GREENING OF A HOME PERFORMANCE CONTRACTOR

A contractor shares his odyssey toward considering himself—and advertising himself as—a green builder.

BY GREG THOMAS

PERFORMANCE SYSTEMS

Jon Harrod of Performance Systems Contracting uses an infrared camera. He will later show the customer the heat loss and cold air movement so that they have a concrete visual image of their energy problems.

How many times have you tried to explain what you do for a living? You say home performance, and your new acquaintance nods blankly. You know better than to say energy efficiency or, even worse, energy conservation; those are real sleep inducers. So you start talking about green buildings and indoor air quality. You see some light of recognition and then your acquaintance says, "Oh, do you put in solar panels?"

After too many times of saying, "No, we install energy efficiency improvements and you really should improve efficiency before you invest in long-term paybacks like PV, and you really ought to fix your existing house instead of building a new strawbale house," and then having the new acquaintance immediately lose interest, I decided that our company would at least start installing solar PV panels. Solar electricity and green building have been getting a lot of free publicity through newspaper and magazine articles and societal support. This social marketing effort is bigger than all the investments that EPA and others are making in marketing the Energy Star label. So if you can't beat 'em, join 'em, and bring your Energy Star with you (see "Letting Green Do Your Marketing," p. 27).

Real-Life Education

A number of years ago, as a single dad, I brought my kids to an energy efficiency conference where I was doing a presentation. And it wasn't just any energy efficiency conference, but a conference focusing on K-12 energy education. I was responsible for my own lodging, so I got a room at a local bed-and-breakfast (B&B) that was marketed as a green building. When we landed at the airport and trudged over to the rental car agency, it didn't have any compact cars left. So the agency offered us a free upgrade to a brand-new sports-utility vehicle (SUV). I was not interested in the SUV or in driving up to the green B&B in an SUV. My son, Brendan, however, was ecstatic. I explained why I wasn't, but my resistance did little to dampen his enthusiasm. All it did was put me in the position of denying him. Not wanting his experience of my ethics to be one of denial, I acceded to the SUV, but explained my position.

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These PV panels on a house at EcoVillage in Ithaca, New York, make a very nice billboard for renewable energy. The house is super-efficient also, but efficiency is not nearly as visible.

We got to the B&B and the conference. We all had a great time. My kids were the only kids there, and all the vendors of educational materials were thrilled to have real kids to talk to. As a result, my kids got a great energy education from someone besides Dad. My son met the conference plenary speaker at the B&B and got him to sign the speaker's book that he had won in a raffle. Then, during the speaker's talk, after the review of all the environmental disasters around the world, this speaker paused and said, "So what can we do, here at home? The most important thing we can do here is to stop driving SUVs." Brendan was mortified and gave me a look to match. The chickens had come home to roost.

Later that same day, we went to the exhibit floor for the American Solar Energy Society conference that was being held in the same town. Toyota had one of their first Prius cars at the conference. It was so new that all the dash controls were labeled in Japanese. Brendan fell in love with the car. It was new, cool, high-tech, and green, all at the same time. He could have his cake and ride in it too. He didn't have to deny his desire to be cool in order to be environmentally responsible.

This same challenge is facing home performance contractors. How do we position home performance as cool, high-tech, and green? You and I both know that improving the energy efficiency and performance of existing housing is one of the very best ways to improve our environment, but this truism is not at all well understood by people you might talk to informally at parties, or more importantly, by potential customers. How bad is it? It is so bad that when we recently ran a full-page newspaper advertising insert, with all sorts of information about efficiency, and one small mention of solar, 80% of the leads we got were solar leads. And this was in New York State, where the New York State Energy Research and Development Authority (NYSERDA) has done a great job of advertising the benefits of home performance to consumers. We got the same relative levels of response in our more progressive hometown, Ithaca, as we got in the nearby, but more conservative, Elmira. The local paper is always doing articles about renewable energy; it hardly ever publishes articles about home performance.

If you need any further confirmation of the growing market appeal of solar, take a look at California. There, a Republican governor put his Hummer behind a massive solar subsidy program, despite the fact that energy efficiency has better paybacks and more impact on the environment per dollar spent (see "Environmental Trade-offs," p. 28). But governors understand politics, and the public is behind solar in a big way—much more so than it supports just another humdrum energy efficiency program.

