By Bill Harrison, 2008–09 ASHRAE President

In 2006, the ASHRAE Board of Directors approved a strategic plan with four principal directions, and that plan has served us very well. The first direction was to lead the advancement of sustainable building design and operation.

Last year, ASHRAE Presidential Member Kent Peterson, P.E., asked our members to focus on innovative designs to provide elegant solutions for high-performance buildings. This year, I am asking our members to focus on the operation of high-performance buildings.

The unfortunate truth is that many buildings with great designs fade from green to grey when building operators don't understand how to realize the full potential of the energy conserving systems they manage. ASHRAE Presidential Member Terry Townsend promised the world that our Society would lead the advancement of sustainability and my theme, Maintain to Sustain—Delivering ASHRAE's Sustainability Promise, will challenge ASHRAE to produce the tools required to deliver on that promise after construction is complete and the contractor has left the site.

We have all seen examples of horrible waste in equipment rooms around the world. I was in an equipment room where a steam boiler was being fed with 100% makeup water because the condensate return unit had failed. After protesting this situation and being told that it had been that way for a while

ABOUT THE PRESIDENT

Bill Harrison, Member ASHRAE, is president, Trane Arkansas, Little Rock, Ark.

As ASHRAE's president, Harrison directs the Society's Board of Directors and oversees the Executive Committee. His presidential theme, Maintain to Sustain—Delivering ASHRAE's Sustainability Promise, focuses on operating buildings to deliver the energy efficiency inherent in their design, including effective commissioning, improved documentation, and programs to educate and certify building operators.

He also is chair of the Headquarters Building Renovation Committee. He has served as president-elect, treasurer, vice president, Region VIII director and regional chair, chair of Member Council, Technology Council and the Finance Committee, a member of the Nominating Committee, and vice chair of the Refrigeration Committee and the Society Rules Committee. Harrison was president of the Shreveport Chapter.

He has received the Distinguished Service Award.

Harrison received a Bachelor of Science in industrial engineering from the University of Arkansas.

because the facility manager didn't want to ask for the money to replace the failed unit, I shook my head and rationalized, "this isn't my problem," and walked away.

I was in an equipment room where the variable speed drives for two large chilled water pumps had been set to 100% because the operator did not have confidence that adequate chilled water would get to the far reaches of his campus if the pumps were under automatic control. We had a long discussion about how variable-speed pumping saved enormous amounts of energy but he was unwilling to change and I shook my head and rationalized, "this isn't my problem," and walked away.

I was in an equipment room that was so small the air-handling unit had been shoved against one wall. The pipefitter who had connected the unit had installed a line blocking access to the door to the filter section, effectively eliminating the ability to change the filters in the unit on a permanent basis. The operator and I discussed how this influenced system performance, but he did not want to make waves with his supervisor who had signed off on the installation, so I shook my head and rationalized, "this isn't my problem," and walked away.

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But today, the time has passed when we can shake our head and walk away saying "this isn't my problem." Every day we observe installations and operating practices that are wasting our precious energy and water resources, draining power from the grid, increasing the emissions from our generating plants. Building operating practices that waste energy really are our problem, and they must be addressed.

In developed countries, buildings account for 40% of primary energy use, more than either transportation or industry. The world market for energy will continue to grow. The Energy Information Administration estimated in their 2007 report that the market would grow by 58% between 2004 and 2030. The price of oil has recently approached $140 a barrel. Can you imagine where the price of oil will settle after the 58% increase in world energy demand?

Energy is a global problem today. The Web site EnergyShortage.org identifies a dozen countries where energy supplies are creating availability problems. In January, South Africa suffered power shortages that forced the gold mines to shut down at a time when gold prices were at an all-time high. In countries where energy is available, prices are at all-time highs and rising. Energy prices have driven food prices to levels that have produced rioting in some countries. The International Energy Agency confirms that demand will continue to grow and that oil and coal will continue to be the primary sources of energy. Developing countries will experience the largest growth and see the largest growth in energy related emissions.

