Perception Vs. Reality

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Will the real green energy systems please step forward?

These days, corporations, educational institutions and government agencies appear to be leap-frogging each other to see who can demonstrate the "greenest" approach to their future existence. Going green has reached a point where not doing so might characterize one of these organizations as unpatriotic or apathetic about the environment.

Many design professionals working in these markets are now loyal disciples of the U.S. Green Building Council's LEED rating system. The goal of LEED is to quantify the overall environmental impact of a project based on some very extensive criteria, recordkeeping requirements, and an associated point-based rating system. The more points the project amasses based on these criteria, the higher its rating (silver, gold and platinum).

After talking with several design professionals about LEED, I get the impression that some buildings and their associated mechanical systems are now manipulated, at the design stage, specifically to garner LEED points. Although the LEED rating system is progressive and well-intentioned, it can never replace fundamental design scrutiny, decades of experience, or foresee all the synergistic possibilities that might be available for a specific project.

The LEED rating system undoubtedly has a big impact on the public's perception of what constitutes a green building or green mechanical system. But as we all know, perception and reality can often be quite different. Let's take a look at a couple scenarios that demonstrate this difference.

Follow My LEED

I read articles on a daily basis that cover the installation of renewable energy systems in private houses, educational institutions or corporate centers. The hardware being installed is usually hailed as a precursor of the future, an example of "green" technology or simply as the right thing to do at this point in history.

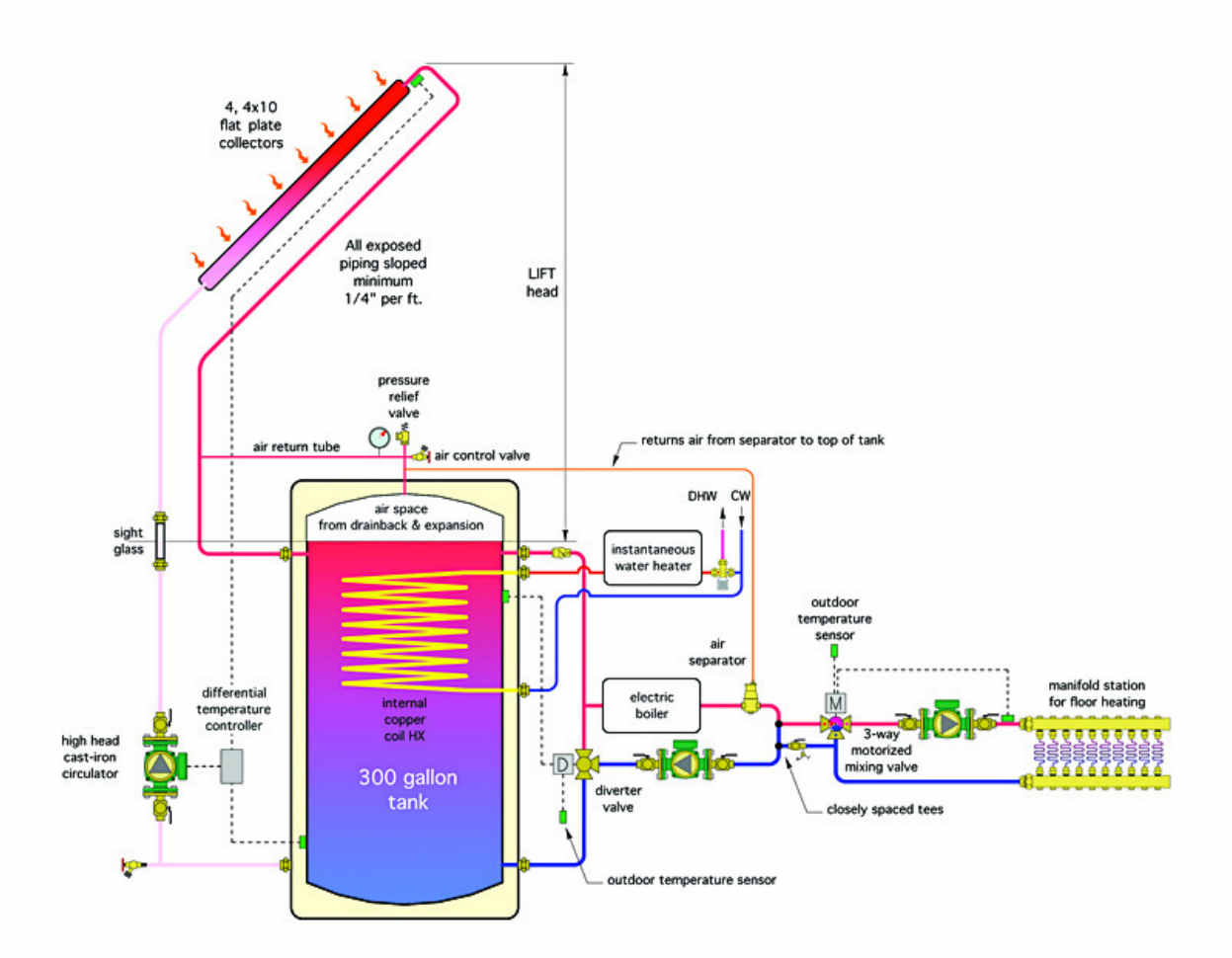
One example was a building in a major city with several small wind turbines fastened to its roof. The turbines are there to tap into the "urban wind environment."

Have you ever walked around in a major urban area on a windy day? At times it feels like you will be blown off your feet. A few seconds later — nothing, or perhaps a gust from a different direction. The bottom line is that most urban wind environments, especially in areas near high-rise buildings, are very sporadic and turbulent. This is not good for wind turbines from the standpoint of either energy production or life expectancy.