To appreciate the rising tide of green building's popularity, take a look at the U.S. Green Building Council (USGBC) annual conference, the Greenbuild Expo. My company, Performance Systems Development, Incorporated, had the honor of helping to start and support this conference and experienced its rapid growth firsthand. For the first year's conference in Austin, we had hoped for 2,000 attendees; we got more than 3,500. In the second year, in Pittsburgh, there was a repeat performance with over 5,000 attendees. In the third year, in Portland, there were over 7,500 attendees. And all bets are off for the November 2005 conference in Atlanta.

Still, I don't want to get trapped by the green label. We are helping many people who don't care two bits about the green aspect of what we do and in fact may consider solar and green as being too far out. I don't want those customers to perceive our company as only doing green building and solar. So we have moved gingerly into solar and are walking a careful line. We don't want to get left behind, and at the same time we don't want to get too far ahead.

Green Recognition for Building Performance

We are moving to green in large part because the public recognition of green does not include building performance, even though building performance is, or ought to be, the critical foundation of any green building project. Unfortunately, it is not only the public who fail to recognize the value of building performance. Not all buildings that are built to what the market considers green have good building performance characteristics. For example, two of the buildings at EcoVillage in Ithaca, where the owners took what they considered to be additional steps to make their buildings

green, ended up with performance problems as a direct result of taking those steps. The additional green features increased energy use and created building durability problems. In one case, the owners chose to build with strawbale but didn't compensate for the high level of air connectivity in the strawbales; this created pathways for air to reach the roof deck and cause ice dams. In the other case, the homeowner thought it would be greener and more self-reliant to install owner-built windows—as an uncontrolled label, green is in the eye of the beholder—but these windows were so leaky that we were unable to get the building to pass Energy Star certification. In the rest of the housing development, the typical Energy Star rating was over 90. These green-motivated owners wanted to go beyond the standard to do something better—but without a clear understanding of, and respect for, building performance issues, they ended up worse off. Clearly, taking control of a building and producing a high-quality, low-impact living environment can be made more difficult when natural materials are installed without regard to building performance issues.

It is very important for the building performance community to reach out to both the green building community and the general public to help both sides to understand how green building and building performance work hand in glove. Seek out the green builders in your area and start to educate them in the principles of building performance, emphasizing the common ground that we already have. Systems thinking is at the heart of both green building and home performance. We teach people to think of the house as a system. True green building expands that approach to thinking of the planet as system. Draw on this common perspective to communicate with green builders. In the commercial sector, it is already clear that the demand for building performance and energy efficiency services is being driven by the market appeal of green building. Will the same thing happen in the residential sector? I think so!

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This older home in Ithaca, New York, has a pretty serious problem with heat loss through the roof, leading to ice damming. What would be better for the owners—and the planet—a new PV system or some attic insulation?

More Than a Green Makeover

So what does it mean to truly be green? A lot of organizations are trying to establish thresholds of greenness that can be used to support the marketing of green labels. The National Association of Home Builders (NAHB) has just launched a new green building program (see "New NAHB Green Building Guidelines," p. 11). Regional green building programs are also popping up around the country. And the USGBC is looking to apply its success in the commercial market to the residential market (see "The Evolution of Green Building," *HE* Nov/Dec '04, p. 30).

I personally like the categories for green that the USGBC set up for its Leadership in Energy and Environmental Design (LEED) building certification programs. These include sustainable sites; water efficiency; energy and atmosphere; materials and resources; indoor environmental quality; and innovation and design process. I also appreciate the member-based public process that established these categories and their associated point scores. I expect that the LEED for Homes rating system, when it comes out, will incorporate these same categories.

Energy is fundamental to any definition of either "green" or "sustainability." In the USGBC scoring system, energy is the category that has the most potential points. One of the basic metrics that the sustainability movement uses is the ecological footprint. Simply stated, a footprint calculation involves assessing the impacts associated with all aspects of a person's lifestyle and comparing that to the carrying capacity of the planet, assuming, for example, that all solar energy on the planet is successfully utilized. When one person uses more than the average carrying capacity, that means that eventually someone else has to go without. The more you use, the faster you will hit the point where the need for energy starts to cause serious conflicts elsewhere. Depending on whom you talk to, our country will reach this point either sooner or later—or it may have already done so. The ecological footprint idea is a key linkage point between the sustainability movement and the environmental benefits provided by energy efficiency poviders.

