year, equal to a 10% reduction in all greenhouse gases produced by a typical two-adult, two-car household. By eliminating one car and taking public transportation instead of driving, a savings of up to 30% of carbon dioxide emissions can be realized.[4]

The Private Vehicle is the Largest Contributor to a Household's Carbon Footprint—Using Public Transportation Reduces Household Carbon Emissions



Source: Public Transportation's Contribution to U.S. Greenhouse Gas Reduction [4]

Public transportation use reduces congestion.

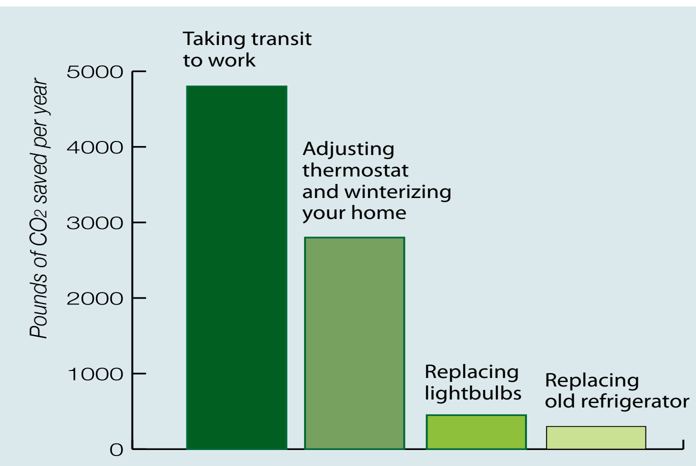
Public transportation serves some of the most congested travel corridors and regions in the country. Increased use of public transportation in these areas eases congestion; as a result, automobiles traveling in these same corridors achieve greater fuel efficiency.[8]




Public transportation use is one of the most effective actions individuals can take.

Public transportation offers an immediate alternative for individuals seeking to reduce their energy use and carbon footprints. This action far exceeds the benefits of other energy saving household activities, such as using energy efficient light bulbs or adjusting thermostats.

Commuting by Public Transportation—One of the Most Significant Actions to Reduce Household Carbon Emissions



By taking existing public transportation instead of driving a car, a single person saves 4,800 pounds of CO_2 per year. Source: Public Transportation's Contribution to U.S. Greenhouse Gas Reduction [4]

Public transportation gives people energy efficient choices.

Public transportation reduces overall greenhouse gas emissions without reducing the mobility so vital to our nation's economic health and our citizens' quality of life.

The increasing cost of fuel makes driving private vehicles even more prohibitive for many. Public transportation households save an average of $6,251 every year[3]—even more as the price of fuel rises.

Public transportation is essential to energy efficient land use patterns.

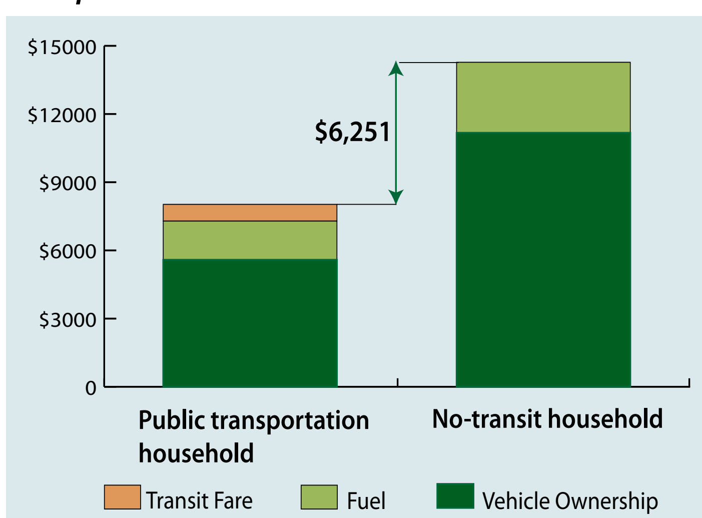
Efficient land use produces results far beyond the immediate benefit of increased use of public transportation. It has the potential to significantly change the way we live and travel, reducing our individual carbon footprints while preserving and enhancing our mobility.

- Higher densities allow for closer proximity of housing, employment and retail, reducing driving distances and enabling communities to plan for and support alternative travel options.
- In many central business districts, trips taken for shopping, dining or other non-commuting purposes are often made on foot—even by those who drive to work.
- Higher density development—including transit-oriented development (TOD), multi-use buildings, and compact apartments and office space—is more energy efficient and extends public transportation's contribution by integrating it with other sectors of our economy.