Sustainability for ASHRAE has to mean more than energy conservation. Many of us remember our immediate response to the energy crisis of the 1970s. Our first energy standard was produced in record time and was very effective. What it failed to take into account was that some energy-efficient buildings did not provide good indoor air quality. A lot of research has been done since then, and our current standards define comfort and prescribe ventilation procedures to provide acceptable indoor air quality. Sustainability for ASHRAE means energy efficiency and healthy, productive indoor environments.

There is a no-regrets answer to reducing the amount of energy used in buildings and reducing emissions, and that is improved building operations. A study by the Energy Systems Lab at Texas A&M University indicated that energy use in buildings could be reduced by 10% to 40% by improving operational strategies in buildings. This reduction in energy was not so much the result of changes in hardware and systems as it was the result of improvements in software and expert knowledge. More progress would have been realized in energy reduction from improved operations if the solutions were product-based. The reliance on expert knowledge has resulted in a minimum transfer and distribution of knowledge in this area.

Retrocommissioning is a popular approach to improving operational strategies in existing buildings. Energy service companies rely on improved operational strategies to ensure the success of performance contracts. However, much of the knowledge developed in these two instances is held as proprietary technology. Reluctance to share proprietary information has inhibited the widespread application of operational strategy improvement. The slow development of building energy performance rating systems has been an impediment. Another constraint is the slow development of advanced monitoring and exception reporting systems. Improved operations are always dependent on improving the knowledge of the building operators, and development of the basic information required for effective training has to be a high priority for ASHRAE.

An important issue that must be addressed is the ongoing life of the energy savings developed through a focused operational improvement program. Without a program to continually upgrade the capabilities of the people operating the building, performance will soon slide back toward the default value of a poorly operated property.

Delivering ASHRAE's sustainability promise means that our members are going to have to work more closely with others in the buildings business. When reviewing energy-saving measures for buildings recently, it was striking to see that six of the ten most promising measures were addressed by the project architect. In a traditional design process, decisions concerning these items would be finalized long before the mechanical and

electrical consultant first received drawings. The size of the equipment rooms would also have been decided, subject to some small amount of negotiation.

A collaborative or integrated design process is essential if a building is to be designed and operated as a high-performing building. We can simply no longer afford to decide building orientation, fenestrations, shading and overhangs without feedback from the mechanical consultant documenting the energy impact of those decisions. Neither can we accept a cramped equipment room that prevents effective maintenance and causes inefficient duct design, both of which plague a building for its entire life. Collaborative, integrated design processes are essential if we are to truly reach our sustainability goals. These processes must go beyond the initial energy performance of the building and consider the effect the building design will have on energy over the entire life of the building. Equipment rooms and duct spaces must be large enough to allow efficient duct designs and good maintenance access for equipment.

The same barriers that have plagued our design and construction processes for generations, time and money, now stand in the way of a collaborative integrated design process. In the years of rapid economic growth during the second half of the twentieth century, command and control management was mandatory as business opportunities were almost unlimited. Businesses struggled to control their growth to a level that did not outstrip capital resources. We evolved into an industry dominated by a first-cost mentality. Energy was cheap, appeared to be unlimited, and the first cost, appearance and functionality of buildings overruled energy considerations. In many cases, engineers could be considered to be evil enablers as we designed overpowering HVAC systems that made some really bad buildings habitable, but at a terrible energy cost.

Achieving sustainability for ASHRAE members today means that we must deliver our message to building owners. Owners must be educated so that they can evaluate building decisions based on life-cycle costing. Investors know how to evaluate the cost of the floor plate lost to a larger equipment room. Our job is to show them how to evaluate the cost of not having accessible equipment with efficient duct transitions. Owners look to someone to be their energy advisor. Too often, engineers delegate the transmission of energy information to others in the design chain, and the message becomes garbled or is delivered in an ineffective manner. Energy decisions need to be made by owners in a collaborative process with full participation by the project mechanical and electrical engineers.