And beyond the problem of running out of resources, nonrenewable energy use also creates a wide range of pollutants. In fact, even renewable energy technology creates pollutants in its manufacture—just not as many pollutants and not in the same place as fossil fuels.

Closely related to a footprint is the concept of embodied energy. An embodied energy calculation captures the

energy use of the fabrication and transportation of building materials and incorporates those figures into a reckoning of the total energy use of the building. This goes beyond just figuring the building's operational energy use, as we in home performance are used to doing. Embodied energy calculations that I have been involved with show that 5%–20% of the total energy used for materials, construction, and operation of a building over its lifetime is embodied in the structure of the building. The less operational energy a building uses, the greater the percentage of embodied energy. So the more efficient a building you are creating—the common goal for both home performance and green building professionals—the more important that building's embodied energy becomes.

Another increasingly common metric for green building is the life cycle assessment (LCA). An LCA looks at products from cradle to grave—from materials extraction to product disposal—and it considers a range of impacts, from biodiversity to toxicity. This invites a lot of apples-to-oranges comparisons. For example, how do you compare the impact of a wood stud to that of a steel stud? At first glance the steel stud is "artificial" and the wood is "natural." But where did the wood come from, and what happened to the forests where the wood was harvested? Steel is very easy to recycle or even reuse, and nearly all steel already has substantial recycled content. In most cases, there is no easy answer. And we may not even want one, because if everyone used one product, that product's overuse might well result in a different LCA. Conducting a comprehensive LCA is difficult and time-consuming, and beyond the scope of most home performance contractors. However, LCA information for different building materials is available on the Internet, so home performance con-

LETTING GREEN DO YOUR MARKETING

Even a small mention of solar or wind power will do a great deal to make your company look green and will generate a large number of leads. Renewable energy marketing can open the door to clients who want to do something positive for the environment and have some money to invest, but who don't know exactly what the best investment will be. We ran an ad recently in a city outside of our typical territory and 80% of the generated leads were interested in solar electricity, even though solar was only one bullet out of ten in our ad. Here's how we turn a call from a customer who is interested exclusively in solar into a home performance customer.

These calls typically begin with the customer saying, "Hello. I'm interested in putting solar on our home, and I saw in your ad that you do solar."

And I always respond, "Great! Thanks for calling. Have you had a home performance inspection done yet?"

"Well, no. What is that? I want solar."

"Usually people want solar or wind because they want to lower their electricity bills, or live completely off grid, or they want to do what is right for the environment. The home performance inspection is the first step in all three cases."

"Really? I've never heard of it."

"Most solar and wind installers don't have the capability to be as thorough as we can, since we are an EPA Energy Star Partner and a Building Performance Institute-certified contractor. We can treat the whole house or building in addition to installing the solar and wind."

"Wow, that sounds like a lot. I really just want solar."

"The home performance inspection we offer is only a $150 deposit on future work done, and it includes a solar or wind site survey. It can potentially save you thousands of dollars on the price of your renewable energy system, and it can make your home more comfortable, healthy, efficient…"

At this point in the conversation, I've accomplished many important sales tasks already. I've introduced and started to up-sell an efficiency audit—our core business—and I've differentiated our company from the competition.

The audit gives a contractor a reason to charge for the renewable site evaluation, since he or she is also testing combustibles, health and safety, air infiltration, and energy reduction, and is providing a report. We've found that customers are much more willing to pay for this expanded set of services than they would be for just the site evaluation—and they generally stop thinking about those competing energy and solar services that don't look at the whole house as thoroughly as we do.

Before I learned to integrate the cost of the solar site survey with an efficiency audit, I had several interested leads that I couldn't close. I would take the call, and the customers were friendly and helpful, but when it came time to schedule a solar or wind site survey, they would balk at the $100 fee I was asking at the time. "I'm not paying for someone to come out to my site and look at shadows or walk around with a GPS!" So we went back and forth, and I would call them every so often to hear that they still weren't ready to pay a fee.

