

David Springer: Setting the Standard for EE



David Springer planned to be an environmental scientist. It was still a new field of study when he attended UC Davis in the 1970s, and David was particularly interested in the science of climate-appropriate buildings. "I got involved with the Davis Low Energy Research Group, the group that launched the first energy efficiency ordinance in the country," David said. "I also participated in planning an alternative community, The Village, which evolved into the world-renowned Village Homes project developed by Master Builder Mike Corbett."

David went to work for Mike Corbett, where he designed and built the first passive/active solar-heated home in California. "Solar was just getting underway, and the California Energy Commission had just formed," he said. "I then started my own business and was the one of the first specialty solar contractors."

David went on to teach other home builders how to incorporate solar panels and heating systems, provided training through the California Office of Appropriate Technology, and was an original board member of the Northern California Solar Energy Association. "I sold the contracting business and joined the California Energy Commission's now-defunct Solar Office," David said. "After a year, I knew I wasn't cut out to be a staffer."

He joined with Marshall Hunt and Richard Bourne to found Davis Energy Group (DEG) to innovate energy technologies in homes. "It was the 1980s and people were just becoming aware of energy efficiency. The State of California had new codes for buildings and appliances. We wanted to be on the cutting edge of designing mechanical systems for schools, office, municipal, multifamily and other building types, that would dramatically cut energy use."

David pioneered the use of plastic pipe for radiant heating and cooling systems, which helped reduce cost barriers and eliminated corrosion-related failures. "A Shell Oil engineer took notice of what we were doing," he said. "He proposed a national workshop to teach others how to design and install affordable, efficient, and comfortable radiant systems. Richard Bourne and I gathered about 15 other manufacturers of hydronic components and led workshops all over the country between 1984 and 1989." This collection of companies became an association that morphed into the Radiant Professionals' Alliance. Now, plastic pipe (PEX) is recognized as the only material to use for radiant heating.



"As this was happening, Amory Lovins of the Rocky Mountain Institute challenged Carl Weinberg, PG&E's Director of Research, that buildings could reduce their energy use by 70% using available technologies," David said. "PG&E then launched the Advanced Customer Technology Test for Maximum Energy Efficiency, called ACT2, to verify Dr. Lovins' claim, and brought us in to manage the residential part of the challenge. It was one of the most-exciting projects I worked on." Amory Lovins, Carl Weinberg, and Ralph Cavanaugh of NRDC served on the steering committee. "We had carte blanche to test our innovations on new and existing homes and saw how they worked in the real world," David said. "For the most part, Amory was right. We were able to reduce energy use by 70%, at least in new homes."



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Several now-standard innovations came from ACT2, like windows that use low emissivity coatings, attic radiant barriers, and high-performance walls. "We watched construction workers gather under the radiant barrier-equipped roof of our house to eat lunch. Clearly that technology was working!" David exclaimed. "During ACT2 we methodize the selection of energy efficiency measures, which NREL later incorporated into BEopt, a modeling tool extensively used by the Building America program."

For David, ACT2 set a new bar. Can available or emerging technologies be used to design buildings that generate as much energy as they use?

"We took a strong interest in cooling because many California homes need cooling only a few days of the year, which typically coincide with utility peak loads," he said. "Compressor-based air conditioners can also contribute to indoor air pollution by recycling particulate-filled air."

David joined the Alternatives to Compressor Cooling Project, a four-year effort initiated by the California Institute for Energy Efficiency that culminated in the development of the NightBreeze system. NightBreeze, for which David acquired three patents, delivers filtered, cool nighttime air to reduce or eliminate air conditioner energy use and improve indoor air quality. "Filtered outdoor air has fewer pollutants and particulates than recirculated indoor air," David said, "which delivers distinct health benefits."

ACT2 also led to DEG's participation in the DOE-supported Zero Energy Homes and Building America Programs. "We used BEopt software to optimize designs, evaluated emerging technologies, and used construction techniques to build single and multifamily homes that approached zero net energy," he said.