One primary path for effective communication to owners is through commissioning agents. When ASHRAE commissioning guidelines are used, owners working collaboratively with a design team and a commissioning agent will develop a much better set of owner project requirements and a much better understanding of the long term energy implications of alternatives.

We need to take our message to organizations that serve the needs of owners, such as BOMA, IFMA and APPA. These messages need to be delivered at the global level, but need to reinforced by our local chapter members meeting with the local chapters of these organizations. Our chapters are ideally suited to carry our message, and our chapter members must play the leading role in establishing ASHRAE as the owners' trusted advisor on building energy issues. Our message must go far deeper in the owners' organization than the executives and facility managers. While business leaders set policy, operating personnel implement those policies. All too often, the policies are interpreted through an obsolete set of personal prejudices. I don't know any operators who drive to work in the morning thinking about "how can I waste more energy today?" However, many go to work without the technical knowledge required to conserve energy every day. We can't blame operators who were trained on systems in the 1980s when they operate today's systems to produce 1980 results. Our chapters must accept the challenge of delivering educational programs to a broad base of operating personnel to equip them to be effective in a sustainable world. We are introducing new and innovative sustainable products and systems every week. We must accept the task of educating the people who operate these sophisticated systems in the technical fundamentals that will enable them to make good decisions.

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As I travel and present programs to ASHRAE members around the world, I frequently advocate early and comprehensive energy modeling during a collaborative design process. An ideal case would be for a design team to establish an energy budget early in the project and then to model the energy performance of the building as the design evolves. After one of these presentations it is not unusual for someone in the audience to point out that many business arrangements used by our consulting engineers do not provide compensation for doing that work. I also advocate that design engineers develop a comprehensive narrative describing how building systems function and how they should be operated for maximum efficiency. This narrative will form the basis for a training program that is part of the permanent record for the building.

The narrative is important because operating personnel move around, and this document will allow the new operators to gain understanding to maintain building energy performance. It is likely that many practitioners' reaction to this recommendation will be the same as for energy modeling: there is no design budget for that work. We need to recognize that owners must be educated to the reality that designing high-performance

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buildings costs more and that the additional design costs will save money every year the building is in service.

We need to be very open about the fact that a larger budget for planning and design results in lower construction and operating costs. Owners need to recognize that ignoring the energy performance of buildings cannot be tolerated in an energy-starved world with unacceptable levels of carbon emissions. We must educate investors and owners so that they understand that a larger investment during the design phase of a project produces an outstanding long-term return on investment.

High-performance buildings require very specialized maintenance. The operating cost for HVAC systems is made up of several components. Energy cost is a large component. Repair and replacement cost can be large. Maintenance cost is significant and is different from others in one critical characteristic: it can be deferred. Unfortunately, when maintenance is deferred, all of the other costs increase. Owners need help from ASHRAE professionals as maintenance plans are designed and executed. It is our obligation to define maintenance procedures that will optimize the energy performance of the building. We must also advise the owner of the effect that improper maintenance will have on the total cost of owning and operating the building. It has long been acknowledged in business that you can't manage what you can't measure. Maintenance plans need to include energy budgets, and maintenance procedures need to include energy reporting.

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ASHRAE has recognized the need for additional materials and programs to address sustainable building operations and has formed Technical Resource Group 7 (TRG 7), Tools for Sustainable Building Operations, Maintenance and Cost Analysis. I am asking this committee to coordinate the efforts of several ASHRAE bodies to produce publications and programs to advance our efforts to communicate more effectively to investors and owners.

I am asking our chapters to reach out to local owner-focused organizations such as BOMA, IFMA, and APPA to offer to present local chapter programs focused on sustainable system operation and maintenance. TRG 7 will coordinate the development of the support materials for those programs drawing from the resources of our technical committees and the Chapter Technology Transfer Committee.

