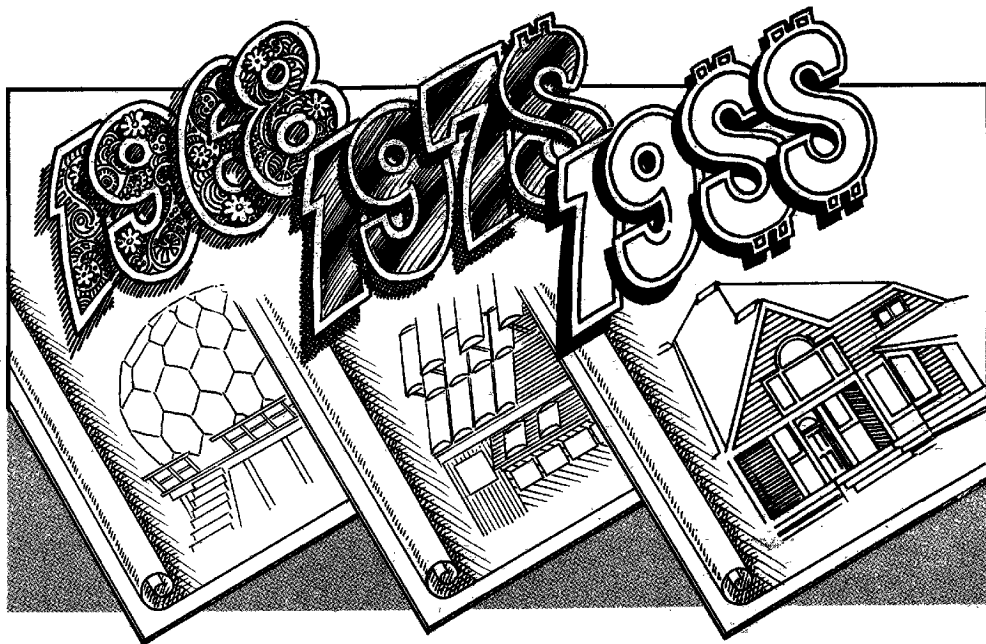


How To Survive and Prosper Building Low-Energy Homes

Success requires tempering missionary zeal with good business sense

by Charles Wing



"It's no longer acceptable to buy a truckload of material, nail it together, call it a house, and hope that it works." With these words, Bill Eich of Spirit Lake, Iowa, speaks for a new generation of builders.

Many of these builders got their start in the period following 1973, when the Arabs unwittingly introduced a powerful marketing strategy for energy efficiency—basic fear for survival. Jimmy Carter proclaimed energy conservation the moral equivalent of war, and the government poured millions into energy conservation research. No idea was too kooky. And into this vacuum stepped hundreds, maybe thousands, of idealistic young builders, each eager to save more Btus than the last.

But times have changed. The trade magazines no longer feature plans for breadbox water heaters, and energy bureaucrats are scrambling to collect their last paychecks. More to the point, a homeowner survey in the December 1987 issue of *Professional Builder* reports that energy conservation is no longer a leading consumer hot button. In fact, only 3 percent of home buyers now list energy efficiency

as their primary reason for buying a new home. And sunrooms were the only energy component that made it to the top ten design features (ranked eighth, behind such things as home entertainment centers and cathedral ceilings).

So where are all these energy-efficient builders today? How have they coped with the realities of the building industry and a changing market? And how have their businesses grown and matured, or failed? These were the questions put to me by *New England Builder*.

To answer them, I identified about a dozen energy-efficient builders ranging in size from \$50,000 to \$15,000,000 in annual sales and asked each 34 questions about their financial and emotional well being. Many of their answers caught me by surprise. This is not a group of incurable do-gooders living off trust funds, but a diverse and pretty happy bunch that has staked out a segment of the housing business and is doing just fine, thank you.

Following is a summary of my questions and their answers.

Q: *How long have you been building?*

All but two had been building between ten and twelve years, meaning they had begun, just as I had expected, in the energy heyday of 1976-78. Most of those had started in the owner-builder movement, "building hippie houses," as Nancy Hazard of Greenfield, Mass., put it. The most zealous I talked to, however, had been building in the Midwest for twenty years and had caught the religion late in life from a seminar taught by building scientist Joe Lstiburek.

Q: *What is your motivation for building energy-efficient houses?*

Using phrases such as: "the right way," and "doing the right thing for the client," these builders revealed a philosophical commitment that still burned in their breasts. Several credited their parents with instilling a conservation ethic. One said, almost plaintively, "I've tried it the other way and I just can't hack it!"

