

CHAPTER 9

RESIDENTIAL ENERGY CONSERVATION

According to the U.S. Department of Energy, residential energy use accounts for about 21 percent of all energy use nationwide,¹ although homes in the Pacific region, with its milder climate, use up to 35 percent less energy than homes in other parts of the country. Space heating and cooling account for about 43 percent of residential energy use, followed by water heating (12 percent), and lighting (11 percent).² Greater energy efficiency in these three residential components would greatly contribute to an overall reduction in energy use.

Opportunities for residential energy conservation exist at all levels: the individual dwelling unit, the residential project, the neighborhood, the community, and the region. As described in this chapter, Sacramento County currently has or will adopt strategies, policies, and programs to address opportunities for energy conservation, including residential energy conservation, at all of these levels. Opportunities for residential energy conservation include:

- Compliance with minimum energy conservation standards for residential construction and operations (heating, cooling, cooking, refrigeration, etc.). California requires cities and counties to enforce minimum energy efficiency standards through state building code standards (Title 24 of the California Code of Regulations) and through energy efficiency standards for household appliances.
- Retrofitting of existing homes that are energy inefficient through weatherization, rehabilitation, and the replacement of older appliances.
- Energy efficient project site planning that takes maximum advantage of natural systems (sun, shade, wind) for lighting, heating, cooling, and generation of electricity.
- Neighborhood design and layout that encourage alternatives to automobile use through higher density, mixing of uses, greater connections, and street design for all types of mobility.
- Community and regional growth strategies that emphasize infill development, higher density and mixed-use development along transportation corridors.
- Neighborhood, community, and regional centers with a mix of employment, housing, retail, and services.
- The placement of housing for a variety of households and income levels as close as possible to job centers and services.
- Water conservation, water conserving landscaping, and stormwater management systems that reduce energy use.

State law (Government Code Section 65583[a][7]) requires housing elements to contain an analysis of opportunities for residential energy conservation. According to the California Department of Housing and Community Development, the energy conservation section of a housing element must inventory and analyze the opportunities to encourage the incorporation of energy saving features, energy

¹Source: U.S. Department of Energy at www.eia.doe.gov/emeu/aer/pdf/pages/sec1_3.pdf.

²Source: U.S. Department of Energy at <http://buildingsdatabook.eren.doe.gov/docs/1.2.3.pdf>.

saving materials, and energy efficient systems and design for residential development. Housing element policies and programs should address the environmental significance and operational benefits of employing energy conservation in the building and retrofitting of housing. Sacramento County has taken several measures to implement energy conservation programs in residential projects. The building orientation, street layout, lot design, landscaping, and street tree configuration of all residential projects are reviewed to maximize solar access and energy conservation.

GENERAL DESIGN STANDARDS

There are many opportunities for conserving energy in new and existing homes. New buildings, by design, can easily incorporate energy efficient techniques into their construction. According to the Department of Energy, the concept of energy efficiency in buildings is defined by the building envelope, which is everything that separates the interior of the building from the outdoor environment: the doors, windows, walls, foundation, roof, and insulation. All the components of the building envelope must work together to keep a building warm in the winter and cool in the summer.

Constructing new homes with energy conserving features, in addition to retrofitting existing structures, will result in a reduction in monthly utility costs. There are many ways to determine how energy efficient an existing building is and, if needed, what improvements can be made. Examples of energy conservation opportunities include installation of insulation and/or storm windows and doors, use of natural gas instead of electricity, installation or retrofitting of more efficient appliances and mechanical or solar energy systems, and building design and orientation which incorporates energy conservation considerations.

Many modern building design methods are used to reduce residential energy consumption and are based on proven techniques. These methods can be categorized in three ways:

1. Building design that keeps natural heat in during the winter and keeps natural heat out during the summer. Such design reduces air conditioning and heating demands. Proven building techniques in this category include:
 - Location of windows and openings in relation to the path of the sun to minimize solar gain in the summer and maximize solar gain in the winter.
 - Use of "thermal mass," earthen materials such as stone, brick, concrete, and tiles that absorb heat during the day and release heat at night.
 - Use of window coverings, insulation, and other materials to reduce heat exchange between the interior of a home and the exterior.
 - Location of openings and the use of ventilating devices that take advantage of natural air flow (particularly cool evening breezes).
 - Use of eaves and overhangs that block direct solar gain through window openings during the summer but allow solar gain during the winter.
 - Zone heating and cooling systems, which reduce heating and cooling in the unused areas of a home.

2. Building orientation that uses natural forces to maintain a comfortable interior temperature and take advantage of solar heating. Examples include:
 - Incorporate climate responsive design principles.
 - Location of dwellings and windows to take advantage of natural air circulation and evening breezes.
 - Southern exposure of rooftops to increase the potential for photovoltaic panels.
3. Use of landscaping features to moderate interior temperatures. Such techniques include:
 - Use of deciduous shade trees and other plants to protect the home.
 - Use of natural or artificial flowing water.

