

# CURRENTS

AN ENERGY NEWSLETTER FOR LOCAL GOVERNMENTS

## Straw Houses Bring Green Building Down to Earth

Mar/Apr 2000

by Peter Asmus

The practice of building homes with high mass walls comprised of dirt, straw and other raw natural materials found in the local environment dates back to the Neolithic period around 7000 B.C. Back then, it seemed logical that buildings should be constructed out of materials that were in ample supply nearby.

While some still view these structures as relics of the past, a new generation of homeowners regard the use of these alternative building materials as a way to shape architecture for the new millennium.

Today, an updating of these ancient building practices is being driven by concerns about the environment. These buildings not only

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A straw bale home under construction in Berkeley. See the finished look on p. 3.

## Sacramento County Converts Its Landfill Gas into Energy for Homes

In December 1999, Sacramento County began turning a liability into an asset by converting potentially polluting methane gas generated at the county-owned landfill into green electricity for county residents. The largest reciprocating engine landfill gas-to-energy project in the state, the site generates 8.3 megawatts of renewable electricity – enough to provide power to more than 8,000 homes.

All landfills generate gas as waste decomposes. Left unchecked, the gas can pollute air and groundwater. Most landfills take steps to control the gas, often just burning it.

Landfill gas is approximately 50% methane and 50% carbon dioxide. The project's state-of-the-art internal combustion engines have been specifically designed to use landfill gas. Combustion of landfill gas converts methane to carbon dioxide and water vapor. Since methane's global warming potential is 21 times that of carbon dioxide by weight, this conversion results in a net positive benefit to the atmosphere.

A landfill gas-to-energy system has three components: ① the gas collection system, ② the gas processing and conversion system, and ③

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Public Goods Report

# Sacramento Landfill Gas Turned into Energy

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the interconnection equipment which delivers the electricity to the utility.

To collect gas in an existing landfill, wells are drilled throughout the landfill to within 5 to 15 feet of the bottom. Perforated plastic pipes surrounded by large gravel to prevent refuse from blocking the perforations are inserted in the wells. The wells are connected by a series of pipes leading to the gas processing and conversion stations. The entire piping system is under a partial vacuum created by blowers or fans at the processing station, causing landfill gas to migrate toward the wells. As Sacramento County fills new cells at the landfill, the perforated pipes will be laid horizontally to collect gas in the future.

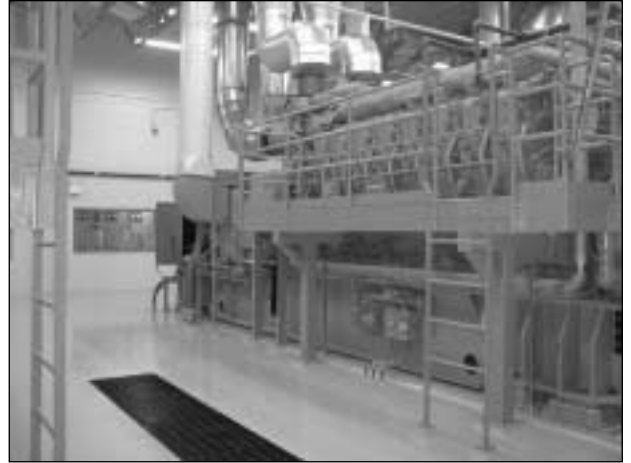
Once blowers or fans deliver gas to a certain point, it can be processed or converted to another energy form. Internal combustion engines convert the gas into salable electricity. A dedicated line is used to deliver the electricity to the Sacramento Municipal Utility District (SMUD). Interconnection includes metering equipment necessary to monitor sales. SMUD sells this energy as part of its "Greenergy"

program to customers who purchase renewable energy.

**T**o make the project financially viable in a time of declining energy prices, the County developed creative partnerships with SMUD and with a private developer, Landfill Energy Systems (LES).

Since the County and SMUD share the same constituents, it was decided that neither the County nor SMUD would accrue profit from this project. The County provided financing for construction, operation and maintenance. SMUD provided the required emission reduction credits required by the Sacramento Metropolitan Air Quality Management District. Additional funding was provided by the U.S. Department of Energy's incentive payment program for renewable energy.

