

ENERGY CONSERVATION UNDER THE SUN: A RESOURCE BOOK FOR LOCAL GOVERNMENTS

FALL 1998

PRODUCED BY LOCAL GOVERNMENT COMMISSION

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INTRODUCTION

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alifornia cities and counties can significantly reduce energy costs, improve air quality, and provide future economic vitality for their communities by optimizing use of the sun as a source of natural heating and lighting.

This resource book provides local elected officials and staff with:

- * An overview of current state solar energy laws,
- * A summary of local solar ordinances and programs,
- * Actions that local governments can undertake to promote solar energy as a tool for energy use and conservation,
- * Case studies highlighting the work of three California cities,
- * A list of available resources for further information, and
- * Appendices with excerpts from solar-related laws, ordinances, General Plans, and local government programs.

TYPES OF MEASURES CONSIDERED

 he solar-related laws, ordinances, and programs addressed in this resource book deal with solar access, solar site orientation, and solar water heating for homes and swimming pools.

"Solar access" refers to a building's ability to receive the benefits of the sun's rays without obstruction from neighboring buildings, structures, plants, and trees.

"Solar site orientation" refers to situating a building to optimize exposure to the winter sun for passive heating and lighting, while reducing this exposure to the summer sun to minimize overheating.

"Solar water heating" refers to using the sun directly to heat water in homes and swimming pools. Proper orientation of buildings with sufficient solar access allows for the use of solar energy systems, which can be installed to heat water or generate electricity.

Because this resource book is focused on increasing energy efficiency rather than generating electricity, we have not included a discussion of photovoltaic systems, which transform the sun's energy into electricity. However, proper building orientation will maximize the energy generation of photovoltaic systems if installed.[•]

Besides proper solar site orientation, many other passive solar design elements can be incorporated to increase a building's energy efficiency, such as window and door placement, glazing areas and materials, skylights, roof angles, window overhangs, and structural ventilation. The City of San Jose's *Solar Access Design Manual* (see Appendix K) and the Union of Concerned Scientist's "*Putting Renewable Energy to Work in Buildings*," (see Appendix S) provide useful information on these energy conservation opportunities.

[•]NOTE: The California Energy Commission and the U.S. Department of Energy are fostering the growth of the PV industry and its cost-effectiveness as an energy source. The PV-generated energy market is rapidly increasing. Since 1990, photovoltaics have been the world's second fastest growing energy source, with a 40% sales increase from 1996 to 1997 (WorldWatch Institute, 7/16/98 news release: www.worldwatch.org/alerts/ pr98716.htm). As the technology advances, the price per kilowatt hour from photovoltaic energy systems continues to fall. Since 1970, the price of electricity from PV cells has dropped from \$5.00 to 25 cents in 1995. (California Energy Commission: www.energy.ca.gov/development/solar/index.html). One innovative California program, the Sacramento Utility District's (SMUD) Solar Pioneer Program, recruits residents (400 to-date) to allow SMUD to place PV systems on their roofs, to generate electricity for the utility. For information, call SMUD's Solar Office at €(916) 732-6835, or visit their web site at www.smud.org.



STATE LAWS

In the 1970s, a decade of major energy crises and the nuclear accident at Three Mile Island in Pennsylvania, the State of California passed two bills addressing solar energy — The Solar Rights Act of 1978 and The Solar Shade Control Act (see full text in Appendices E and F). Both California and the federal government also encouraged the purchase of solar energy systems by offering tax rebates that reduced costs to the buyer.

The Solar Rights Act requires subdivision maps to provide, to the extent feasible, for passive or natural heating/cooling opportunities, including proper solar site orientation. According to an April 1981 Opinion of the California Attorney General (#80-702), "a tentative map of a subdivision must be disproved if it fails to meet (these) design requirements" (see Appendix L). This language was codified as part of the Government Code in the California Subdivision Map Act (Section 66473.1).

The Act also authorizes local governments to require the dedication of solar easements — defined as "the right of receiving sunlight across real property of another for any solar energy system" — as a condition of subdivision approval, and precludes local governments and homeowner associations from enacting ordinances that prohibit solar energy systems.

The Solar Shade Control Act prohibits any tree or shrub occurring subsequent to the installation of a solar system on another property from casting a shadow greater than 10% over the solar collector area between the hours of 10 a.m. to 2 p.m. standard time.



