American Society of Heating, Refrigerating
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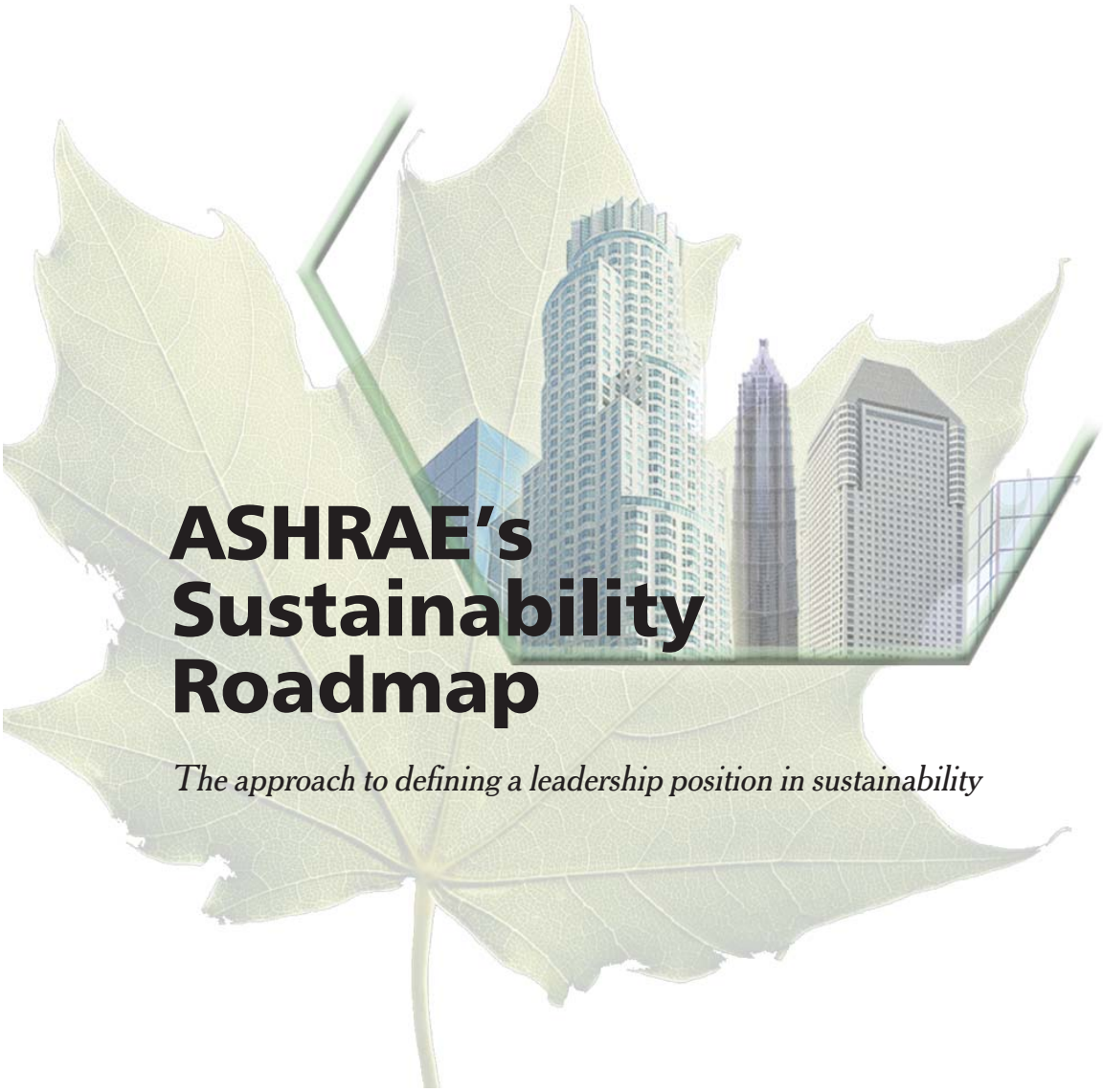

ASHRAE's Sustainability Roadmap

The approach to defining a leadership position in sustainability

Approved by ASHRAE Board of Directors
January 22, 2006

ASHRAE
Engineering for Sustainability

Presidential Ad Hoc Committee

ASHRAE's Sustainability Roadmap

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Executive Summary

This document guides the Society's efforts in defining a leadership role in sustainability.