This consensus is supported by several authorities in the wind energy industry — authorities who want to see wind energy systems applied where they are appropriate, not haphazardly used in ways that ultimately harm their reputation.

However, wind turbines are certainly one of the most visible ways of harvesting renewable energy. They are kinetic and audible. A spinning wind turbine attracts attention like free food at a state fair.

So, if the intent is to demonstrate your commitment to the green movement, there is probably no better way of declaring that intent than to install a wind turbine. You might even want to order it bedazzled in custom colors as shown in Figure 1.



The vertical axis wind turbines shown in Figure 1 can be set atop the lighting poles in a parking lot. That's exactly what's being planned for the "green" expansion of a shopping mall close to where I live. People will see and hear these turbines spinning as they head from the parking lot into the stores. Perhaps it will impress upon them that the merchants at the mall care about being green, and as such should be supported financially. If so, it's an example of well-conceived marketing.

However, there are some questions that most of these mall patrons will never get around to asking. Questions such as:

- How much electrical energy have these turbines actually produced since they were installed?
- What was the total (nongovernment-subsidized) cost of installing them?
- What are the logistics and costs associated with maintaining them?
- How long will they last?
- How much energy was used in manufacturing and installing these turbines and their supporting equipment?
- How does this "embodied energy" compare to the energy the turbines will produce over their useful lives?
- What happens when the turbines reach the end of their lives?

These are the hard questions that separate the positive public relations aspect of having wind turbines on the property from the long-term viability and, indeed, "sustainability" of the concept being demonstrated.

All these questions can be answered through due diligence. It takes time and money to study installed costs, perform simulations, track performance records of similar systems and perform life-cycle cost comparisons.

Sometimes the answers are not what certain proponents want to hear. In such cases, justification for the installation must be fully supported by altruistic convictions rather than ROI (return on investment) numbers. That's OK, provided it's factually disclosed to others making their own decisions about similar applications. As for me, the concepts of "Do the math," "Show me the numbers" and "Follow the money" are still worthy of consideration.

Impressing Young Minds

I was recently asked to provide a small "advisory" role for a project conceived to demonstrate solar space and water heating on a college campus. A small building with several washrooms would be heated and supplied with domestic hot water by an array of solar collectors. The mechanical room below the collector array would be equipped with a prominent display window so passers-by could view the workings within. I'm not sure how this project was funded, but cost was never discussed in a manner that suggested it was highly important.

The system that ended up being installed involved multiple storage tanks, several bronze circulators, multiple flat-plate heat exchangers and several controls. Just the piping, fittings and valves for this small project would cost at least a couple thousand dollars. A schematic cross-referencing all this hardware would be displayed so viewers could attempt to understand what takes place on the other side of the display window.

In my opinion, this system was far more complicated than necessary, given the function of the building and the size of the load. It was also not a design that conveyed the appropriateness of solar thermal technology for such an application.

Instead, I pushed for a simple, single-tank drainback system like that shown in Figure 2. The only heat exchanger would be a coil of copper tubing inside that storage tank for domestic water heating. A standard, self-contained, motorized mixing valve would ensure that hot water from the solar storage tank would be tempered prior to entering the flooring heating circuits. One cast-iron circulator would handle the collector array, and two more would handle the remainder of the system.

The diverting valve in this system selects either the storage tank or electric boiler as the heat source. It's operated based on the temperature at the top of the storage tank and outdoor reset logic. The reset logic calculates the proper water temperature for the radiant floor circuits based on outdoor conditions — just like in a standard hydronic system. If the tank temperature is at or above this value, it serves as the heat source. Otherwise the diverter valve causes return flow to bypass the tank, and allows the electric boiler to operate. The use of electricity as back-up energy was specified at the onset of the project.

What can I say? You win some and you lose some.

It would be interesting to read the minds of the people who will now view this installation and decide for themselves if the solar thermal technology they see makes sense, both for this application and, more importantly, for some building they might someday help make decisions about.

Will they see this example of solar thermal technology as practical, understandable, affordable and repeatable? Or will they see it as something conjured up by solar geeks with plenty of grant funds?

If your intent is to convey the appropriateness, economic merit and true sustainability of renewable energy technology, the systems you provide must be simple and long-lasting. They should also be efficient, but not to the degree that trades off simplicity, affordability and reliability for the sake of harvesting every last Btu.

The propensity to build overly complex and costly renewable energy systems, especially solar thermal systems, is not unlike what the radiant heating industry went through, and in some cases still contends with. In applications where cost is not a primary concern, it's common to find systems that contain every bell and whistle. Although many are designed by competent and accomplished individuals, to the average consumer they convey a message of complexity, expense, frequent service requirements and general lack of understandability.

The greenwashing marketing angle that's currently in vogue has, in my opinion, almost reached a saturation level. If the frenzy to "greenify" our systems eventually results in unmet expectations or premature failures, we will see the current blow torch of interest dialed back to a pilot light.

Where Do You Come In?

The ability of nearly every renewable energy heat source to deliver its claimed performance rests on its underlying hydronic conveyance systems. It behooves hydronic heating pros to interject the best design and installation knowledge we can to the growing renewable energy markets.

Don't assume those already entrenched in the renewable energy field know what you do about modern hydronic design. Likewise, don't assume you know everything you need to about their specialized technology. Work together, share expertise and create systems that will stand the test of time. Those systems will ultimately prove their sustainability, as well as gain the public's acceptance and trust — regardless of how many green points they generate on some scorecard.

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