During the Building American Program, David and DEG worked with Mutual Housing California to design a sustainable, affordable multifamily housing development. Mutual Housing at Spring Lake in Woodland, California opened in March of 2015 to provide permanent, year-round housing for Yolo County's agricultural worker families. The housing complex was the first "Zero Energy Ready" rental housing development in the United States, a distinction that helped Spring Lake earn the prestigious World Habitat Award presented in partnership with the United Nations in 2018.



"Our team gave design guidance and provided the certifications necessary for the project to qualify under the Department of Energy's rigorous Zero Energy Ready Home program," David said. "Spring Lake meets requirements for exceptional levels of energy savings, comfort, health, and durability."

Spring Lake has 62 units, a community building, playground, and shared garden. Nearly 200 people, including 90 children, live in the development. Vanessa Guerra, a project manager with Mutual Housing California, said, "Energy efficiency is very important to us because the families we serve are low income; getting their utility costs down has a big impact on their day-to-day lives."

The units are sealed to a higher standard than required by California, mechanical ventilation systems provide the necessary amount of fresh air to maintain indoor air quality, and all heating and cooling ducts are located inside the conditioned space to eliminate heat loss. The project uses air-to-water heat pumps that provide heating, cooling, and hot water. ENERGY STAR-rated appliances and LED lighting reduce electricity use. During construction, the team developed innovative ideas about the location of the air barrier and structural requirements for advanced wall framing. Most residents pay only \$13 a month for utilities; PG&E's minimum charge for providing service.



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Resident Helen Corona said, "With my new ability to save some money I was able to invest in a car for reliable transportation. I also purchased new furniture and got rid of the old infested ones with the help of my children. I now have a very active and fulfilled life in the most stable home I've ever known."

"With Spring Lake, we saw a large-scale opportunity to influence people's comfort and health," David said, "and we applied lessons learned to student housing in West Village on the UC Davis campus and other projects. Our greatest opportunity to influence the direction of energy efficiency improvements is through the California Title 24 standards process. We led development of the 2019 California Title 24 residential codes and standards and are currently leading the team to develop the 2022 standards."

For the 2019 standards, David was personally responsible for an indoor air quality measure. "People spend about 90% of their time indoors, mostly in their homes. As building envelopes have become tighter, less air circulates and indoor air pollutants can be up to five times higher than outdoors," David explained. The 2019 codes, which go into effect on January 1, 2020, set a new standard for ventilation in single- and multifamily housing and upgrade the air filter requirement from MERV 6 (trapping about 35% of particles) to MERV 13, trapping about 85% of particles in the 2.5-micron size range known as PM2.5. "The MERV rating is important for health," David explained. "PM2.5 is a known health hazard that can cause premature deaths, aggravates asthma, and is implicated in other respiratory ailments."

Now David's attention is on another source of indoor pollution—cooking. "I was surprised to learn that cooking can create as much pollution as car exhaust." Natural gas stoves can release carbon monoxide, oxides of nitrogen, and other harmful pollutants, and cooking itself can generate particulates from oil, fat, and other food ingredients. Self-cleaning ovens create pollutants as they burn food waste.

"The best way to protect yourself and others from the air pollutants from cooking is to have range hoods that capture most of the pollutants," David explained, "and we're working on building codes that will set minimum standard for range hood capture efficiency. We're coordinating with a lab to test hoods and reviewing all manner of data on this topic. It's a new frontier for indoor air quality."



In addition to his engineering work, David is passionate about the environment. "I'm a hiker, cyclist, and back-country skier," he said. "I do a 1,000-foot climb every Friday and scaled Mount Shasta twice. From the top you become more aware of the concentration of particles and smoke in the air. The effects of California's increasingly common wildfires are evident, and the smoke impacts our ability to safely ventilate our homes."

David lives in Winters, California, and chaired the Winters Putah Creek Committee that advised Winters City Council about habitat restoration and is a board member of Friends of Putah Creek, which promotes low-impact habitat restoration methods instead of using heavy equipment as has been done in the past. David also has a seat on the Valley Clean Energy Alliance (VCEA) Community Advisory Committee. VCEA is a community choice aggregation entity serving Yolo County and the cities of Woodland and Davis. Once a week he volunteers time on the construction of the Matthew Turner, a new 130-foot, 39-berth tall ship being hand built in Sausalito. Once finished, the ship will be used to educate young people about oceanography and to teach teamwork.