



Dollars and sense: the logic behind implementing sustainable systems

THIS ESSAY augments my presentation at the Western Conference at Asilomar: Implementing Mainstream Alternative Energy Heating, Ventilating, and Air Conditioning (HVAC) and Indoor Air Quality Systems in Timber Frames. I addressed design and demonstrated components at Asilomar; I will focus here on the rationale to justify the mainstream adoption of these systems. The bottom line is that the pro forma financial analysis of a project drives what is put into practice. Regardless of one's position on the environment, if the numbers don't work, the systems will never gain widespread adoption.

I am always amazed at Americans' myopic understanding of our contribution to greenhouse gases, fossil fuel depletion, and global pollution. Recently I witnessed a soccer mom driving a large black Hummer to drop off two elementary school children at an affluent private school in one of the wealthiest counties in the U.S. Attached to the bumper of this beast, originally designed to

deliver six to eight combat troops into battle, was a "Save the Rainforest" bumper sticker. The irony of this statement is missed by most suburban Americans. My exposure to the cultures of Western Europe and Japan—through TFG-sponsored adventures—has enlightened me to the stark contrast of viewpoints between our own culture and our overseas neighbors. Analogous to the contrast between stick built homes and timber frames, taking the long, rather than the short, view dramatically alters what is built.

The technologies I propose offer these advantages over conventional systems: lowest life cycle cost, better comfort, higher safety, better indoor air quality, longer equipment life with less maintenance, less aesthetic impact on indoor living spaces, more versatility for complex applications, and, finally, environmentally responsible alternatives.

The real reason alternative energy systems are not commonplace in the United States is the conflicting pri-

orities between developers and home owners. Purchasing criteria are established by the developer's marketing staff. (This is tantamount to tobacco manufacturers sponsoring smoking cessation clinics.) The builder/developer is driven by the *pro forma*—the financial spreadsheet that shows return on investment, profitability, costs, etc., on a project basis. As most builders reading this essay can relate, the factors that drive success or failure on a project are different from what the consumer expects after they move in. The *pro forma* creates the metrics to monitor the impact of design on the builder's priorities of cost, schedule, and risk, yet it ignores the factors important to the consumer: health, comfort, safety, operating cost, and maintenance.

Homeowners are surprised to learn that ecology-friendly solutions are actually more cost effective than traditional HVAC systems. As Detroit was in denial that quality and cost could be achieved at once, W. Edwards Deming and the Japanese auto industry delivered high quality cars at a lower cost (and with better fuel economy) than American manufacturers.

With few exceptions in hundreds of implementation examples, the life cycle costs of green systems are substantially lower than those of typical systems installed in conventional production spec homes. The life cycle costs of a heating and cooling system include the initial cost (the only factor considered by builders), financing cost, operating cost, interest deduction, tax credits and rebates, and maintenance and replacement costs. In most cases, integrated HVAC and power systems are cash flow positive on day one. More specifically, the consumer pays less to the bank each month to fund a green system (to pay back a higher initial investment) than they pay to the power company to operate a conventional HVAC system.

Ironically, the one exception to this statement is solar photovoltaic (PV) power—the fastest growing industry segment of alternative energy in the United States. For every \$10,000 spent on the roof to install a PV system, the expense offsets only \$15 in energy bills (assuming a cost per kilowatt-hour at ten cents). The most cost effective approach is staging implementation within a strict

and linear design process, which puts solar PV as the last consideration.

The method I propose prioritizes residential HVAC and energy improvements, forcing intentional design for energy efficiency and improved indoor air quality in existing residential structures as well as new construction projects. The priority list is in an order to provide the highest payback at the lowest installed cost while preserving or improving indoor air quality. After fixing the building envelope, the priority is first to reduce energy demands of HVAC systems and then find alternative energy systems to meet power requirements. For example, for every \$1 reduction in demand, the consumer saves \$5 in capital investments to provide solar PV power.

1. Design for passive solar impacts (whether heating or cooling)—new construction.
 - 1.1. Correct building orientation
 - 1.2. Appropriate window selection for orientation and exposure
 - 1.3. Suitable shading over windows and doors based on latitude
 - 1.4. Thermal mass incorporated within the conditioned space
2. Seal air to reduce convection losses (supported by blower door testing).
3. Insulate to reduce conduction losses (first attic and then walls).
4. Upgrade heating and cooling systems and/or zone systems using:
 - 4.1. Geothermal heat pumps (in any climate)
 - 4.2. Radiant floor heating (in or under floor)
 - 4.3. Radiant ceiling cooling (if using a reversible water-to-water heat pump)
 - 4.4. Zoning forced air systems (when tied to geothermal heat pumps)
5. Integrate domestic hot water with heating/cooling system.
6. Add alternative power.
 - 6.1. Wind. If no resource, then
 - 6.2. Water (micro hydro). If no resource, then
 - 6.3. Solar Photo Voltaic (flat panels), then
 - 6.4. Solar Photo Voltaic (thin film)

I have received emails and phone calls from a number of individuals requesting more information and specific recommendations for implementing these technologies. I also received an email from David Blackwell, the TFG Conference Coordinator, stating that the pre-conference seminar and conference presentation in Asilomar was very well received. He suggested that if there is widespread interest within the Guild to understand this technology, we could provide a section on the Guild website for that purpose. If you find the content of the Ecologic columns to be useful and want to know more, send an email to David at blackw3@hughes.net expressing your interest.

If you have questions or thoughts you'd like to share to me, please do. You can reach me at 303/877-5776 or alwallace@covad.net.

Thank you. I look forward to seeing you at Montebello this fall.
—*Al Wallace*

Asilomar proceedings on web

THOSE WHO missed the Western conference can look through the topics covered by going to www.tfguild.org and downloading the proceedings PDF (in color).