LOCAL ORDINANCES

umerous cities and counties also passed ordinances in the 1970s to protect solar easements and require solar water heating and solar pool heating devices along with other energy conservation measures. In the 1980s, amid falling energy prices, the solar tax rebate programs ended, making solar water heating systems less attractive. Many of California's local solar ordinances were subsequently repealed.

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A few California cities still have solar energy ordinances and policy language. The City of Claremont requires solar water heating devices on all new residential homes, with exemptions allowed if the applicant can demonstrate that technological, environmental, and/or architectural conditions warrant an exception. Further, if the exception is approved, the applicant must provide energy savings by at least 10% beyond the requirements of Title 24, Part 6 of the California Code of Regulations that dictates minimum energy efficiency standards for new building construction.

The Town of Los Gatos requires solar water heaters on all new residential developments which do not have access to natural gas, and pre-plumbing for solar water heating systems on all other new residential developments. Los Gatos and the City of Del Mar both require solar heating devices as the primary means of heating swimming pools.

Other cities and counties, such as Santa Barbara County and the Cities of San Jose and San Bernardino, have created innovative voluntary programs that offer builders, developers, and owners detailed information and assistance with proper solar orientation techniques and help to identify other energy efficiency opportunities.

ECONOMIC HEALTH, CLEAN AIR, AND JOBS: SOLAR ENERGY'S GOLDEN OPPORTUNITIES

Sing the sun to improve energy efficiency not only reduces the burning of polluting fossil fuels, but can also create new local jobs and increase residents' purchasing power by lowering their energy costs. The California Energy Commission's *Energy Aware Planning Guide* (January 1993) reports that every one dollar spent on energy efficiency generates two dollars of economic activity. Reducing energy consumption redirects money that previously left the community to pay for energy and recirculates it within the local economy.

For areas where natural gas is not available, solar water heating systems provide the most cost-effective method of residential water heating. A May 1996 California Energy Commission study, "Analysis of Various Water Heating Systems," found that the average California homeowner would save \$130 per year in annualized energy costs and would reduce the household's carbon dioxide emissions (CO2) by 2,786 pounds per year by using a solar water heating system financed through a mortgage instead of an electric water heating system.

Compared with natural gas water heating systems, solar water heaters provide a cleaner source of energy at a competitive cost (see "Some Factors to Consider" in this resource book for a more detailed comparison of solar and natural gas heating systems). According to "Analysis of Various Water Heating Systems," when financed through a mortgage, a solar water heating system with a natural gas backup reduced annual CO2 emissions by 1,373 pounds per household while costing only \$2.67 more per month to operate than a natural gas water heating system alone.

[•]NOTE: The solar-electric system cited in the study used 2.577 megawatt hours less electricity annually than the electric system. The CO2 emissions factor for electricity is 1,081 lbs/megawatt hour, according to the California Energy Commission's Tony Wong (thus, 2.577 x 1081 = 2,786).

For pool owners who plan to heat their pool, solar pool heating systems offer compelling energy savings. Compared with a fossil fuel heating system, solar pool systems will save pool users who regularly heat their pool \$4,500-\$12,000 in energy costs over a ten-year period.[•]



Proper solar orientation improves a building's energy efficiency at no or little additional cost. Placing a building's long face on an east-west axis with a large percentage of its windows on the south side can reduce heating fuel consumption by up to 25%. Window overhangs to block the summer sun will also reduce the amount of energy needed for cooling. A passive solar tract home designed by Neuffer Construction in Reno, Nevada,

adds only 1% to the design costs, yet yields a 50% energy savings. (see Appendix S, "Putting Renewable Energy To Work In Buildings," July 1993.)

The City of San Jose found that proper solar orientation of new homes built in the San Jose area produced total energy savings of 11% to 16.5% — with up to 40% savings from space cooling (see p. I-II of its *Solar Access Design Manual* in Appendix K).

Buildings realize even greater energy savings by integrating other passive solar design elements, such as light colored walls, increased insulation, and night ventilation along with proper solar site orientation. *"Passive Solar Marketing Strategy, Appendix C: Energy Savings Analysis,"* a report written for the California Energy Commission, found that new homes that incorporated a host of passive solar design features reaped significant heating and cooling savings — reducing heating needs in San Diego homes by 52% and cooling needs in Sacramento homes by 73%. (see Appendix B for the report's executive summary.)