Two contracts with LES covered engineering, procurement and construction of the project, and operations and maintenance. The first contract allowed the County to take advantage of LES' extensive



*Sacramento's landfill-to-energy project.*

experience and ensured the proper equipment for the project. The operations and maintenance contract is performance-based, with LES paid on a net kW delivered basis. This arrangement reduces the County's risk because the O&M expense and the revenue to the County rise and fall together.

**O**verall, the financial picture for the County is good. Revenues for about the first 15 years will repay the bonds issued for the implementation of the project. After the bonds are repaid, the project will generate income for the County. The project also will result in cleaner air and groundwater, reduced reliance on fossil fuels, improved safety at the landfill site, and new local jobs in construction and design as well as in operations and maintenance.

This project has received the U.S. Environmental Protection Agency's Landfill Methane Outreach Program award for 1999.

For more information, contact Kathy Garcia, Sacramento County's Waste Management and Recycling Division, ☎(916) 875-6660, fax (916) 875-6767, or 9850 Goethe Road, Sacramento, CA 95827-3561.

## Solar Roofs Program Goes to School

**T**he Bay Area Solar Consortium's (BASC) Solar Schools Workshop will be held Friday, March 24th at DeAnza Community College.

BASC is a partner in President Clinton's Million Solar Roofs Initiative. The workshop is one element of BASC's strategic plan to install 5,000 solar energy systems in the San Francisco and Monterey Bay areas by 2010. Solar Schools Workshop will include presentations on creating a solar curriculum, developing a solar action plan, and building and financing solar energy systems at school sites.

The workshop fee is \$10. For registration information, call Mary Tucker or Lian Loo at the City of San Jose at ☎(408) 277-5533.

# Down-to-Earth Green Building Grows

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reduce waste and reliance upon the harvesting of wood from our dwindling forests, but are proving to reap energy efficiency gains that far surpass what most conventional homes can achieve.

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***Long-term savings on utility bills are where straw bale construction really comes out ahead of conventional materials. A standard bale wall system is roughly twice as energy efficient as wood frame construction.***

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From structures made of nothing more than earth mixed with a little concrete to homes whose fundamental ingredients are waste straw, many alternative building concepts are particularly well-suited for California's climate. Local governments

throughout California are beginning to accommodate this emerging industry. In the process, forward-looking local governments may be able to encourage the kind of market transformation that was the clearly stated intent of California's restructuring law.

The one alternative building material that is currently receiving the most attention in California is straw bale construction. Because it can be more easily adapted to the state's earthquake standards and waste straw is widely available throughout the Central Valley, the



*The straw bale house is finished in stucco. Extremely energy-efficient, the thick walls also provide a peaceful sanctuary from the noisy urban life outside. (photos by DSA Architects)*

straw bale appears to be the alternative building material of choice here and may be on the verge of major growth in the state.

Long-term savings on utility bills are where straw bale construction really comes out ahead of conventional materials. A standard bale wall system is roughly twice as energy efficient as wood frame construction. This means that a straw bale house requires very little heating or cooling.

The energy efficiency benefits of straw bale homes are far greater than any mere R values – an insulation measure – would indicate, according to Nehemiah Stone, a former California Energy Commission staffer who recently constructed the first permitted straw bale house in Placer County.

Stone co-authored *Tested R-value for Straw Bale Walls and Performance Modeling for Straw Bale Homes*, a 1998 report for the Energy Commission, which examined the existing literature and reported

## Adobe Structures Gaining Popularity in the Southwest

**E**arth buildings work well in hot, dry climates. Particularly popular in the southwest, adobe houses are catching on in states like New Mexico, where roughly half of all new luxury homes feature adobe or other forms of earthen construction.