ASHRAE's Sustainability Roadmap follows a set of overarching goals:

- Expand our efforts to foster sustainable buildings.
- Conduct our own affairs in a sustainable manner.
- Lead in researching technologies that enable the design and application of sustainable HVAC&R equipment and systems.
- Integrate building sustainability principles, effective practices and emerging concepts into all appropriate ASHRAE standards, guidelines, research, Handbook chapters and publications.
- Partner with appropriate sustainability advocacy organizations where our strengths are complementary.
- Develop materials and programs related to sustainability to educate and inspire the current and next generation of members.

The Roadmap identifies and quantifies ASHRAE's sustainability impacts, beginning with the process of setting goals and continuing through implementing strategies for improving those impacts in the years ahead.

The Roadmap makes several key recommendations:

- Develop and maintain productive relationships with other organizations in the sustainability field.
- Raise public awareness of ASHRAE's contributions to sustainability.
- Aggressively market ASHRAE's sustainability profile in the industry.
- "Walk the talk" by practicing what we preach.
- Develop educational products that assist in sustainable building design, building operation and evaluation.
- Implement the sustainability-oriented objectives in the Society's Research Strategic Plan.
- Accelerate development of the *Advanced Energy Design Guide* series.
- Implement sustainability certification.
- Act on sustainability-related strategic directions included in the Society's Strategic Plan.

To ensure the success of Roadmap implementation, the following milestones have been established:

- 2006 ASHRAE Winter Meeting – Liaisons appointed from the Society to organizations with whom ASHRAE partners on sustainability initiatives.
- Calendar Year 2006 – Implement various public relations and marketing initiatives, including creating the Green Team, exploring sustainability as a component of the AHR Expo, re-focusing the ASHRAE Technology Awards on sustainability achievements, and writing articles for related industry publications describing sustainability practices and which provide ASHRAE guidance.
- 2006 ASHRAE Annual Meeting – Conduct this meeting as a sustainable meeting, conforming to accepted sustainability guidelines for meeting organization and operation.
- 2006 ASHRAE Annual Meeting – Make the ASHRAE Headquarters renovation project a LEED EB project.

- 2006 ASHRAE Annual Meeting – Technology Council to move sustainability-related research projects up in priority and monitor their implementation to ensure timely completion.
- 2007 ASHRAE Winter Meeting – ASHRAE Technical Committee 2.8 "Building Environmental Impacts and Sustainability" to review ASHRAE materials and literature and make recommendations to the Society's Technology Council and Publishing and Education Council regarding needed projects and publications.
- 2007 ASHRAE Annual Meeting – Offer online based learning for sustainability and certification program.
- 2007 ASHRAE Annual Meeting – Funding provided such that publication of the *Advanced Energy Design Guide* series is accelerated by one year from originally scheduled completion dates.
- 2008 ASHRAE Winter Meeting – Develop rating systems to certify building operational performance for sustainability.
- 2008 ASHRAE Annual Meeting – Offer a full complement of publications that provide sustainable design guidance for all types of buildings and that make available life cycle cost analysis information of building components and systems.
- 2009 ASHRAE Winter Meeting – Partner with other organizations to develop standards on all aspects of sustainable building design and operation, including recyclability as well as a standard articulating a sustainability performance metric.
- 2009 ASHRAE Winter Meeting – Publish guides for building owners that emphasize the benefits of decision making based on life-cycle-cost analysis.

Overview of the Roadmap

ASHRAE's Sustainability Roadmap provides goals and guidance necessary to assist the Society in defining a leadership position in sustainability. The Roadmap includes:

- Background for Roadmap Development
- Market Demand for Sustainability Leadership
- What is Sustainability?
- ASHRAE's Goals for Sustainability
- ASHRAE's Impact on Sustainability
- ASHRAE's Relationship with Other Organizations
- Implementation Plan: Recommendations for Achieving "Engineering for Sustainability" Leadership
- Sustainability Roadmap Milestones

Background for Roadmap Development

In August, 2005, ASHRAE President Lee Burgett appointed a Sustainability Roadmap Ad Hoc Committee with the following charge: *"Develop a roadmap for ASHRAE's involvement in sustainability. The issue of sustainability is broad, and ASHRAE is deep and strong in some aspects such as energy conservation. The thrust is to identify new areas of involvement, including relationships with other organizations. The outlook should be both short-term and long-term."*
The committee began its work by examining the Society's Position Statement on Sustainability.