No one likes losing sales, so we brainstormed and decided that the up-sell audit technique was worth a try. Once I was able to explain clearly that we provide a unique, expert service that tests for many different problems that other contractors overlooked, the same customers who had refused to pay $100 for a renewable site survey were happy to pay $150 for the home performance inspection. This small shift alone raised our closing percentage by 30%.

—Caleb Crow

Caleb Crow is the content manager for Performance Systems Development.

ENVIRONMENTAL TRADE-OFFS

Given a limited budget, which home improvement measure is greener: completing a home performance retrofit or installing a residential PV system? Since carbon is a basic metric for climate change impact, it makes sense to translate this question into a comparison of the carbon impact of each approach. And you may be asked this question sooner than you think, because more and more people are paying attention to climate change impacts—from local and state governments to individual customers.

In order to make this comparison, you have to consider the carbon impact of the energy savings generated by each measure, and how long each measure will last. Home performance retrofits save all different sorts of energy, including electricity. Home performance retrofits have an improvement life that varies with the improvement. PV systems create electricity (kWh) without emitting any carbon, thus removing the need for electricity generated using a carbon-based fuel. Energy is used in manufacturing the solar panels, but these panels have an expected life of 30 to 40 years, producing carbon-free electricity, and the carbon emissions from creating the panels is offset after 5 to 7 years of PV electricity production.

Different types of power plant produce different amounts of carbon for every kWh they produce. Coal-fired power plants use a fuel with a lot of carbon per unit of energy, compared to natural gas-fired plants. Nuclear and hydropower plants produce electricity with no carbon emissions. But nuclear plants have other waste products that we are left to deal with. They all put power into the grid, and you usually don't know where your particular electron is coming from, although some utilities do put the power mix on the bills they send out. So to calculate the impact of carbon for 1 kWh of electricity you have either saved or displaced, you have to know the mix of power plants supplying power to your state. For our contracting company, I went to the Web site for the New York State Energy Research and Development Authority (NYSERDA). The state of New York has a higher percentage of nuclear and hydropower than is typical in the United States, This means that the New York fuel mix produces about 15% less carbon per kWh than does the average U.S. fuel mix.

The different fuels used in the home also produce a range of carbon emissions. These fuels include gas, oil, propane, wood, and even coal. The EPA has links from its Web site to various calculators that convert units of energy into carbon impacts. See, for example, http://yosemite.epa.gov/oar/globalwarming.nsf/content/ResourceCenterToolsCalculators.html.

I gathered the information on each fuel and entered it into a spreadsheet. I asked our senior building performance specialist for a typical Ithaca whole-house retrofit. The retrofit combined insulation and air sealing with a new heating system retrofit and a lighting upgrade. The total price tag for the work was just under $12,000, or roughly equivalent to the cost of installing a 3 kW residential PV system after state rebates. I used TREAT (see www.treatsoftware.com), the software used in the NYSERDA Home Performance with Energy Star program, and various calculations to come up with the carbon impact and life for each of the recommended improvements (see Table A). The total carbon from energy production saved over the lifetime of this installation was 357 tons.

The typical residential solar PV system has a rated instantaneous output of 3 kW. This rated output must be translated into a realistic estimated output for a full year for the specific solar exposure, based on the climate. We estimate the annual output for a 3 kW solar PV system in Ithaca to be 2,500–3,500 kWh. Over a generously estimated 40-year life in New York, the panels will save between 30 and 42 tons of carbon, not counting their embodied energy. A better solar climate might increase this number by 25% or so. In a different state that uses more fossil fuels in its power mix, generating electricity with

Table A. Home Performance Impact

Improvement	Cost ($)	Annual MBTU Savings	Treatment Life (yrs)	MBTU per lifetime	Fuel	Carbon Conversion	Carbon Emissions Avoided (lbs)
Sidewall insulation	2,250	20.20	40	808	Therms	11.742	94,800
Insulate floor over garage	770	12.00	40	481	Therms	11.742	56,500
Programmable thermostat	100	12.10	15	181	Therms	11.742	21,300
Install condensing boiler	4,900	52.60	20	1,050	Therms	11.742	123,000
12 compact fluorescent bulbs, 2 hr/day	90	0.37	10	3.69	NY kWh	0.595809	645
Energy recovery ventilation	2,350	-0.018	20	-0.36	NY kWh	0.595809	-63
Install indirect hot water tank	1,450	6.1	20	122	Therms	11.742	418,000

PV panels would result in greater carbon savings.