In addition to natural techniques, a number of modern methods of energy conservation have been developed or advanced during the present century. These include using:

- Solar energy to heat water.
- Radiant barriers on roofs to keep attics cool.
- Solar panels and other devices to generate electricity.
- High-efficiency coating on windows to repel summer heat and trap winter warmth.
- Weather-stripping and other insulation to reduce heat gain and loss.
- Natural gas for dryers, stovetops and ranges.
- Energy efficient home appliances, including Energy Star® home appliances.
- Low-flow showerheads and faucet aerators to reduce hot water use.

Natural space heating can be substantially increased through the proper location of windows and thermal mass. Use of solar panels can generate 1,000 watts of electricity on a sunny day. This can constitute more than enough power for daily residential operations.

ENERGY CONSERVATION PROGRAMS

The County's strategies and policies related to energy conservation are shaped by several state, regional, and local initiatives and programs. Among the most important initiatives and programs described in this chapter are:

- State building code standards for energy efficiency (Title 24);
- The state's emerging climate change strategies focused on reductions in greenhouse gas emissions, as required by Assembly Bill 32, the California Global Warming Solutions Act of 2006;

- The Sacramento Area Council of Governments' (SACOG's) Preferred Scenario of the Blueprint Project;
- The Sacramento County General Plan Update; and
- The Sacramento Housing and Redevelopment Agency's (SHRA's) strategies to improve energy conservation in residential neighborhoods and supporting City efforts to increase energy efficiency in older residences and neighborhoods.

STATE OF CALIFORNIA

Two major state initiatives related to energy conservation are energy efficiency building standards and reductions in greenhouse gas emissions (which will require significant improvements in energy efficiency for residential and other developments). These state requirements are described below.

State Energy Efficiency Requirements for New Construction

Title 24 of the California Code of Regulations contains California's building standards for energy efficiency. Each city and county must enforce these standards as part of its review of building plans and issuance of building permits. The standards, prepared by the California Energy Commission, were established in 1978 in response to a state legislative mandate to reduce California's energy consumption. The standards are updated periodically to consider and incorporate new energy efficiency technologies and methods. The Energy Commission estimates that California's building efficiency standards (along with those for energy efficient appliances) have saved more than \$56 billion in electricity and natural gas costs since 1978. It is estimated the standards will save an additional \$23 billion by 2013.

Greenhouse Gas Emissions Reduction

The California Legislature adopted the California Global Warming Solutions Act in 2006 (Assembly Bill 32) and declared that "global warming poses a serious threat to the economic well-being, public health, natural resources, and the environment of California." In adopting the act, the legislature found that human activity is one of the leading contributors to an increase in carbon dioxide, methane, and other "greenhouse gases" (GHGs). The state has declared that these gases are leading to an increase in average global temperatures and contributing to changes in climate throughout the world. The purpose of the act is to reduce GHG emissions to 1990 levels by 2020 (25 percent reduction over current levels) and then to reduce GHGs to 80 percent below 1990 levels by 2050.

The act is being implemented by the California Air Resources Board and local air pollution control districts. The California Air Pollutions Control Officers Association (CAPCOA), which represents local air districts, recently released a report on ways to measure and reduce GHGs at the local level, including steps that cities and counties can take to contribute to the goals of Assembly Bill 32. An important local strategy recommended by CAPCOA is the adoption of general plan policies and implementation measures that encourage energy conserving community layout and design. Many of the recommendations are relevant for residential energy conservation. Among the suggestions are:

- Promote walkability through a highly connected street system with small blocks.
- Promote mixed-use neighborhood centers and transit-oriented development.

- Reduce the amount of water used for landscaping and encourage the use of recycled water for landscaping.
- Promote the use of fuel-efficient heating and cooling equipment and other appliances.
- Encourage green building designs in both new construction and building renovation.
- Encourage building orientations and landscaping that enhance natural lighting.
- Encourage the expansion of neighborhood-level products and services and public transit opportunities throughout the area to reduce automobile use.
- Promote energy-efficient design features, including appropriate site orientation, use of light color, roofing, and building materials.
- Encourage the development of affordable housing throughout the community, as well as development of housing for elderly and low- and moderate-income households near public transportation services.
- Ensure that a portion of future residential development is affordable to low- and very low-income households.