Adobe structures are the most common type earth construction. Traditional adobe buildings were constructed with earth excavated at the site mixed with straw. Today, however, most adobe bricks include stabilizers such as small amounts of liquid asphalt or Portland Cement. The newest and most radical earth technology is Pneumatically Impacted Stabilized Earth – PISE. Invented by David Easton, PISE greatly reduces the labor costs that can make earthen homes more costly than traditional housing structures.

In the PISE process, a mix of earth, cement and water is squirted out of large hoses into plywood frames. This innovation cuts construction time in half and greatly boosts performance. One Sonoma County home that relied upon 450 tons of earthen building material amazed researchers when it was discovered that the PISE process saved the owners over 5,000 BTU/sq. ft. in annual heating, cooling and water heating when compared to a conventional house.

# Cooperatives Buying into Green Power

by Peter Asmus

**F**ood, bike and student housing cooperatives throughout California are beginning to vote for the environment with their electricity purchases, taking advantage of new opportunities to choose their own power supply. At least five co-ops have already switched to a green electricity provider for their stores over the past year. An organized effort is also underway to get all 60,000 members of the 20 food co-ops operating in the state – which serve over 15,000 members daily – to purchase power from one of several existing green power providers.

“The co-op movement was born out of a frustration with the status quo way of doing business,” said Steven Kelly, executive director of the Renewable Energy Marketing Board (REMB). “It only makes sense that co-ops, which often offer more environmentally conscious and superior products, would purchase their electricity from non-polluting renewable sources such as solar, wind or geothermal steam power,” he added.

Missing Link, a Berkeley-based, worker-owned bicycle cooperative started in 1973, is one of the most recent co-ops to make the green power switch. The store shifted to GreenMountain.com’s 100% renewable energy product in January, which helps support a new solar photovoltaic power plant in Mendocino County and costs less than generic power.

“I had the impression that switching to green power would require a customer to pay a lot,” said Ivor Thomas, Missing Link’s co-owner. “I received a flyer in the mail from CEERT (Center for Energy Efficiency and Renewable Technologies) and it showed me it was easy to switch – and I could actually save money,” he said.

The vote to buy green instead of brown power was unanimous. “Everybody here has a keen interest in cleaning up the environment. I had always been interested in energy conservation, but this was the first opportunity I had to change the nature of the energy I used,” Thomas said.

**A**nother Berkeley-based co-op, University Students’ Cooperative Association (USCA), switched to Green Mountain.com’s 100%

renewable product over a year ago. The student housing cooperative – the largest in North America – owns 20 properties, all of which are now powered by green electricity. Members pay for the green electricity as part of their rent.

“The decision to buy green electricity is in accord with the USCA’s ideal of being a socially responsible organization,” said Devra Bachrach, a co-op member. “In addition to using green electricity, we actively recycle, compost, and buy organic food and food in bulk. The USCA is a cooperative, so one of our missions is to promote the general welfare of the community, the switch helps us work towards that goal,” she said.



Three food co-ops in southern California have also switched to green power products. In January, Co-opportunity Consumers Co-op of Santa Monica went with Commonwealth Energy of Tustin. This company won the contract to serve the City of Santa Monica last year, and the cooperative decided to follow the city’s lead. The electricity for both Santa Monica’s municipal facilities and the food co-op is generated from geothermal steam that has been tapped to generate electricity in Sonoma, Lake and Imperial counties.

Both the Isla Vista Food Cooperative (located near Santa Barbara) and People O.B. Organic Food Co-op of Ocean Beach have switched to GreenMountain.com’s Wind For The Future 2.0. These co-ops are paying about a 10% premium to insure that 25% of their electricity is generated at new wind turbines installed in the San Geronio Pass, California’s best wind farming site.

**T**he three food co-ops that have already switched are part of a statewide campaign organized by the Twin Pines Cooperative Foundation to get all 20 of its food co-op members to first purchase green power for their own facilities and then to educate their accumulative 60,000 members to also switch to green power.

The campaign, underwritten by ratepayer funding authorized by the California Energy Commission, is focused on the state’s ten biggest food co-ops – representing 90% of the state’s co-op food business sales.