The impact of the home performance retrofits outweighs the impact of the PV system by a factor of about ten. I was pretty surprised at the order of magnitude difference. We are starting to include this information in customer presentations. To minimize carbon emissions, it's important to get the order straight. Insulate before you insolate—improve home performance before investing in PV—and the electric load reduction will mean you can buy a smaller PV system. Since we are both home performance contractors and solar installers, we can communicate this powerful information to our customers without seeming like we have a conflict of interest.

Table B. Equivalent Trees

Improvement	Carbon Emissions Avoided (tons)	Equivalent Number of Trees Planted
HP retrofit	357	1,070
PV Install low estimate	30	90
PV install high estimate	42	126

As part of our effort to translate the environmental impact from our work into a less abstract value for our environmentally minded customers, we translated the carbon savings we produce into a commodity. We used trees, because trees are friendly and tangible. But we found trees have their own interesting twists that make them hard to count—they grow. Should we count planted saplings or full-grown trees? What about the trees that die along the way? In the end, we chose saplings, since they seemed to best capture the concept of tangibility. Going out and planting saplings is pretty concrete. Based on a review of literature, without doing a climate-specific study, we decided that three saplings planted per ton of carbon would be a sound value (see Table B). So now we can tell our customers that they can retrofit their homes or go out and plant more than a thousand trees if they want to help the planet to the same extent.

tractors can start thinking in this way about the materials we are putting into our houses.

Health and safety is another important aspect of green building. A building that starts out green in terms of wise materials use but shortly turns green with mold (hopefully not black mold) not only wastes resources but may also be making people sick. Similarly, durability is a key consideration. Paraphrasing David Byrne of the Talking Heads: Build something once—why build it again? Resource-, construction-, and maintenance-related energy use is reduced if buildings are built to last and to adapt to changes over time. I like to recommend Stewart Brand's excellent book, *How Buildings Learn*, to both green builders and building performance types. Brand examines how buildings evolve over time to meet changing needs, and which types of building survive by continuing to meet their occupants' needs; his book is a sort of Darwin's *The Origin of Species* for buildings. One conclusion he draws is that buildings that perform well encourage people to take care of them. You can get people to spend the extra effort to take care of poorly performing buildings by making them architecturally significant—Frank Lloyd Wright was good at that—but for the rest of us, one of the best ways to get a building taken care of is to make it a high-performance building.

Another aspect of green building is minimizing toxins. One toxin that is, or ought to be, already on every home performance contractor's mind is lead. We have put all our crews through lead-safe training, and they automatically adopt lead-safe practices on every job that has any potential for lead exposure. We have been lucky to get additional training from the local weatherization lead trainers, the New York State Weatherization Directors Association. Another commonly encountered toxin is asbestos. We use only certified asbestos removal contractors. All our crews have their personal high-efficiency particulate air (HEPA) filter masks and Tyvek suits available at all times, and our supervisors reinforce the need to use safety practices.

What Have We Left Out?

Since performance is really the foundation for green homes, what is home performance currently missing? What does home performance need to be able to proudly receive public recognition for its inherent greenness? In addressing this question for my company, I have tried to focus on the big items. I don't want to get too caught up in the fuzzy details of trying to be green and lose sight of the big picture of making buildings work. But when my company can reduce our environmental impact by making clear and economically viable choices, we will make them.

We can go beyond our regular operations in several key areas. We can reduce our introduction of toxic substances into the environment. We can use recycled materials and recycle our own waste. We can improve the efficiency of our own operations. And when we implement changes that make us different, we can effectively communicate that to our customers.