That document, approved in June 2002 by the ASHRAE Board of Directors, pledges the Society's support of building sustainability as a means to provide a safe, healthy, comfortable indoor environment while simultaneously limiting the impact on the Earth's natural resources. Specifically, the position statement calls for ASHRAE to:

- Consider integrating sustainability principles into all appropriate ASHRAE standards, guidelines, Handbook chapters and publications.
- Actively participate with internationally recognized building sustainability groups where deemed appropriate.
- Promote and provide education on sustainability to its members and society through the ASHRAE Learning Institute and grassroots chapter activities.

In the years since adoption of the position statement, ASHRAE has made significant progress in achieving these objectives. *Advanced Energy Design Guides* have been initiated, sustainability-focused educational programs have been developed, and partnerships with building sustainability groups have been initiated.

Market Demand for Sustainability Leadership

In 2005, ASHRAE completed a broad-based, comprehensive market research study of members and potential members. The primary objectives of the research were to examine growth opportunities and to identify how ASHRAE can make its business practices more customer and member focused.

This research indicated strong desire among members and non-members of all ages for products and services on green building topics, Based on this opportunity, the Board Planning Committee in June 2005

recommended and the ASHRAE Board of Directors endorsed "Engineering for Sustainability" as a Society priority. It further recommended that this priority be communicated to all levels within the Society with the commitment of appropriate resources.

The intent of this Roadmap is to guide ASHRAE to achievement of that vision: A leadership position in sustainability. The Roadmap will stimulate and guide the process of "doing things differently" within ASHRAE. The result will be an ASHRAE, which by responding to its membership, better enables its members to make a profound impact on what it means to design, build and operate sustainable buildings.

If implementation of this Roadmap is successful, buildings employing sustainable technologies will be in greater demand, the critical need for contributions by ASHRAE members will be better understood, and the quality of life will be enhanced in the present and long into the future.

Through the direction and focus established by ASHRAE's Sustainability Roadmap, ASHRAE members, through application of advanced technologies, can lead the march towards a sustainable built environment, giving substance to the "Engineering for Sustainability" initiative.

What is Sustainability?

The *ASHRAE GreenGuide* defines sustainability as "providing for the needs of the present without detracting from the ability to fulfill the needs of the future."

A green building is one that achieves high performance over the full life cycle in the following areas:

- Minimal **energy consumption** due to reduction of need and more efficient utilization of both renewable and non-renewable natural resources;
- Minimal **atmospheric emissions** having negative environmental impacts;
- Minimal discharge of **harmful liquid effluents and solid wastes**;
- Minimal negative impacts of **site ecosystems**;
- Maximum **quality of the indoor environment**.

This Roadmap guides ASHRAE's efforts in helping its members in building sustainability and green building design, construction and operation.

Why is Sustainability Important?

Buildings fundamentally impact people's lives and the health of the planet. In the U.S., buildings use one third of our total energy, two-thirds of our electricity, one-eighth of our water, and transform land that may provide a valuable ecological function. The worldwide market for environmental goods and services is estimated to be $600 billion annually.

In accordance with the definitions of sustainability and green, what society does today impacts what happens to future generations. Efficient energy use is of prime importance but so are the materials used, what is emitted

and disposed of, and how we impact existing ecosystems. We cannot do these things at the expense of health and well-being so it is vital to maintain excellent indoor environmental quality. ASHRAE, as the organization of professionals who are responsible for the total life cycle cost of the building – design, operation and evaluation – has expertise that impacts elements related to sustainability. These elements include building materials, indoor environmental quality, land use, water use, and waste management and disposal, as well as:

Energy Use

Buildings consume approximately 37% of the total energy and 68% of the electricity produced in the United States annually, according to the U.S. Department of Energy. Implementing energy saving technologies reduces the cost to maintain a building. In addition, environmental concerns and the impact of energy consumption must be considered, along with the need to design energy-efficient buildings.

Atmospheric Emissions

The use of HVAC&R technologies is an essential element of contemporary life. Yet, HVAC&R systems contribute to greenhouse gas releases directly and indirectly through energy-related effects and directly through the effect of refrigerant losses. Worldwide concern for the global climate has emerged with the recognition of increasing concentrations of greenhouse gases in the atmosphere and with reports of increased average global temperatures. Scientific evidence clearly suggests that responsible, cost-effective measures should be adopted in the building industry. Both release-related and energy-related effects must be considered in a life-cycle environmental approach.