One of the better-known superinsulation builders, Roger Beaulieu of Roki Associates, however, admits that building energy-efficient passive-solar houses for a living was his wife's idea—a solution to Roger's discontentment as a pharmacist. Roger went along with her suggestion because he recognized a market niche that he, with his experience

as an owner-builder, could tap. Roger is now expanding Roki into commercial development and real-estate investment, while his partner continues on the original superinsulation course.

Q: *Do you still enjoy building?*

Due to growth, few get to swing hammers any more, but the transition to management seems not to have dampened their enthusiasm for the building business. Except for R.I. builder Art Boyce who has gone into real estate, all still enjoy it; several "live for it." One, who had better go nameless, was on a high because his wife and children were away, allowing him to work eighteen hours a day. After twenty years, Bill Eich loves it, "especially since I've learned how!"

Q: *What part of building do you enjoy the most?*

These builders enjoy solving complex problems; the word "synthesis" occurred again and again. R.I. developer Dan Paquette gets "visceral satisfaction" from taking a project from concept to completion, from a raw piece of land and an owner's vague notions to the finished product he will someday point out to his grandchildren. To Doug George of Nashua, N.H., it's the traditional rural New England value of "getting the job done." In addition to building it right and building something

that will last, Bill Eich derives pleasure from his earned reputation as the best builder around, a builder who can count his clients as friends.

Q: *What part do you enjoy the least?*

Nearly all had a hard time dealing with money. Several times I felt religious overtones creeping into the conversation: "building is righteous"; "money corrupts"; "money is the source of all evil." Projects that had started gloriously ran amok in the end because of the mounting financial pressure cost overruns placed on contractors and homeowners alike. A few, however, claimed they had solved the money issue. "The key," says Eich, is to be "totally up-front with the customer, even to the point of showing him your expected profit margin."

Running a close second was the frustration of dealing with subcontractors. Ex-builder Art Boyce gave up the business because he was "tired of dealing with jerks," a category that included not only clients and subcontractors, but bank appraisers as well.

Boyce also mentioned a growing problem for innovative builders such as himself—the liability of trying new design ideas for clients who don't understand building, much less the risks of innovation.

Q: *Do you make enough money?*

Most felt that, after an average of twelve years of "giving it away," they had finally identified their true costs and were accurately billing the customer. They had learned business management in the school of hard knocks, but considered themselves successful businessmen at this point. Several cited articles in *NEB* as major sources of their management education.

Two stated that the market could never fully bear the true value of their work, reflecting extreme pride in their product more than frustration with business success. Uniquely, Nancy Hazard admits that she has never gotten past that point of billing her customers for the hours she thinks the job would have taken were she a better builder.

Q: *If you went bankrupt, would you start over?*

I stopped asking this question after four in a row seemed unable to comprehend, much less contemplate, the question. Bankruptcy is apparently reserved for the spiritually weak. A builder has a "moral obligation to his workers and their families," one said. They would all cut back, make do, build McDonalds, anything but quit!

Q: *Do you think better management and/or marketing techniques would help your business?*

Passive Solar: Now & In the Future

by Mark Kelley

We don't hear much today about passive solar, mainly because it's rapidly becoming a part of mainstream custom building. It's important to pause and look at the state of passive solar today, and what we can expect in the future.

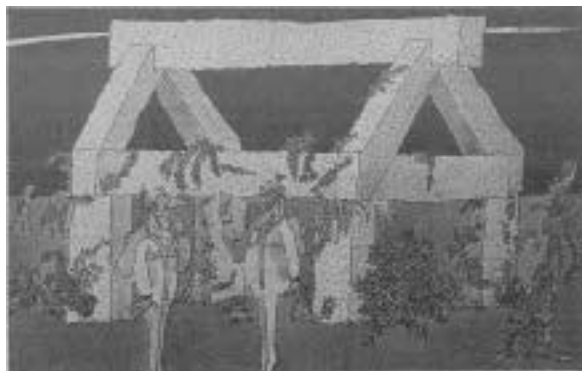
Passive Direct Gain

The most popular solar technique today is direct gain. At its simplest level, this amounts to little more than adding glass on the south side of a house. This can help, but with limited results. Unless the extra glass is coupled with thermal storage, the collected energy will be wasted, the house overheated, and perhaps the fuel bill even increased! With the high levels of insulation common today, there is a greater potential for overheating in the winter, because the strong shot of solar heat is trapped. In fact, if the south glazing exceeds 10.5 percent of floor area (in a 5,000-plus degree-day environment), you run the risk of overheating. For these designs, our rule is to do more precise analysis.