First let's look at the materials we use. As home performance contractors, we install a lot of materials in the houses we work on. We should already be being careful about the toxins we might introduce directly into the home. But what about the hazardous compounds created and then lost into the environment, as seen in the LCA? The big-impact actions on the materials list are reducing materials with a toxic production process, eliminating toxic materials that can eventually get into the environment through the waste stream, reducing smog-causing volatile organic compounds (VOCs), and reducing gases that increase global warming. When we started looking at how to make our business greener, we came up with the concept of total toxic load. How do we avoid putting more toxic substances into the environment—not just in the house, but anywhere in the world, as part of resource extraction, fabrication, transportation, installation, or disposal?

The materials list for a home performance contractor is much shorter than

that for a home builder. Just nine items account for 95% of the materials we install. These items are insulation, windows, doors, air sealing, boilers and piping, furnaces and air conditioners, ductwork, lighting, and appliances. So let's examine these items.

Insulation. We mostly install cellulose insulation. Cellulose is created from waste wood fiber in the form of newspaper. It is treated with a boric acid fire retardant, a relatively nontoxic substance that, by the way, helps to control insects—a big winner, though we are getting some pushback from chemically sensitive folks who are concerned about the inks in the newspaper. Our response is to be sure that we install the cellulose behind a sealed air barrier when we can, especially when we are dealing with a client who is chemically sensitive. We are considering spray foams for certain installations and will choose foam that is based on soy oil, both for its reduced environmental impact and for its green marketing potential. Our installation process deals with lead and asbestos in appropriate ways.

Windows. We used to install a vinyl replacement window, because of its cost competitiveness and durability, but we have moved to metal or vinyl-clad wood replacement windows. The wood replacement windows reduce the amount of vinyl we are using. The production of vinyl has been targeted by groups such as Greenpeace for its impact on the environment. We like the low-maintenance aspect of the vinyl, but we see no need for the entire window to be vinyl.

Air sealing. We are working to reduce the amount of foam we use in air sealing, and are moving toward using mastics and other innovative techniques. Most foam insulation has propellant chemicals in it that degrade the atmosphere—either through smog production or by increasing global warming. Foams tend to be overused, even though they are not inexpensive; their main saving is in labor. Who has not seen a pile of foam used to fill a small hole? We are looking for labor- and cost-saving alternatives. For example, Darin Hughes of Hughesco, Incorporated, has started mixing latex with joint compound and spraying the mixture using a compressed-air setup.

Boilers and piping. The key green issue in installing boilers and piping are plastic piping and mercury. Mercury is a very persistent toxic substance that damages the nervous system at low levels of exposure. Mercury is found in switches, thermostats, controls, and the like. We avoid mercury in all our installations and are very careful when we remove it from the buildings we treat. We find appropriate ways to collect and dispose of the mercury we remove. I understand that Honeywell, a major manufacturer of thermostats and controls, has a mercury-recycling program. (There is a mercury recyclers association; their Web site is www.almr.org.) We still use PVC for exhaust piping. Combustion exhaust is not an area for experimentation. Metal piping has a history of failing when it is exposed to the corrosive acids in the exhaust. Other plastics lose structural integrity and sag at a lower temperature than PVC does. So we feel that this is an appropriate use of vinyl.

Furnaces, air conditioners, and ductwork. The challenges here are pretty much the same as they are with boilers, except for the effects of using flex duct and the global warming impacts associated with the use, and corresponding loss, of refrigerants. As home performance contractors, we know the performance hazards of flex duct and we are already on a mission to reduce its use. We also like to bury ducts with cellulose when we get the chance. There are several environmentally appropriate refrigerant choices for new equipment. The

THE BUSINESS ADVANTAGES OF HOME PERFORMANCE VERSUS RENEWABLE ENERGY

Doing home performance work has some basic business advantages over installing renewable energy technology. For example, solar installations are very subsidy dependent. Subsidies are nice if and while you can get them, but when they go away—boy, you better look out. As a survivor of the 1980s solar subsidy days, I can tell you that there wasn't much left after the tax credits went by the wayside. Even though we have diverse political support for solar energy at the state level, there are budget realities that may affect subsidies. And subsidies assume that the subsidized product will remain a niche market, since if there were broad market penetration there would not be enough government funds available to support the subsidy. There is hope that the prices will drop, but until that happens, variations in subsidies are likely to produce market instability.