Engineering Design and Architecture

As the world has increased in population and developed technologically, the consequences of uncontrolled growth are being recognized: pollution, toxic waste creation, waste disposal, global climate change, ozone depletion, deforestation and resource depletion, and water and energy shortages. The built environment contributes significantly to these effects. The building industry's recognition of the impacts of its activities is changing the way it approaches the design, construction, operation, maintenance, reuse and demolition of what it creates – toward addressing the environmental and long-term economic consequences of its actions.

Facility Management, Commissioning

Commissioning typically helps to ensure good indoor environmental quality, reduce energy and water consumption, and improves how well the building is operated.

Other justifications for green design, according to the *ASHRAE GreenGuide*, include:

Doing the Right Thing

The motivations and reasons for implementing green buildings are diverse but can be condensed into essentially wanting to do the right thing to protect the earth's resources. For some, a wakeup call occurred in 1973 with the oil embargo–and with it a realization that there may be a need to manage our planet's finite resources.

Regulations

Society has recognized that previous industrial and developmental actions caused long-term damage to our environment, resulting in loss of food sources and plant and animal species, and changes to the earth's climate. As a result of learning from past mistakes and studying the environment, the international community identified certain actions that threaten our ecosystem's bio-diversity–and consequently it developed several governmental regulations designed to protect our environment. Thus, in this sense, the green design initiative began with the implementation of building regulations. An example is the regulated phasing out of chlorofluorocarbons.

Lowering Ownership Costs

A third driver for green design is lowering the total cost of ownership in terms of resource management and energy efficiency. Examples include controlling site storm water for use in irrigation, incorporating energy efficiency measures in HVAC design, or developing maintenance strategies to ensure continued high-level building performance.

Increased Productivity

Another driver for green design is the recognition of increased productivity from a building that is comfortable and enjoyable and provides healthy conditions. Comfortable occupants are less distracted, able to focus better on their tasks/activities, and appreciate the physiological benefits good green design provides.

Filling A Design Need

There are increasing numbers of building owners and developers asking for green design services. As a result, there is considerable business for design professionals who can master the principles of green design and provide leadership in this arena.

ASHRAE's Goals for Sustainability

To achieve and maintain a position of leadership, ASHRAE will:

- Expand our efforts to foster sustainable buildings.
- Conduct our own affairs of the Society in a sustainable manner.
- Lead in researching technologies that enable the design and application of sustainable HVAC&R equipment and systems.
- Integrate building sustainability principles, effective practices and emerging concepts into all appropriate ASHRAE standards, guidelines, research, Handbook chapters, and other publications.

- Partner with appropriate sustainability advocacy organizations where our strengths are complementary.
- Develop materials and programs related to sustainability to educate and inspire the current and future generation of members.

ASHRAE's Impacts on Sustainability

ASHRAE has an enormous impact on many aspects of the economy, and consequently, on the environment. Its spheres of influence can be divided into three major categories:

- The Society as an organization.
- The members of the Society.
- The publications, research and standards produced by the Society.

ASHRAE as an Organization

As an organization with more than 100 employees, 55,000 members and an annual budget of $17 million, ASHRAE conducts many activities that have environmental impacts and which could be the focus of efforts to improve their sustainability, as shown in the left column of Figure 1. These activities are the direct actions of the Society, and their sustainability can be *directly* affected by policies and decisions of the Society.