# LEAP Update: 1999 Was A Great Year

by Patrick Stoner

**T**he Local Energy Assistance Program made a great leap forward in 1999.

Last year, LEAP provided development plan analysis and General Plan assistance to 15 local governments, created and distributed a computer tool that provides LEAP-like analysis of new development plans, and reached thousands of people interested in energy efficiency through our publications and web site.

Funding from Southern California Edison (SCE) and Southern California Gas Company (SoCal Gas) was maintained from its initial year in 1998, and will continue in 2000 through contracts with both utilities.

## Plan Analysis

**O**ur plan analyses quantify the benefits of livable community strategies that the Local Government Commission (LGC) has been promoting for the last decade. LEAP has provided this assistance on projects ranging from a 29-home infill development to a specific plan encompassing 1,100 acres.

Since starting the program, the LEAP team has reviewed plans for over 21,000 new residences in California. In these homes, energy efficiency has been improved by an average of 19% and annual home energy utility bills were reduced by



*LEAP shows how narrow, tree-lined streets cool neighborhoods and save money.*

an average of \$130. Several local governments and developers have incorporated some or all of the recommended options, while others are using the reports as demonstration pieces for future projects.

Typical LEAP recommendations include maximizing solar orientation (required by state law), narrowing streets (to reduce urban heat island effects and calm traffic), increasing the number of trees (which shades streets and homes and lowers temperatures), and upgrading the energy performance of the homes.

Narrow streets provide significant savings to developers – and to local governments which maintain them – and allow for extra land that can be used for additional lots or public spaces. In hot climates, shaded streets provide local governments with additional savings as they require repaving less often.

LEAP is looking for other funding sources to add quantified air and water quality benefits in its reports to further support the recommendations. We are also looking for local governments in the SCE and SoCalGas service territories to work with in 2000.

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## Workshops for Clean Power and Local Governments Set for Spring

**T**he Local Government Commission is working with the Renewable Energy Marketing Board, the Center for Energy Efficiency and Renewable Technologies, and Global Green USA to produce four free workshops for local elected officials and staff who are interested in promoting the use of green power in their communities – including wind, solar, biomass, landfill gas and geothermal-generated electricity that is non-polluting and renewable.

In addition to green power experts, the workshops are open to local government representatives from jurisdictions that are already purchasing green power for their municipal needs, generating their own green power, or are promoting green power to their residents and businesses, to share their experiences with others who are considering these options. To ensure that the workshops will be very interactive, attendance will be limited.

Supporting materials such as sample guides on how to buy green power and information about green power marketers will be provided. Check out the dates and locations below, and mark your calendar now. For registration information, call Pat Stoner, at the Local Government Commission, at ☎(916) 448-1198 or e-mail at [pstoner@lgc.org](mailto:pstoner@lgc.org).

April 7	Santa Monica	May 12	San Diego
May 4	Oakland	May 18	Arcata

# Local Energy Assistance Program Progress

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## General Plans

**L**EAP has also been offering model language and information support to jurisdictions for General Plan updates. In the City of Santa Clarita, the city council and planning commission adopted all but one of LEAP's recommendations for the Open Space and Conservation Element of the City's General Plan.

An Orange County city is currently considering our suggestions for its Housing Element. LEAP included policies and programs that, if adopted, will reduce energy use, add affordability and quality to housing, and allow residents to spend more of their money within the community. If you would like help with updating elements of your General Plan, let us know.

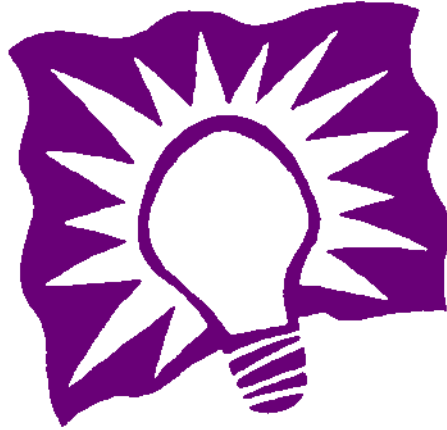
## Computer Tool

**L**EAP 1998 and 1999 participants received a free CD of the LEAP-1 analysis tool to help them estimate energy and cost differences between proposed development and alternatives with typical LEAP measures. This easy-to-use tool allows planners to adjust orientation, street widths, tree species and spacing, street lighting type and spacing, and building energy improvements, and then see the energy and cost impacts that result.