According to the U.S. Department of Energy, the use of solar and renewable energy is expected to double by the year 2010. In June 1997, President Clinton announced the Million Solar Roofs initiative to install solar energy systems (including household water and swimming pool heating systems and photovoltaics) on one million U.S. buildings by the year 2010. The U.S. Department of Energy predicts that this will create approximately 70,000 high tech jobs. Encouraging solar power can foster job growth and help California communities capitalize on an expanding world solar energy market. (www.eren.doe.gov/millionroofs/)

[•]NOTE: Payback periods average two to four years. Annual operating costs for conventional heating systems range from \$750-\$2000 (see the Solar Energy Industries Association's "Solar Thermal Water Heating" web page at www.seia.org/stwathea.htm). For the ten-year savings projection, a four-year payback period was assumed.



GETTING THE MOST OUT OF THE SUN YEAR ROUND

S olar site orientation works best when the following design elements are incorporated:

- * The building's long axis is within 15 degrees of a line running from east to west.
- * Most of the building's glass area is on the south side.
- * Roof overhangs are sufficient to block the high summer sun, but not the lower winter sun, from penetrating south facing windows.

RECOMMENDED ACTIONS FOR LOCAL GOVERNMENTS

ocal elected officials and staff have numerous opportunities to promote solar energy and passive solar design for increasing energy efficiency and reducing energy use. This resource book suggests several actions that local governments can take. The appendices provide local leaders with examples of solar ordinances, General Plan language, and programs that be implemented in their communities. Cities and counties that have undertaken these or similar measures are listed below in parenthesis after each recommendation.

■ ENFORCE STATE SOLAR LAWS AND PROMOTE SOLAR ENERGY

Enforce the Solar Rights Act of 1978 and the Solar Shade Act of 1978. Recommended steps include:

- Adopt general plan language stating the City/County shall revise the subdivision ordinance and review process to ensure effective implementation of the Solar Rights Act of 1978, including a requirement for solar easements and providing passive and/or natural heating or cooling opportunities. (Town of Los Gatos, City of San Bernardino, and Shasta County)
- Adopt general plan language stating that, in accordance with the Solar Rights Act of 1978, the City/County shall deny a tentative subdivision map that does not meet the Act's requirements.
- Adopt general plan language that the City/County will work with property owners to enforce the Solar Shade Control Act.
- Add language to the General Plan stating that the City/County shall promote the utilization of solar energy and other renewable energy sources in all new and existing residential, commercial, and industrial buildings. (Town of Los Gatos and Shasta County)
- Revise the subdivision ordinance and review process to ensure effective implementation of the Solar Rights Act of 1978. State that the subdivision map must provide for passive and/or natural heating or cooling opportunities to the extent feasible and require solar access easements as a condition of approval.
- Pass a resolution reinforcing the City/County's commitment to enforcing the Solar Rights Act of 1978.

Formulate solar site orientation guidelines for new residential developments that capture the winter sun's heat and light while offering natural shading opportunities in the summer. Guidelines should recommend orienting the building's long face within 30 degrees (15 degrees is optimal) of the east-west axis. (Cities of Davis and San Jose, and Town of Los Gatos, and San Luis Obispo and Santa Barbara Counties)

■ PROMOTE AND/OR REQUIRE SOLAR WATER HEATING DEVICES

Adopt general plan language stating that the City/County will promote solar water heating devices as a means of reducing the consumption of fossil fuels. *(Town of Los Gatos)* Recommended follow-up actions include:

- Pass an ordinance that requires the use of solar water heaters on all new residential buildings where solar access is available and natural gas is not available. (Town of Los Gatos)
- Pass an ordinance that requires pre-plumbing for solar water heaters on all new residential construction. (Town of Los Gatos)
- Adopt ordinance language stating that, to achieve energy savings beyond Title 24, energy savings from solar water heating systems shall be excluded from the Title 24 water heating credit.
- Pass an ordinance that requires solar water heaters on all new residential buildings. As a means of standardizing solar system performance and quality, specify that systems must be certified by the Solar Rating and Certification Corporation. (City of Claremont)

See page 10 of this resource book for more on the Solar Rating and Certification Corporation.

■ PROMOTE SOLAR HEATING IN SWIMMING POOLS



- Require that all municipal swimming pools be fitted with a solar heating system by a certain date.
- Require solar energy as the primary means of heating all new swimming pools, including residential, where solar access is available. (*City of Del Mar and Town* of Los Gatos)



SOME FACTORS TO CONSIDER

he Solar Rights Act of 1978 and the California Subdivision Map Act both require that subdivision maps utilize passive and natural heating and cooling design opportunities (such as proper building solar site orientation), and mandate that local governments deny approval to a subdivision map that fails to meet these requirements (Attorney General Opinion #80-702, 4/21/81; see Appendix L).