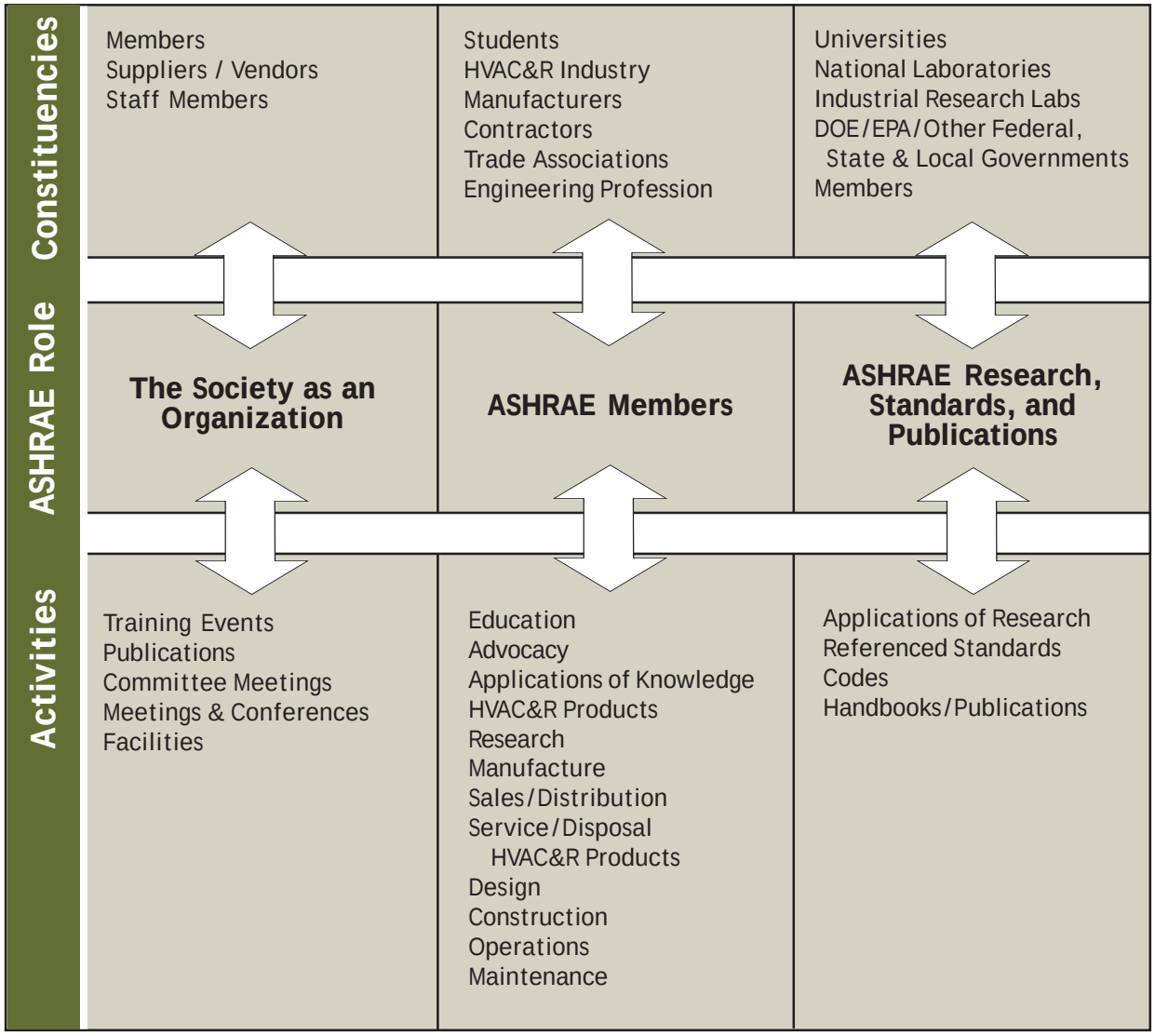
A critical element in deciding to reduce these direct impacts is to develop quantitative metrics of the impacts, tracking them as mitigation measures are implemented. The process for this is that ASHRAE would establish policies for sustainability, with quantified goals for impact reduction and methods for measuring and tracking progress toward the reduction goals. This could be done internally or externally in the context of becoming certified under ISO 14001, which would be a clear statement and commitment to the public of ASHRAE's goals regarding sustainability.

Society Members

As a membership organization dedicated to the advancement of technology through educational opportunities and technical resources, ASHRAE has a unique opportunity to influence global sustainability *indirectly* through its members and others in affected industries by increasing their knowledge of sustainability so that they can make their own activities more sustainable. (See center column of Figure 1).

In contrast to the direct impacts of the Society as an organization, these *indirect* impacts are the result of the actions of ASHRAE members. The Society's ability to influence and control those actions is *indirect*. However, through effective programs of education and advocacy, the Society can profoundly influence its constituents to make their activities more sustainable. The environmental magnitude of these *indirect* impacts is many times that of the direct actions of the Society, so it is critical to establish metrics and track them to improve ASHRAE's impact on global sustainability.

Figure 1-ASHRAE Constituencies and Activities



ASHRAE Publications, Research and Standards

Undoubtedly the most extensive impact which ASHRAE has had on sustainability is through its development and dissemination of intellectual work products.

ASHRAE publications, supported in part through an annual research expenditure of more than $2 million, define practice within the environmental control industry. Its technical information includes Standards 90.1 and 90.2 for energy efficiency, Standards 62.1 and 62.2 for indoor air quality, and Standard 55 for thermal comfort. ASHRAE standards along with other ASHRAE publications, such as the ASHRAE Handbook, Advanced Energy Design Guides, and *ASHRAE GreenGuide,* are indispensable resources in engineering offices. Society standards are the basis for codes adopted by many governmental jurisdictions and provide design procedures and methods of testing and rating that are adopted by many industry groups. The right column of Figure 1 shows examples of the constituents of these intellectual products and the ASHRAE activities which they both rely upon and influence.

