Re: High-Performance Buildings

In their recent article, "High-Performance Buildings: Lessons Learned" in the September 2004 issue, the authors (Paul A. Torcellini, Ph.D., Ron Judkoff, and Drury B. Crawley) describe the energy performance of six "green" buildings. I know a great deal about one of these, Oberlin College's Lewis Environmental Center (Scofield, J.H.. 2002. "Early energy-performance for a green academic building." *ASHRAE Transactions,* 108(2):1214–1230).

The authors distort this building's energy performance by: 1) presenting selective data gathered under questionable conditions, 2) inventing a "net-energy" figure of merit that is dominated by energy from the PV array, and 3) constructing an unrealistic and extremely inefficient baseline case for comparison.

Readers are left unaware of this because the authors neither state key assumptions nor do they cite the NREL document containing such details (Pless, S. and P. Torcellini. 2003. "Energy Performance Evaluation of a Low-Energy Academic Building – Adam Joseph Lewis Center for Environmental Studies, Oberlin College, Oberlin, Ohio," NREL TP-550-33180). They also fail to cite my earlier *Transactions* paper.

In the past 12-months the Lewis Center has consumed 151,000 kWh of electric energy, 36% of this supplied by its PV array. This consumption corresponds to an annual source energy of 114,000 Btu/ft^2 — about 10% below that for a conventional, comparable building. Readers can judge for themselves if such savings justify the more than \$500/ft^2 cost of this building. It is useful to note that the \$420,000 PV array contributes only \$31/ft^2 to the cost.

We have come to expect such half-truths and sound bites from architects promoting their own buildings. But the public requires and ASHRAE should demand more.

John Scofield, Ph.D.,
Associate Member ASHRAE,
Oberlin, Ohio

The Authors Respond

The article brings together a sampling of actual practice in the field and some practical experiences from using the technologies. Each owner is an "early-adopter" and made decisions based on their own values.

The question of measuring performance quite often is complicated by definitions of base case buildings, boundary definition, and issues surrounding fuel-switching. Any time one tries to compare the performance of an actual constructed building to a simulated reference case, there is bound to be controversy over the exact definition of the reference building. For this reason

we elected to use the formal ASHRAE rule set for defining reference buildings as specified in ANSI/ASHRAE/IESNA Standard 90.1 – 2001, Addendum *e*. This consensus-based definition requires that the same fuel types be used in the reference building as in the actual building, and specifies the base-line mechanical equipment. ASHRAE Journal articles must be short, so we were not able to discuss all the issues surrounding metrics or have an exhaustive list of references. Additional references are available under Reference 21.

The purpose of our study was to objectively assess the energy performance of each of the six buildings as they were constructed and to evaluate their performance against the design intent as stated by the owners and design teams. Oberlin's Environmental Center was constructed with a nominal 60 kW photovoltaics array, so the energy production of the array was included in our source energy results, and can readily be backed out of the net-energy figure with the data we provided as it is part of the building.

Neither the authors, NREL, nor DOE have a vested interest in the performance of the building, and we did not participate in its design. It would not have been objective or appropriate for us to render value judgments about the owner's design intent, or their use of project funds. There are many reasons for a design team to make design decisions, and only some of those decisions are driven primarily by energy or monetary concerns.

As a final note, our quantitative data is consistent with Professor Scofield's, and we encourage all readers to use and interpret the data in their own way.

Paul A. Torcellini, Ph.D., Member ASHRAE, NREL
Ron Judkoff, Member ASHRAE, NREL
Drury B. Crawley, Member ASHRAE, DOE

Re: ASHRAE's Role in Green

The "Building for the Future" special section in the September 2004 edition of the *ASHRAE Journal* was great. I was especially interested in the guest column by David Grumman titled "Why the Interest: 'ASHRAE's Role in Green.'" Mr. Grumman's column was an excellent overview of the development of the *ASHRAE GreenGuide*, which he coauthored, and that Guide's definition of green design. He spends a lot of time though, puzzling over whether the scope of green design has become too broad. In particular, he thinks that indoor environmental quality (IEQ) has little impact on sustainability. He suggests that IEQ is more a characteristic of "*good design*."

Here's why I think IEQ is correctly a quality of green buildings, at this time. Building occupants are the most important part of the ecosystem that green buildings seek to protect and sustain. Making buildings *considerably* healthier by reducing or

eliminating indoor pollutants, providing natural light, fresh air, and visual connection to the outdoors is consistent with the mission of green building.

However, there's a bigger vision at work here, too. Achieving sustainability requires being successful at meeting today's needs in three arenas: environment, economy, and society. Improving the indoor environment is a winner in all three arenas. A healthy, uplifting indoor space results in a cleaner environment, greater worker productivity (or learning in educational spaces), and healthier, happier workers.

Andrew S. Lau, P.E.,
Member ASHRAE
State College, Pa.

The Author Responds

Although the worker/occupant's welfare is of great importance, my point in raising the issue about whether this supports sustainability is based on the premise that the *ASHRAE GreenGuide's* definition of sustainability is focused on what happens in the *future*: whether what we use today will leave enough for future generations. I am not sure I see how good IEQ today, worthy as it may be, contributes directly toward meeting that future need.

As a practical matter, however, this is a fine point of difference. The last paragraph of Chapter 1 of the *ASHRAE GreenGuide* states that *every* design should strive to be *both* "good" and green. Thus, good IEQ *should* be a goal of any design endeavor, regardless of how one classifies IEQ.

I agree with Mr. Lau that green design characteristics *should* be part of a well-designed building (good design). Reiterating another statement in the first chapter, I *still* don't believe we're there yet — although we're getting closer. I've had a lot of contact with architects through earlier employment and family, and I still hear many buildings characterized as well-designed (i.e., good design) that are not green in the slightest.

David L. Grumman, P.E.,
Fellow ASHRAE,
Evanston, Ill.

Re: Pharmaceutical Cleanroom

John Zhang's September article on cleanroom design for pharmaceutical and biotech applications was informative and interesting. However, as a veteran of the U.S. semiconductor manufacturing industry, I have to point out that the photo on Page 29 depicts the semiconductor manufacturing industry instead of a pharmaceutical cleanroom.

Having moved from the semiconductor industry to the HVAC industry about three years ago, I can assure you that there is little overlap in the design of the two industries' facilities.

Sadly, the biotech and pharmaceutical engineers don't see much value in folks with experience in the semiconductor industry.

Mr. Zhang's third paragraph is very true. These high tech companies don't look to ASHRAE or other design organizations for much help. Here is why. Their industries move faster than our organizations.

Look at the dates on the ASHRAE guides or code guidelines and you will constantly see that the years are well past. Mr. Zhang's most up-to-date reference material is more than five years old. The U.S. semiconductor industry was created, peaked, and is now in decline. All this happened within 25 years.

I mean no disrespect to Mr. Zhang, who I am sure is aware of all I have stated. My comments are directed to the readership and my fellow ASHRAE members.

John Goreham,
Associate Member ASHRAE,
Norfolk, Mass.

The Author Responds

I agree with Mr. Goreham almost entirely. I personally don't see any reason why an experienced HVAC engineer in the semiconductor industry cannot be valuable in the other industry and vice versa.

The main reason is that those doing the hiring may not have a good understanding of what is going on.

The photo was ASHRAE Journal's error. Hopefully few among the readers would have such insight as John does. It takes more to tell this difference than to differentiate an African elephant from an Asian one.

John Zhang, P.E.,
Portland, Ore.