SACRAMENTO AREA COUNCIL OF GOVERNMENTS' BLUEPRINT PROJECT

In December 2004, SACOG adopted a preferred scenario for regional growth, called the Blueprint Preferred Scenario. The Preferred Scenario promotes compact, mixed-use development and serves as a framework to guide local government in growth and transportation planning through 2050.³

The core principles of the Blueprint Preferred Scenario are a variety of transportation and housing choices, compact development, use of existing assets (such as infill opportunities), and mixed land uses. Applied together, these principles could result in significant residential energy savings by placing more homes closer to jobs and other daily destinations in a manner that supports more transit use and less reliance on automobiles.

The preferred scenario assumes that a greater proportion of future development, including residential development, will occur *as "infill" within already developed areas* over the next 40 years than has been the case over the past 40 years. Among the key concepts of the Blueprint Project are that more growth would occur within new mixed-use developments and neighborhoods through building within existing neighborhoods, reuse of older commercial corridors, and intensification in density of the Central City area and through higher-density mixed-use developments around transit stations. By focusing more development, particularly housing, in densely developed neighborhoods and by making the areas denser the closer they are to the center of Sacramento, considerable energy savings will result.

SACRAMENTO COUNTY GENERAL PLAN AND ZONING REGULATIONS

In Sacramento County, energy conservation measures are implemented on four levels. The first implementation level is residential energy standards for new housing units required by Title 24 of the State Building Code, as described above.

³ The Blueprint Preferred Scenario also serves as the basis for SACOG's Metropolitan Transportation Plan for 2035. Further details are available at www.sacog.org/mtp/2035.

The County's Building Inspection Division checks all proposed residential units for design and construction compliance with Title 24 energy standards.

The second implementation level is assuring that subdivisions are designed to maximize passive or natural heating and cooling opportunities. This can be achieved by encouraging the incorporation of techniques to maximize use of solar energy. Passive cooling opportunities are listed and included in the design of lots to allow the appropriate orientation of a structure to take advantage of prevailing breezes or available shade. Passive heating opportunities include design of lots to allow structures to be aligned in an east-west direction for southern exposure. Title 22 of the Sacramento County Code (Land Development Ordinance) requires that "new lots shall be arranged and oriented to maximize use of passive solar energy," and "upon such presentation (i.e., of a subdivision proposal), the hearing body may request alternate designs to be prepared by the developer, or may deny the submitted map on the basis that the proposal does not maximize effective use of passive solar energy." In addition, Section 66473.1 of the State Subdivision Map Act requires that the "design of a subdivision for which a tentative map is required shall provide, to the extent feasible, for future passive or natural heating or cooling opportunities in the subdivision." Although no precise standards are given, the State Attorney General has issued an opinion that "a tentative map of a subdivision must be disapproved if it fails to meet the design requirement of Government Code Section 66473.1."

The third implementation level is a zoning amendment, which provides for a 25 percent density bonus to development projects if the following two conditions were met:

- The project would result in an energy savings beyond those obtained with conventional design and construction techniques.
- The amount of increased density is proportional to the amount of increased energy conservation achieved that exceeds adopted regulations.

The fourth implementation level for energy standards is weatherization (i.e., to improve conditions of existing structures and to decrease their energy demand), which falls under the title "retrofit." The most common techniques for increasing building efficiency are: insulation of ceilings, heating-ventilating air conditioning ducts and hot water heaters; weather stripping and caulking; programmable thermostats; low-flow shower heads; window treatment to provide shade (especially on the west side); and furnace efficiency modifications. The County, through SHRA, provides a variety of residential rehabilitation programs to lower income homeowners and renters. The Sacramento Municipal Utility District (SMUD) and Pacific Gas & Electric (PG&E) provide programs to maximize energy efficiency in residential buildings. SMUD, SHRA, and PG&E programs are described briefly below.

Sacramento County General Plan Update

In addition to the measures described above, Sacramento County is currently undertaking a comprehensive update to its General Plan. Several key themes of this update will have a positive effect on energy efficiency in Sacramento County:

- Maintain or improve the character of existing communities. Plan for commercial corridor improvements. Participate in regional planning efforts aimed at implementing more compact land use patterns and an efficient multi-modal transportation system.

- Infill vacant parcels and intensify development on underused lands where appropriate to maintain or improve the quality, character, and identity of existing neighborhoods and communities, as well as to relieve growth pressure on the urban fringe. The County has identified more than 1,200 acres of vacant land and more than 1,900 acres of underdeveloped land within the developed area of the unincorporated County. The General Plan's strategy is to maximize development of these parcels, which do not require extension of infrastructure and services into new areas.
- Create "complete communities" that have a mixture of housing, jobs, and retail amenities to reduce automobile dependence, support local commercial and employment opportunities, and create a jobs/housing balance. The County has designated several areas for mixed-use development, including the Jackson Corridor Planning Area, the West of Watt area, and the Easton area.
- Stimulate reinvestment in targeted commercial corridors through comprehensive planning efforts with a strong focus on implementation. Fourteen corridors have been targeted for redevelopment with mixed-use, retail, employment, and residential uses. These areas are intended to enhance existing communities and accommodate growth in a compact manner.
- Provide the infrastructure and conditions necessary to encourage walking and biking as a means of travel, and to support enhanced transit service. The County has designated six transit-oriented development sites, four along the Folsom light rail line (at Watt Avenue, Bradshaw Road, Sunrise Boulevard, and Hazel Avenue), one along North Watt Avenue, and one on Roseville Road.
- Maintain the Urban Services Boundary as a permanent boundary to urban development. Direct growth toward previously urbanized areas and select new growth areas to reduce sprawling development, strengthen existing communities, relieve traffic congestion, improve air quality, preserve open space and natural resources, protect valuable agriculture and rangelands, and realize economies of scale for infrastructure and services.