Local governments wishing to require solar water heating systems or to otherwise go beyond the parameters of the Solar Rights Act of 1978 and the Solar Shade Control Act must address California Public Resources Code 25402.14 (h)1 & 2, which requires that local governments prove the cost effectiveness of any City/County energy conservation or energy insulation standards that exceed Title 24 and submit their findings to the California Energy Commission for approval. The required procedures are outlined in the Commission's *Energy Efficiency Standards for Residential and Nonresidential Buildings*, Section 10-106, July 1995 (see Appendix C in this resource book for Code 25402.14 (h) 2 and Appendix A for Section 10-106).

Significantly, some of the California Energy Commission's own studies and policy statements provide evidence to prove the cost effectiveness of solar water heating and solar swimming pool heating systems.

Cities and counties that require solar water heating systems for heated swimming pools and/or solar water heating systems for areas without natural gas access can easily fulfill Code 25402.14 (h) 2 requirements. The California Energy Commission's May 1996 study, "Analysis of Various Water Heating Systems," found solar water heating systems to be the most cost-effective choice for areas without natural gas, and considerable data shows that solar heating systems for swimming pools are an extremely economical investment compared with natural gas systems.

While the cost-effectiveness of solar water heating systems in areas with natural gas access is not as readily apparent, local governments can make a very compelling case for requiring solar water heating systems by including the economic costs from the burning of fossil fuels (such as health problems associated with poor air quality) in

their cost analyses. Comparing the annualized cost of electric, natural gas and solar water heating systems over a 30-year period, natural gas heaters were the least expensive option — \$32 a year less than a solar water heater with a natural gas backup (the next least expensive option), according to "Analysis of Various Water Heating Systems."

The California Energy Commission study used climate and energy cost data for the Sacramento area. Solar water heating systems will probably be even more competitive in areas such as Southern California, with its higher gas and electricity costs and greater annual sunshine. Solar water heating can also help the area to reach clean-air standards, especially as population growth further stresses air quality. During the summer months, a solar water heating system can supply all of a household's hot water needs and a portion of those needs during the rest of the year.

aking into account the economic costs of pollution from fossil fuel emissions (often called "externalities"), the costs of natural gas water heating with or without solar water heating systems become almost identical. Ray Darby, an energy specialist who maintains "The Energy Guy" web site, factored externalities and fuel subsidies into the California Energy Commission study data. When these costs were included, the passive solar water heater was only \$8 a year — or about 65 cents/month — more than the natural gas system (see www.TheEnergyGuy.com/ EnergyGuy/solarwaterheating.html#ComparisonofVariousDHWSystems).

The California Energy Commission has publicly endorsed including externalities in cost projections: in the *State of California 1992-93 Energy Plan*, the Commission recommended that the full environmental costs and benefits be included in the economic evaluation of proposed energy activities.

The lingering memory of the maintenance problems of some solar water heating systems from the 1970 and early 1980s may make some consumers wary. However, the maturation of the solar industry and tighter regulation of the sale of solar energy products provide California consumers with a more reliable product. In accordance with Section 1503(j)3 of Title 24, Part 6, the State of California now requires certification — by the Solar Rating and Certification Corporation — of solar energy equipment sold in the state.

The Solar Rating and Certification Corporation is a Florida-based, independent, nonprofit organization that certifies and rates solar energy equipment to ensure high quality and satisfactory performance. Furthermore, since the boom of 20 years ago, market forces have weeded out unreliable solar energy companies and products.



CASE STUDIES

■ CITY OF CLAREMONT

he City of Claremont has required solar water heating devices on new residential and commercial buildings for over fifteen years. Claremont also encourages designs that integrate passive heating and cooling opportunities.

In recent years, City approval of exemptions from the solar water heating requirement has steadily increased, and a revision of the requirement is being considered. Several circumstances explain the trend, including the relatively inexpensive cost of natural gas, increased energy savings through better building products and construction practices, fewer manufacturers of solar equipment, and the maintenance problems of some older solar water heater models.

City staff is also considering the possibility of requiring solar exception applicants to demonstrate more than a 10% energy savings is achieved over that required by Title 24 standards without the solar system.