Low-emissivity (low-e) glass can also help. It reduces overheating since it lets in much less solar energy than standard double glazing, but this effect is compensated for by its higher R-value. Researchers at the Solar Energy Research Institute (SERI), found that low-e glass yielded significant energy savings whether used on the south or the north. It is a good bet for cold, cloudy areas like the Northeast, where this type of window can save 20,000 to 30,000 Btus per square foot per year.

But even with low-e, it is easy to go overboard. *Passive Solar Heating Analysis* is a good design manual you can use to make sure you aren't using too much glass. (ASHRAE, 1791 Tullie Circle, N.E., Atlanta, GA 30329). *Guidelines for Design of Passive Solar Homes* (PSIC, 2836 Duke St., Alexandria, VA 22314; 703/823-3356) is specifically geared to the New England climate. There are also software programs (see "Energy Design and PCs," *NEB*, July 1987) that do the same thing.

The best part of direct-gain design is that with careful attention, the homeowner can enjoy light, warmth, views, openness, and comfort without sacrificing energy savings.



Two twenty-first century archaeologists discussing their find: a granite post-and-beam house built during the 1970s when the concept of "the more mass the better" enjoyed a short-lived popularity with the solar cult.

Isolated Sunspace

For those who want maximum passive-solar performance, particularly in the colder, cloudier regions, an isolated-gain sunspace (one separated from the house by an insulated wall) is a good choice. When it's sunny, the sunspace can be opened to the house, or the heat can be transferred to the house by a fan. There are some good, simple automated fan and control systems. When it's cold and cloudy, or dark, the space can be closed off, acting as a thermal buffer for the main living spaces. Besides contributing and saving energy, such spaces offer a wonderful environment for plants, breakfast, or entertaining, and often serve as a focal point for the home.

There has been a lot of confusion over the years as to where to put the mass in a sunspace. Should there be a mass wall between the house and the sunspace? Or a massive floor? Putting the mass in the floor of the sunspace returns the stored heat only to the sunspace—a good idea if the goal is to keep the sunspace warm. Putting the mass in the wall between the sunspace and house delivers some stored energy to both, but may rob the house of energy in cold, cloudy weather and may block the view. Putting the mass in the house—or using the drywall, floors, and ordinary materials of the house as mass—delivers the most solar en-

ergy to the main living spaces.

In general, thermal storage in a sunspace works best if it is located where heat that it loses is useful to the home. Thus, a well insulated slab on grade can provide good storage, but an elevated slab that can only lose heat to living spaces, not to the ground, is better.

The Future

Although solar design progress seems slow lately, there is actually a tremendous amount of research going on that promises to fuel a new cycle of change.

Glass. Low-e glass is only the first generation of high-performance glazing systems. Several breakthroughs in glass research indicate R-values approaching 10. Also coating technology will give us the ability to allow light in without heat, and holographic surfaces will direct daylight deep into the building while evenly illuminating the whole ceiling. These changes will have a significant effect on design.

Heat Movement. There is also promising research in the area of heat delivery. We now have a much better idea of how natural convection works in houses. Methods are now available to tell how much heat will move through a doorway naturally and what the final temperatures will be in each room. With tighter, better insulated houses, and particularly with super-

glass, there are fewer cold spots and less reason for multiple registers or baseboards on outside walls. Simplified heat-distribution systems will soon be accepted—particularly in smaller houses.

One other interesting development is something called *boundary layer transport*. Simply put, this means that by placing a layer of glass or film near south glass so it becomes heated, the hot air rising along it gets moving very fast in the layer next to the surface. The heated air can be thrown toward the north side of the house, transporting heat far more effectively than open doors or even fan systems. Tests have demonstrated the potential for a 200-percent improvement over today's sunspace designs. It may be as simple as a low-e coating on the second surface with heat-absorbing tinted glass on the inside so it gets hot.

Thermal Mass. The possibility of embedding material in drywall that will increase its ability to store heat has been suggested before, but suddenly the idea is being taken seriously. The material is called "phase-change" because it changes its structure at a certain temperature, storing or giving off a lot of heat (water to ice is a "phase change"). U.S. Gypsum is actively involved in developing the idea. There are a number of promising materials that are inexpensive, change phase at the right temperature (70°F in the North, lower in the South for passive cooling), and increase thermal storage by a factor of ten. Surrounding all the living spaces with a thin layer of such a material would discharge the heat rapidly when needed (such as at dawn). More glass could be used without overheating, with overall improved solar performance.

Where To?