As broad and positive as the impact of these products has been, there has been no systematic effort to integrate sustainability where applicable into all of the intellectual efforts of the Society. One could imagine that the impacts could be even greater if such an effort were to occur. For example, an analysis of the nearly 2,400 pages of technical content in the ASHRAE Handbook reveals that there is little mention of "sustainability," but relatively extensive mention of "energy." When a similar analysis of the ASHRAE Handbook relative to "energy" was done 30 years ago, there were few mentions of "energy." However, through systematic efforts by the Society to integrate "energy" where applicable into all sections of the Handbook, this has completely changed.

It will be hard to develop appropriate direct metrics of these impacts, since they are at such a large scale (literally, the energy and environmental performance of buildings and other HVAC&R-related systems worldwide). Yet, there may be goals that could be set and metrics that could be monitored toward those goals.

The general objectives of this Roadmap are to identify and quantify ASHRAE's sustainability impacts. The start of the process is to set goals and in the years ahead implement strategies for improving those impacts. As this process occurs, each of the spheres of influence discussed above will be affected and will be critical to the success of this initiative.

ASHRAE's Relationship to Other Organizations

ASHRAE plays a unique role as the developer of intellectual products upon which sustainable building design and operation rests. Other organizations are potential users of ASHRAE's intellectual products and beneficiaries of ASHRAE's educational outreach. Sustainability advocacy organizations include:

- US Green Building Council
- Sustainable Buildings Industry Council
- Green Building Initiative

In addition, ASHRAE interacts with the U.S. Department of Energy and the U.S. Environmental Protection Agency on sustainability initiatives, and interacts with national HVAC&R organizations globally through the Associate Society Alliance.

It is important for ASHRAE to define its role relative to other players in the sustainability field. In particular, ASHRAE must develop guidelines on how it will interact with, support or assist other organizations to maximize the effectiveness of assets. While the relationships must be mutually beneficial, ASHRAE needs to recognize situations where other organizations may be in competition and structure the organizational relationships in such a way as to avoid the appearance of picking winners and losers.

The relationships in sustainability might mirror the relationships in the codes and standards arena where ASHRAE works with organizations such as the International Code Council, National Fire Protection Association, Illuminating Engineering Society of North America, International Organization for Standardization and others. In essence, ASHRAE provides its technical resources to all of these organizations in order to further its mission.

Some of the recommended activities with other organizations are:

- Develop standards, guidelines, and publications in areas of mutual interest.
- Initiate research in areas of sustainability that help enhances the technical quality of products and services of other organizations.
- Make major contributions to programs of other organizations programs when ASHRAE has unique expertise.
- Assume a leadership role in bringing other organizations together to advance sustainability in the built environment.
- Develop memorandums of understanding that describe areas for collaboration.
- Contribute technical speakers for conferences and meetings from the ranks of ASHRAE experts.
- Serve on technical panels and committees that guide the technical development of the organizational programs.

The Implementation Plan

Recommendations for Achieving "Engineering for Sustainability" Leadership

The recommendations included in ASHRAE's Sustainability Roadmap are driven to accomplish the following:

- Raise the awareness among all ASHRAE members that it is an ethic of engineering to practice and promote sustainability.
- Convince building owners, government and those in related professions that total building design and performance over the life of a building must drive the construction and building operation decisions.
- Provide ASHRAE members with the tools necessary to achieve sustainability in new and existing buildings.

Implementing the following strategies should achieve the above objectives:

Raise public awareness of ASHRAE's contributions

ASHRAE has long provided "Engineering for Sustainability" by applying its diverse technology assets to the sustainability movement in energy efficiency, indoor environment and industrial processes. With growing focus in the industry on the green movement, we need to emphasize that ASHRAE is the engineering engine that drives sustainability.

Appoint Spokespeople: The Green Team

ASHRAE should identify and provide media training to members who are well-versed in ASHRAE's work in sustainability. This "green team" would be used for media interviews regarding sustainability and related areas, such as energy efficiency and the *Advanced Energy Design Guide*. In addition, media briefings or media tours could be scheduled to promote bigger efforts by ASHRAE, such as publication of new books related to sustainability, research, etc. Using the selected members would ensure that ASHRAE's message – we are the engineering engine that drives sustainability – gets out.