Based on input from initial local government users, we will be revising the tool this year to allow for customization of variables such as paving costs which can be dependent on local labor rates.

## Sharing Information

**L**ast year, LEAP continued to develop free resources with strategies for saving energy



and enhancing local communities. The latest publication now available, *Tree Guidelines for Southern California Coastal Communities*, describes how to cool homes and neighborhoods, improve air and water quality, and increase property values. Following the popular *Tree Guidelines for San Joaquin Valley Communities*, this is the second in the LEAP-produced series prepared by a U.S. Department of Forestry research team. Plans for a third set of guidelines for inland Southern California are underway. We filled almost 500 requests for the San Joaquin and Southern California Coastal guidelines last year.

We also produced two videos last year. The *Sustainable Design: Planning for Solar Orientation and Energy Efficiency Workshop* video is available thanks to the City of Santa Clarita which hosted and taped the workshop we produced there in conjunction with the City, the Los Angeles Chapter of the American Planning Association, and SCAG's Livable Communities Initiative.

We also produced a working draft of a video involving fire officials and equipment demonstrations, developers and street design experts addressing the viability of reduced street widths. A final version will be created later this year.

As with LEAP publications, these videos are available for free.

Late in the year, we partnered with the Renewable Energy Marketing Board (REMB) to include renewable energy materials in *Currents* (see also the article on page 5 about the LEAP partnership with REMB and others to produce renewable energy workshops for local governments). Back issues of *Currents*, including the special edition on street lighting for energy efficiency and livability, are now available on our web site at [www.lgc.org/energy](http://www.lgc.org/energy). Many of our other energy materials are also downloadable.

We also had the opportunity to share what LEAP has learned at other workshops and conferences. We participated in a workshop promoting urban forests, in California's Clean Power Day, and in U.S. DOE's Rebuild America peer exchange program. We also presented strategies to integrate nature into urban environments at a national conference on Smart Growth.

Overall it was a very active and productive year, and we look forward to doing even more in 2000.

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## CORRECTION

In the January/February 2000 issue of *Currents*, the Sacramento Municipal Utility District's ambitious Earth Day 2000 projects were incorrectly credited to the City of Sacramento. We apologize for the error. For more information, please visit the SMUD web site at [www.smud.org](http://www.smud.org).

# Straw Homes

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the findings from the authors' own testing. The Energy Commission has subsequently released its official measurement R-value for straw bale houses: R-30 for 22-inch bales laid flat or 16-inch bales laid on edge.

Yet, because of California's unique climate together with the high thermal mass of straw bale houses, the energy efficiency of straw bale goes beyond what an R-30 value may imply. "In California, straw bale houses perform more like R-45 because of our diurnal temperature swings," Stone said.

It takes from 12 to 15 hours for heat to transfer through a straw bale wall. Because that is the approximate length of the heat cycle of a summer day in California, straw bale walls are able to keep the indoor temperature stable. "This would not be the case in a place like the Yukon in Alaska, where it stays cold for a long, long time. The daily temperature swings in California are well matched to the thermal mass storage characteristics of straw bale," said Stone.

**M**aurice and Jo Bennett, a husband and wife team who are still working on their straw bale home near Murphy in Calaveras County, love their new home. "It was an awesome experience," as Joy Bennett described the process she and her husband went through while building a straw bale home. "We wanted to show people there was another way to live than stick houses. We went into it for environmental reasons. We wanted to be good to the planet."