Solar and wind analyses are also fairly weather dependent. You don't really want to be doing too much work up high outside when the weather is rough. Except in times of real boom, it is hard to keep a solar crew busy every day. These days, it is not often the swings in sales that cause slow days for solar installers, but rather the lack of available solar panels from the limited list of distributors and manufacturers. In contrast, home performance contracting seems to have a much steadier flow of work, and you can usually find something to do inside when the weather is poor. So our overhead cost per labor hour is probably lower than that of a strictly renewables contractor of the same size. We get some home performance subsidies now, but if the subsidies disappeared we would probably just slow down our growth; we would not feel as if our business were threatened.

Solar and wind installations and maintenance can provide high-margin work, but renewable energy work is risky as an exclusive long-term business model. Combining renewable energy with home performance seems like a great way to reduce risks and increase profits, for both home performance contractors and solar installers.

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This leaky window next to an old A/C condenser at a multifamily project in Syracuse, New York, is responsible for a lot of lost energy and unnecessary CO_2 emissions. Performance Systems is currently working with a developer on a private multifamily renovation that they hope to market as healthy and green apartments.

relative global warming impact of most refrigerants is very high. According to the Energy Information Agency, 2003 emissions of hydrofluorocarbons (HFCs), typically used in refrigerants, were equivalent to 111 million tons of CO_2, so capturing old refrigerants and preventing refrigerant leaks is a big way to improve the environment. We are also promoting ground-source heat pump systems as a choice in our climate, which has both a heating and a cooling demand.

Lighting and appliances. There is a variable amount of mercury content in fluorescent lighting. Research by groups such as Envirospec is helping to develop databases that large purchasers or even contractors can use to help them select lighting that is lower in mercury. Our nonenergy efforts in the appliance area are limited at this point to recycling. NYSERDA has wisely included appliance recycling in its refrigerator replacement program. Of course we install only Energy Star appliances, and we educate our customers about plug load issues.

Finally, there is the issue of recycling and reducing waste. We recycle and reuse houses by making them work better and last longer. This becomes increasingly important as land becomes more and more scarce. The greenest building you can build is not a new one; it is a reused old one. So the more we know about making existing buildings work, the bigger the positive impact we have on the environment. We also recycle waste at the job site and salvage materials like radiators. These reusable materials are donated to a local nonprofit materials recycler in exchange for donation receipts.

We continue to make our operations more efficient by taking into account the fuel economy of our vehicles when we purchase them, and by improving the efficiency of our building. We also purchase green products for use in our own office.

All of the above information can be used to help customers understand how we are greening our business. We put this information on our Web site and include it in our presentations to customers. The more they feel that we are treating the environment right, the more we will get referrals from customers who care about that part of our work.

Greening your business is the right thing to do, both to help protect the environment and to help create important linkages to a rapidly expanding market (see "The Business Advantages of Home Performance Versus Renewable Energy"). There are a lot of commonsense things we can do to take the next step to green our businesses. We may think we are already green—maybe even greener than the neighbors—but if we don't learn to speak the language and effectively communicate what we are doing, we may miss major opportunities. Residential green construction and remodeling is busy and growing, with or without building performance. My experience is that green remodelers, and even consumers, are ready to hear about the importance of building performance. Building performance is part of what they see as a general move toward best practices that include protecting the environment. We may tend to see green building as represented by the more fringe elements, as is often the case with social movements, but there are also a lot of solid practitioners who want to do the right thing and they see the right thing as green building. We are doing building performance for just the same reason. I think we have a lot to talk about together.

Greg Thomas is president of Performance Systems Contracting, a home performance contractor, and Performance Systems Development, a national consulting firm supporting contractors and efficiency programs.

FOR MORE INFORMATION:

Brand, Stewart. *How Buildings Learn: What Happens After They're Built.* Penguin Books, 1994.

There are two Performance Systems Web sites that offer information related to this article that may be helpful to readers interested in green building and home performance businesses: www.psdconsulting.com and www.pscontracting.com.

Some great links to LCA information include www.umich.edu/~nppcpub/research/lcahome/; an Australian Web site, http://buildlca.rmit.edu.au/casestud/Ee/EEresiden.html; and www.doka.ch/lca.htm#Sites.