Create a Green Speakers Bureau

Speakers to discuss aspects of sustainability that would be of interest to the general public, such as indoor air quality and energy savings, should be identified. These speakers would identify speaking opportunities in their area, such as local radio stations or civic clubs, and be responsible for arranging interviews. They also could speak to ASHRAE chapters and student branches or chapter meetings of other industry organizations. Guidelines would be established, explaining that the speakers are speaking as individuals and not as representatives of ASHRAE; however, the objective would be for speakers to promote and make the public aware of the activities of ASHRAE. They should not offer ASHRAE's opinion on matters of public interest except for the opinions contained in position documents, standards and other Board-approved documents.

Develop Consumer-Based Green Resources

Resources in the form of kits to assist speakers and be used for other outreach to the general public and related professions should be developed. Such materials could include consumer-oriented brochures to distribute on relevant issues, such as how to improve energy savings in your home.

ASHRAE
Engineering for Sustainability

Exploit www.engineeringforsustainabilty.org

To make it easier for members and others to locate ASHRAE's products and services related to sustainability, ASHRAE has created a Website, www.engineeringforsustainability.org.

Creation of the micro-site supports the goal of the Planning Committee that ASHRAE should "aggressively re-package its existing sustainability activity" to not only attract new members but to send the message to existing members that ASHRAE is setting a new course in the area of sustainability.

The site highlights ASHRAE's position statement on sustainability, GreenTips from the *ASHRAE GreenGuide*, the upcoming sustainability broadcast in April 2006 and a link back to ASHRAE.org home page.

The site can be easily adjusted to incorporate other green efforts by ASHRAE, such as adoption of the roadmap or development of new products.

Increase marketing to enhance ASHRAE's sustainability profile

ASHRAE's establishing and maintaining a leadership position in the sustainability marketplace depends upon our ability to communicate the value of intellectual products needs to members, potential members, related professionals and other customers.

ASHRAE will add focus to its efforts through use of the positioning phrase "Engineering for Sustainability."

Specific goals will be to increase membership among younger candidates and to offer new products and services meeting needs of the sustainability marketplace.

Identify Our Target Audience

There are many groups in the sustainability marketplace, but those that stand out include:

- Young engineers
- Construction professionals in related fields who are involved in various aspects of integrated building design
- Architects
- Engineers and other construction professionals in countries where energy costs are high or where the energy efficiency ethic is prominent because of culture or governmental regulation.

Develop a Positioning Strategy

ASHRAE should be positioned as the 'total building" resource, whose members are responsible for integrated building design, operation and evaluation. To establish a leadership position in the marketplace ASHRAE should:

- Communicate the recommendations in the Roadmap identifying what could and should be done in the HVAC&R/building space.
- Review the Society's suite of sustainable-related products and services to ensure each reinforces ASHRAE's role as being a leader in the sustainability market.
- Demonstrate the collective expertise that ASHRAE offers in sustainability through technical committees and chapter programming. Personalize it through use of testimonials and examples.
- Demonstrate how easy it is to access ASHRAE's technical data on sustainability and how many formats are available – print, download, live instruction web-based and physically, on demand e-Learning, satellite broadcast and DVD.
- Demonstrate the value ASHRAE technology brings to a building and industrial process and relate that value to the engineer's ability to provide this while meeting sustainability and fiscal objectives – through use of new technologies and guidance from ASHRAE resources.

Employ Marketing Driven Tactics

Various tactics to accomplish the Society's positioning strategy should be used:

- Partner with other groups to communicate how our sustainability resources can assist others in reaching their objectives;
- Explore development of new sustainability tools, such as software, considering partnership with other commercial and non-commercial entities in these activities.
- Develop a Sustainability for Engineering presentation that highlights ASHRAE resources to be given at related meetings and conferences of related organizations.
- Develop a Sustainability for Engineering presentation that highlights how building professionals are achieving sustainable building design and operation to be given at business meetings and at meetings attended by end users of HVAC&R services.
- Use the Engineering for Sustainability logo and positioning phrase on every ASHRAE product and communication device that is appropriate.
- Create awareness in the ASHRAE Technology Awards program through honoring sustainable building design and highlighting use of the ASHRAE resources that should be followed to achieve sustainable buildings.
- Create a section of the AHR Expo or create a companion show that focuses on green technologies and use of alternative energy resources in buildings.
- Effectively use existing ASHRAE periodicals to promote ASHRAE as a source of sustainability information and to consider development of new, focused communication vehicles for this purpose as can be supported by business models.