The Bennetts, who built the home largely themselves between August 1998 and December 1999, are enjoying the fruits of their own

## Earth Building Internet Resources

California Straw Builders Association: [www.strawbuilding.org](http://www.strawbuilding.org)

Rammed Earth Works: [www.rammedearthworks.com](http://www.rammedearthworks.com)

Cast Earth: [www.castearth.com](http://www.castearth.com)

New Mexico Energy Conservation and Management Division: [http://intertech.albuquerque.nm.us/ecmd/html/Publications/Adobe/archives/Adobe\\_TOC.htm](http://intertech.albuquerque.nm.us/ecmd/html/Publications/Adobe/archives/Adobe_TOC.htm)

Sustainable Sources: [www.greenbuilder.com](http://www.greenbuilder.com)

The Earth Building Foundation: [www.earthbuilding.com](http://www.earthbuilding.com)

Home Energy Magazine, May/June 1999 issue: [www.homeenergy.org](http://www.homeenergy.org)

Daniel Smith and Associates/DSA Architects: [www.dsaarch.com](http://www.dsaarch.com)

Solstice Straw Bale Construction Web Info:  
[http://solstice.crest.org/efficiency/straw\\_insulation/index.html](http://solstice.crest.org/efficiency/straw_insulation/index.html)

*source: Home Energy Magazine*

labor. "Our indoor temperatures last summer lagged outside daytime temps by 20 degrees or more," said Maurice, proudly extolling the virtues of his straw bale home.

"We opened the house at night and then closed it up early in the morning to capture cooling. A four-foot overhang on the south side keeps sunlight out of the house during summer months. In order to quell the hot summer sun, there are no windows or other openings on the west wall," he added.

But the home offers more than efficiency savings. "With the thick walls, it feels like a monastery. It is so peaceful and quiet," said Joy.

**L**ocal governments can play a supportive role by adopting building and safety codes for straw bale, and providing training to planning and building department staff on straw bale construction.

AB 1314, which was signed into law in 1996, established a building code for straw bale structures (see the California Straw Builders Association web site at [\[building.org\]\(http://www.strawbuilding.org\)\). However, these codes are not instituted locally without the vote of the city council or board of supervisors. Currently, more than half of the cities and counties have adopted such codes.](http://www.straw-</a></p></div><div data-bbox=)

Even after the codes have been adopted, planners and building code inspectors need training in dealing with a building that differs from a conventional wood frame home.

"The biggest obstacle to the use of straw bale in residential construction is a lack of knowledge on the part of plan checkers, building inspectors and other code officials," said Bennett, who with his wife Joy and Stone, manages the California Straw Builders Association (CASBA).

To respond to this dilemma, CASBA has just published a guide on straw bale homes for building officials, which was distributed to the building department of each California county. To date, Calaveras County

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## NRDC Reports on Efficiency Savings

State ratepayers should continue to fund energy efficiency initiatives after the current “public goods charge” expires at the end of the year 2001, according to a new report by the Natural Resources Defense Council.

In *Investments in the Public Interest*, NRDC energy policy analyst Cheryl Carter notes that, during 1998, the first year of public investment in energy efficiency under AB 1890, California’s restructuring law, some 582 million kWh in electricity – equivalent to providing power to 97,000 homes – was not consumed in the state. These energy savings produced \$190 million in net benefits, with benefits exceeding costs by a 2:1 ratio.

Since the California Energy Commission forecasts that 6,300 MW of unrealized cost-effective energy conservation exists in California through the year 2007, NRDC urges state lawmakers to extend the current levels of public funding for energy efficiency, as well as renewable energy development, low-income services, and Research, Development and Demonstration technologies.

Funding levels for public goods charges for purposes such as energy efficiency are well below those at the beginning of the last decade. These investments enhance reliability while delivering significant economic and environmental benefits.

For a copy of the report, contact Cheryl Carter at [Scarter@nrdc.org](mailto:Scarter@nrdc.org).

## Straw Homes

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has more straw bale residential units than any other county in the state, but many counties could surpass the dozen or so straw bale homes there in the coming years.

Given the newness of straw bale construction, each builder’s experience will likely differ. Stone noted that Placer County planners were very helpful when it came to permitting his straw bale home.

His primary frustration is not with local government, but with bank lenders. “It took me 22 months to get a loan,” Stone lamented.

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### LOCAL GOVERNMENT COMMISSION

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