I am asking our chapters to reach out to local building operators and to present programs on the fundamentals of HVAC engineering and operation of high-performance buildings. We must build technical understanding in this important group of people, because their performance is the last and most vital link in delivering high performance in our buildings. Again, TRG 7 will coordinate the development of the support materials for those programs.

I am asking our technical committee responsible for operation and maintenance management to collaborate with other TCs to develop a proposal for a research project to document the energy performance of high performance buildings over time. While there is a lot of anecdotal evidence of the decay in efficiency of these buildings, there is little hard evidence to describe what is happening and the causes of any changes.

I am asking that work be accelerated on a guideline explaining in layman terms the high-efficiency features used in high-performing buildings and the operating and maintenance procedures necessary to protect the performance of those systems.

I am asking that our technical committee for integrated building design complete its work on an integrated design manual of practice to support the work of design teams working collaboratively to produce high-performance building designs. This manual must include the design features that enable effective operation and maintenance for high-performance building systems.

I am asking the cognizant committees for commissioning Guidelines 0 and 1 to review those documents to ensure that these guidelines adequately address high-performance operation and maintenance procedures, documentation and training.

It is encouraging to find that ASHRAE has the infrastructure in place to address these critical issues. We are close to publishing ASHRAE/ACCA Standard 180P, *Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems*. We need to work collaboratively with other organizations such as the Mechanical Service Contractors of America and the Air Conditioning Contractors of America who have developed materials that address maintenance and improved operations. Cooperative activities with these organizations can certainly accelerate our efforts to keep our green buildings green.

Our business, the buildings business, is the largest user of primary energy in most countries with developed economies. Improving building operating procedures is a no-regrets strategy for saving 10 to 40% of the energy used in HVAC systems. The key to implementing improved building operation is education on the local level. ASHRAE is ideally suited to fill that need.

Why is it important that we attack this challenge with priority? This year, we will dump about 30 billion metric tons of CO_2 into our atmosphere. How much is that? There are roughly six and one half billion of us on the planet, so that is about 4.6 metric tons per person. How big is 30 billion metric tons? We know that globally, we produce a lot of oil. We have constructed a tremendous amount of infrastructure to move this oil with pumping stations, pipelines and supertankers. We only produce about 4 billion metric tons of oil annually, so we dump

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7.5 times as much CO_2 into the atmosphere as we produce oil. The International Energy Agency estimates that emissions could climb to 42 billion metric tons per year by 2030.

I was privileged to hear Senator John Glenn speak last summer, and the former astronaut commented on how beautiful the earth looked when viewed from space. He commented that from space, our atmosphere appeared to be very thin. Our atmosphere is important for a lot of reasons, the major one being that it is what we breathe. When you go outside and look up, it appears the sky goes on forever, but only about the first 25,000 feet of the atmosphere supports life. If you modeled that on a 12-inch globe, the layer of air that we can breathe easily is about the thickness of a business card.

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How long are we going to continue to use our fragile and precious atmosphere like a landfill, dumping in 30 to 40 billion metric tons of CO_2 every year?

Wasting energy is our problem, and we can no longer afford to shake our heads and walk away. Buildings account for 40 per-cent of primary energy use in developed countries. Much of that energy use can be avoided by improved operating strategies. For those of us who understand that simple truth, it is our duty to attack that wasted energy.

We must communicate with the owners and operators of the buildings we touch to build understanding of the sources, costs and consequences of energy being wasted in their buildings. Our future holds net-zero-energy buildings, but the majority of the buildings that will exist in 2030 exist today, and we must attack energy use in those buildings with the same focused attention we direct at designing the buildings of the future.

We know the answers. If the studies are accurate, we have a no-regrets method to reduce the HVAC energy use in buildings by 10% to 40%, solely by improving building operations. All we have to do is communicate and educate more effectively. It is our duty. We are pledged to deliver ASHRAE's promise of sustainability, and to do that we must maintain to sustain, we must train to sustain, and we must influence the operation of our buildings to conserve energy.

I ask for your help and your commitment, and I am confident that working together, we can deliver on ASHRAE's promise of sustainability.