Public transportation *with its overarching effects on land use, is estimated to reduce CO_2 emissions by* ***37 million metric tons*** *annually.*

This indirect "leverage effect" of public transportation is estimated, conservatively, at three to four times the direct effect of transit service. With this leverage effect, transit is estimated to reduce CO_2 emissions by 37 million metric tons annually. In addition, public transportation reduces energy consumption by the equivalent of 4.2 billion gallons of gasoline each year, the equivalent of 320 million cars filling up—almost 900,000 times a day.[6]

Average Annual Household Savings from Using Public Transportation



By taking public transportation instead of driving a car, a two-worker household can save $6,251 annually. Source: Public Transportation and Petroleum Savings Report [3]

Public Transportation Requires Investment to Further Reduce CO_2 Emissions and Conserve Energy

Protect and preserve public transportation service where it exists today.

Public transportation ridership has increased by 30% since 1995—a growth rate more than twice that of population, and greater than vehicle miles of travel. As transit ridership has increased, a number of systems are struggling to maintain the quality of assets and consequently the quality and reliability of service. Systems must be adequately funded to allow people who are choosing public transportation, more than 10 billion trips annually, to stay on public transportation.

Expand capacity of existing public transportation services.

In many parts of the country, public transportation systems are operating beyond their design capacity. With future annual ridership growth projected at 3.5% annually, it will be difficult for a number of these systems to carry additional riders without significant new investment.

Systems that are investing to expand capacity and attract new riders include:

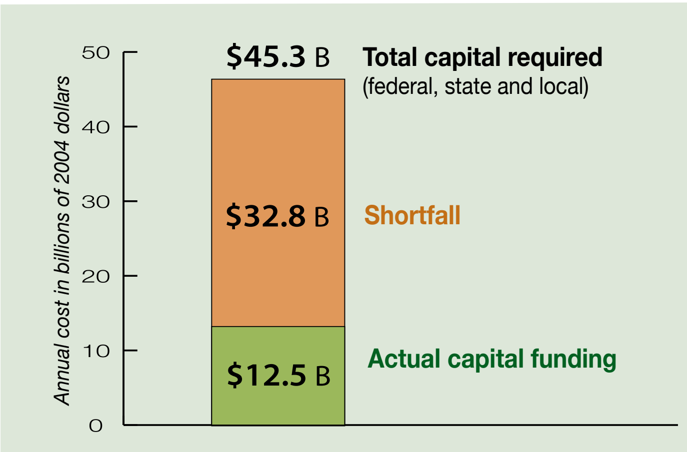
- Charlotte, NC, recently opened its first modern light rail system.
- The New York Metropolitan Transportation Authority is in the process of constructing the Second Avenue Subway Line to relieve severe crowding.
- Cleveland's bus rapid transit system is expected to open in late 2008.
- Salt Lake City is expanding its light rail and will soon add commuter rail.

Expand the geographic coverage of public transportation services.

According to U.S. Census data, 46% of American households do not have access to any public transportation.[7] Public transportation must expand geographically to capture shifts in population, both within regions and across the country. Individuals cannot be asked to reduce their vehicle miles of travel without options. On a national scale, those regions experiencing rapid increases in population must have the resources available to enable public transportation to viably serve local travel demands.

We all have a stake in expanding public transportation.

Annual Capital Investment Needs for Public Transportation



In order to improve physical conditions and improve service performance, the U.S. must make a sizable investment in public transportation. Source: State and National Transit Investment Analysis [5]

Public transportation agencies are reducing their carbon footprints—even more can be done with additional investment.

- The Los Angeles County Metropolitan Transportation Authority is investing in improvements to several maintenance facilities that will use solar energy.
- In Portland, OR, Tri-Met has implemented procedures to reduce idling and improve vehicle maintenance, lowering vehicle fuel use by 10%.
- Throughout the country, bus systems are adding hybrid diesel-electric vehicles.
- In Grand Rapids, MI, The Rapid was the first system to construct a LEED-certified facility.
- Metro in Cincinnati, OH, runs its entire 390-bus fleet on a blend of 50% soy-based biodiesel and 50% regular diesel fuel.

Sources

1. **Department of Energy**, Energy Information Administration, 2007.

2. **"Growing Cooler: The Evidence on Urban Development and Climate Change,"** Don Chen, Reid Ewing and Steve Winkelman, January 2008.

3. **"Public Transportation and Petroleum Savings in the U.S.: Reducing Dependence on Oil,"** ICF International, January 2007.

4. **"Public Transportation's Contribution to U.S. Greenhouse Gas Reduction,"** Science Applications International Corporation, September 2007.

5. **"State and National Transit Investment Analysis,"** Cambridge Systematics, Inc., 2006.

6. **"The Broader Connection between Public Transportation, Energy Conservation and Greenhouse Gas Reductions,"** ICF International, February 2008.

7. **American Housing Survey for the United States: 2005**, U.S. Department of Commerce, Economic and Statistics Administration, U.S. Census Bureau, August 2006.

8. **2007 Annual Urban Mobility Report**, Transportation Institute, Texas A&M University, 2007.

For more information on the many benefits of public transportation, visit www.publictransportation.org or call 202.496.4800.

Climate change and energy legislation should specifically target public transportation as a national priority.