The new developments discussed here point to higher performance, easier design, greater comfort, and the eventual elimination of auxiliary heating systems—all worthwhile goals. ■

Mark Kelley is an energy systems engineer and head of research and development at Acorn Structures. He is actively involved in solar energy associations at the local, regional, and national levels, and is a member of ASHRAE.

Though even the smallest builder was spending 20 percent of his time on paperwork, none felt that management was a significant problem. Most considered "marketing" unnecessary, relying totally on word-of-mouth from satisfied customers. The more aggressive, growth-oriented builders snagged work by demonstrating superior knowledge at public seminars and workshops. Perhaps the most aggressive, Bill Eich arms his potential customers with complex energy and moisture questions he knows the competition will flub, then just sits back and waits.

Q: Where do you get your knowledge?

All read the "better" building periodicals. All had attended building conferences in the past, but most would now attend only if the conference were in their back yard.

Q: Are there fewer energy-efficient

builders today than a few years ago?

Definitely not—in fact there are more today. Several referred disparagingly to "R-19 energy-efficient builders," a reference to the growing percentage of conventional builders who introduce some energy details only because they're forced to by code or by example of the leaders. Homeowner

One builder had stopped strapping inside walls because it took too much time. Another just started the practice because he felt it saved time if you included wiring.

expectations have made R-19 walls the new minimum standard in the frostbelt.

Q: Do your customers understand what you do and why you do it?

Even though homebuyers seek out these energy-efficient builders, few know enough to understand vapor barrier details or the concept of the house as a system. As one builder put it, "They've read just enough to throw around terms and confuse the issues." Most builders hope the client will simply accept their words, although the *Professional Builder* survey showed that only 15 percent do so, with 69 percent wanting a written warranty or guarantee. Two builders take the opposite tack: they assign The *Superinsulated Home Book* by Nissen and Dutt as required reading before groundbreaking. An unexpected bonus has been fewer arguments over money. Write that down!

Q: What building techniques have you tried and abandoned?

It seemed that every builder had a different answer. They included: underground houses, shed roofs, numerous poly details, caulked (versus gasketed) framing joints, double-studded walls, sloped glazings, window insulation, and Tyvek over cathedral ceilings. Because time costs money and complexity costs time, the universal theme was simplification. The kicker, however, was the lack of agreement as to the simplest ways to build. One builder had stopped strapping inside walls because it required too much time, while another had just started the practice because he felt it saved time if you included wiring. Some felt very strongly that foam sheathing was simpler on the outside, while an equal number felt it was simpler under the drywall. There were definite trends, however, away from double-studding and toward the use of foam sheathings for that extra-R punch

and away from poly envelopes and toward the gasketed-ADA approach.

None of the builders had much faith that new design ideas or details (including ADA) would make life simpler. They seemed resigned to a choice of less-than-perfect options and most often let their crews make the final decision. They were considerably more optimistic about the possibility of new and simpler products, however. Mentioned were: better foam sheathings, totally integrated HVAC/DHW systems, efficient lighting fixtures, and higher-R windows.

Roger Beaulieu sometimes has to remind his carpenters that they are building houses, not furniture.

Q: *How much more expensive (than tract homes) are your houses due to greater energy efficiency?*

One builder who built just one home per year reported a tab of 10 to 15 percent. He acknowledged that the high figure might reflect the fact that every house is a "learner" for his crew. I found it interesting that the rest estimate between 1 and 5 percent, in contradiction to studies of several years ago which pointed to 5 to 10 percent. I believe the builders have their numbers under control. The difference simply confirms the fact that these builders have weeded out the more time-consuming details.

Q: *Are your crews better than average?*

It was agreed that educating seasonal pick-up laborers was prohibitively time-consuming. But most of the builders were sure that their core crews were better than average, and that this was a major reason for their success. For this added skill at least half of the builders paid no premium, yet turnover was very low. Two reasons were offered: (1) The owners/managers were committed at all costs to providing stable year-round employment, and (2) The crews shared the company's (the owner's) building philosophy, and considered working for that company a badge of distinction. Roger Beaulieu, in fact, sometimes has to remind his carpenters that they are building houses, not furniture.

Q: *What is the possibility of another "1973 energy crisis" within the next ten years?*

One builder considered the question irrelevant since current fuel prices justify energy-efficient construction. The rest felt they were protecting their customers from the nearly 100 percent chance of another Mideast-sparked energy crisis within the decade. Three, in fact, put the odds at "more than 100 percent." Perhaps that tells us more than anything else. ■

Charlie Wing is editor of the Building and Remodelling Index, and author of several widely-read books on energy-efficient construction.