For more information: ≪ Michael Diaz, Associate Planner, (909) 399-5483 ⊠ City of Claremont, P.O. Box 880, Claremont, CA 91711

CITY OF SAN JOSE

he City of San Jose has been a leader in implementing policies and practices that save energy and preserve resources for future generations. Its *"Sustainable City Major Strategy"* policy statement provides the cornerstone of the San Jose 2020 General Plan. The statement's key goals include reducing projected energy consumption for the year 2000 by 10% and pursuing energy- and

resource-efficient practices to "encourage and support a stronger economy and improve the quality of life for those who live and work in San Jose."

In June 1993, the City developed the *Solar Access Design Manual* (see Appendix K), an excellent resource on optimizing solar heating and cooling opportunities through building and landscaping design. The manual establishes specific solar orientation goals for subdivisions, sets design guidelines for single- and multi-family housing, and documents case studies demonstrating the feasibility and cost-effectiveness of incorporating solar orientation design principles into various types of development plans.

In 1998, San Jose initiated the Green Building Dialogue to investigate creating green building standards. Initial feedback has been positive. If instituted, the standards would provide a blueprint for environmentally sustainable housing.

For more information:

- Mary Tucker, Environmental Services Specialist, (408) 277-5533
- **™** City of San Jose, Environmental Services Department,

801 N. 1st St., San Jose, CA 95110

TOWN OF LOS GATOS

The Town of Los Gatos promotes the use of solar and other renewable energy resources in existing and new city, commercial and residential developments. Los Gatos requires pre-plumbing for solar water heating in all new construction. Owners must perform shadow studies for buildings over one story to ensure solar access for neighboring lots. Protecting solar access is also a pre-condition of approval in all new developments.

The Town's Design Review Committee encourages applicants to maximize solar benefits in building design and recommends the use of specific tree species and proper location to allow winter solar access and supply summer shade. The committee recommends that lot size and building design permit an east-west alignment of the building to maximize southern solar exposure. Further, developers are urged to take advantage of prevailing breezes for natural cooling and other passive heating and cooling opportunities.

Since 1990, outdoor swimming pools must be equipped with a pool cover and use solar heating equipment as the primary means of heating.

For more information:

- S Irwin Ordonez, Town Planner, (408) 354-6872
- Town of Los Gatos, 110 E. Main St., Los Gatos, CA 95032



RESOURCES: PUBLICATIONS

- Building Sustainable Communities An Environmental Guide for Local Government, League of California Cities/Global Cities Project, (July 1991). Contact: Environmental Policy Center, 2962 Fillmore St., San Francisco, CA 94123. \$(415) 775-4159.
- Cooling Our Cities: The Heat Island Reduction Guidebook, Hashem Akbari, Joe Huang, Susan Davis, eds., April 1991. Contact: Lawrence Berkeley Laboratory, Bldg. 90-4000, 1 Cyclotron Rd., Berkeley, CA 94720, or call Susan Davis, editor at \$(415) 486-4647.
- *Energy Aware Planning Guide,* California Energy Commission, #P700-96-006, January 1993.
- Passive Solar Handbook, California Energy Commission, #P500-80-032, 1980.
- Protecting Solar Access: A Guidebook for California Communities, California Energy Commission, #P500-80-013, 1980.
- A Guide to the Adoption of Local Solar Pool Heating Ordinances, SolarCal Council, 1981 (revised 1990).
- A Guide to Passive Cooling A Model Shading Ordinance, SolarCal Council, 1981.

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- Solar Access Ordinances A Guide for Local Governments, SolarCal Council, 1981.
- California Energy Commission publications are available by contacting its Publications Department at \$(916) 654-5200, or by mail at: MS-13, 1516 9th St., P.O. Box 944295, Sacramento, CA 95814.

SolarCal publications are available from the Local Government Commission. Please call �(916) 448-1198, or write to the LGC at: 1414 K St., Suite 250, Sacramento, CA 95814-3929.



RESOURCES: WEB SITES

 California Energy Commission "Solar Energy in California" page: www.energy.ca.gov/development/solar/index.html
 The Energy Guy "Solar Water Heating" page: www.TheEnergyGuy.com/EnergyGuy/solarwaterheating.html
Interstate Renewable Energy Council: www.irecusa.org
Passive Solar Industries Council: www.psic.org
 Solar Energy Industries Association "Solar Thermal Heating" page: www.seia.org/stwathea.html
 U. S. Department of Energy "Million Solar Roofs" page: www.millionsolarroofs.org
 U. S. Department of Energy "Reduce Swimming Pool Energy Costs (RSPEC!)" "Outdoor Pools" page: www.eren.doe.gov/rspec/outdoor.htm
 U. S. Department of Energy "Solar Buildings" page: www.eren.doe.gov/solarbuildings/