To implement these themes, the County will establish new land use classifications for transit-oriented developments and mixed-use corridors. In addition, minimum densities will be used to encourage full build-out of available infill parcels. Encouraging new commercial, industrial, and mixed-use development along existing commercial corridors will improve the mix of housing and job-generating uses, making shorter commute distances possible. New communities will be expected to implement mixed-use growth patterns, resulting in reduced travel needs for work and shopping. All of these land use strategies are expected to result in a more energy-efficient land use pattern than currently exists in the unincorporated area of Sacramento County, with a greater mix of uses and higher density.

SACRAMENTO HOUSING AND REDEVELOPMENT AGENCY

Housing Rehabilitation

SHRA helps to pay the cost of weatherization and certain energy efficient improvements through its housing rehabilitation program. This program helps reduce the operating costs of housing.

Tree Planting Program

SHRA has implemented a tree planting program in consultation with the Sacramento Tree Foundation and SMUD as a form of energy assistance, to provide shade, and to help with neighborhood revitalization.

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Sacramento Municipal Utility District provides technical and financial assistance for design, construction, and remodeling of housing. For new construction, SMUD offers design and technical assistance for incorporating efficiency features. Incentives may be available for upgrading air conditioning, lighting, and appliances to more efficient systems. SMUD has programs to incorporate advanced systems such as photovoltaic roof panels and ground source heat pumps into new projects. Design assistance is available for retrofit projects.

Other ways in which SMUD works with its residential customers and local jurisdictions to promote energy conservation include (SMUD 2008):

- Online home energy analysis that allows customers to identify energy waste.
- Consumer information containing a variety of tips saving energy during winter heating and summer cooling periods.
- The Peak Corps program in which Peak Corps volunteers allow SMUD to cycle their air conditioners during emergency situations, thereby reducing electricity demand.
- Free shade trees that help cool homes naturally.
- The Advantage Homes program that helps homebuyers identify homes that have been engineered and constructed with energy-saving windows, insulation, heating, ventilation and air conditioning systems.
- The SolarSmart program that allows residential customers to purchase SolarSmart new homes and reduce their annual energy bills by as much as 60 percent.
- Consumer information on how to keep pools clean, warm, and energy efficient.
- The Cool Roof program in which SMUD provides rebates to owners of flat-roof single-family, multifamily or mobile homes who install a reflective white roof coating that reflects the sun's energy.
- Rebates to buy down the cost of electric appliances and products to encourage energy efficiency.

CONCLUSION

Sacramento County has taken steps to implement residential energy conservation on four levels: (1) compliance with the state building code standards (Title 24 of the California Code of Regulations); (2) ensuring that subdivision design maximizes passive and natural heating and cooling opportunities; (3) providing density bonuses to developments that, by project design, conserve energy; and (4) supporting numerous retrofit programs offered by the Sacramento Housing and Redevelopment

Agencies, SMUD, and PG&E for existing housing units. Energy conservation programs include:

- Use of energy efficient building techniques in new construction.
- Replacement of older, energy inefficient appliances with newer, efficient appliances.
- Retrofitting of existing homes that are energy inefficient through weatherization and rehabilitation.
- Energy efficient project site planning that takes maximum advantage of natural systems (sun, shade, wind) for lighting, heating, cooling, and the generation of electricity.
- Neighborhood design and layout that facilitates non-automobile trips.
- Community and regional growth strategies that emphasize infill development, higher intensity and mixed-use developments along transportation corridors and within neighborhood centers.
- Water conservation, water conserving landscaping, and stormwater management systems that reduce energy use.

The County implements its strategies through regulatory and incentive programs (for example, zoning, subdivision, and building codes) that promote mixed-use development, infill and reuse, transit-oriented development, subdivision designs that take advantage of natural heating and cooling, and development along the City's major commercial corridors.

The County collaborates with other agencies to pursue energy conservation programs, including SHRA and SMUD. These collaborations allow residents to access funds for activities such as weatherization, replacement of old roofs and appliances, tree planting, and installation of water conserving devices.