Walk the talk

ASHRAE's direct impacts on sustainability can be characterized as the extent to which the Society is willing to "walk the talk" of sustainability in the ways it conducts its business.

If ASHRAE adopts lofty goals for sustainability in its programs and publications but does not work to mitigate the environmental impacts of the ways it operates as a business, it sends a mixed message.

It seems likely that the three most significant impacts which the Society's activities have on sustainability are those related to travel, printing, and facilities use. (See Figure 2) These impacts are common to many of the different ASHRAE activities, even though the quantities and methods of mitigation may need to be different.

Sustainable Meetings

One approach to travel mitigation would be to encourage the use of video-conferencing and other virtual meeting techniques for training and committee meetings. However, this would not be applicable in cases like the semi-annual Society meetings in which the physical presence of participants is a fundamental aspect of meeting success. For physical meetings, an appropriate mitigation measure might be the purchase of carbon offsets for the transportation miles traveled by all meeting participants (a carbon offset purchases a source of CO_2 sequestration, such as a tree planted, equivalent to the CO_2 emitted to the atmosphere by the travel).

Sustainable Products

For printing, the Society can take a leadership position in working with its printers and paper suppliers to find sources and types of papers and inks which will minimize impacts on the environment. It can also accelerate the path it is already pursuing to offer its publications in digital form, thereby eliminating the need for paper and inks. This also radically reduces or eliminates the transportation impacts associated with shipping the publications.

Sustainable Facilities

For facilities, the Society has two major impacts: the operation of ASHRAE Headquarters facility in Atlanta, and the operations of the hotels and convention venues in which it stages its meetings.

In the case of ASHRAE Headquarters, there is the very real opportunity to make the facility an example of energy efficiency and sustainability. This could include such things as certification under Leadership in Energy and Environmental Design (LEED) for Existing Buildings, retro-commissioning of the building systems, implementation of performance monitoring and verification (of energy, indoor environmental quality, water, etc.). Given ASHRAE's area of professional activity, this is truly the closest thing to

Figure 2-Environmental Impacts of ASHRAE-Related Activities

ASHRAE Role	The Society as an Organization	ASHRAE Members	ASHRAE Research, Standards, and Publications
Activities	Training Events Publications Committee Meetings Meetings & Conferences Facilities	Education Advocacy Applications of Knowledge HVAC&R Products Research Manufacture Sales/Distribution Service/Disposal HVAC&R Products Design Construction Operations Maintenance	Applications of Research Referenced Standards Codes Handbooks/Publications
Environmental Impacts	Travel (energy, global warming) Printing (deforestation, water, solid waste) Facilities (energy, global warming, water, IEQ)	Energy Performance (energy, global warming) Refrigerant Impacts Materials Useage IEQ Impacts (IAQ, thermal comfort)	Energy Efficieny of Building Stock Environmental Performance of Building Stock
Mitigation Meausres	Virtual Meetings Digital/Online Publications Greening of HQ Facility Greening of ASHRAE Operations Procurement Standards	Education of Members Setting Goals for Improvement Implementing Metrics of Impacts	Integration of Sustainability as a Key Component Setting Goals for Improvement Implementing Metrics of Impact

"walking the talk" that the Society could do. However, it could go well beyond that to include establishing carpooling policies, solid waste recycling programs, "green" janitorial and landscaping practices, etc.

For the meetings venues, there are well-established set of guidelines for "sustainable approaches to meetings," which could be adopted and implemented by ASHRAE. This would involve setting standards for the convention centers and hotels to assure that they are operating in energy efficient and sustainable manner. It could also involve setting standards for the materials used in displays in the AHR Exposition, to encourage use of recycled materials and reduction of VOC off-gassing by the display. ASHRAE's role in this would help to educate its vendors and the show management company on matters of sustainability, which would most likely impact the ways that those same entities display elsewhere. Use of recycling bins and purchase of "Green Power" would also be vehicles to demonstrate to attendees ASHRAE's commitment to sustainability.

Lead by example

ASHRAE should establish policies for sustainability in each of its areas of direct activity, with quantified goals for impact reduction and methods for measuring and tracking progress towards the reduction goals. The responsibility for this can be distributed among the various operating groups within the ASHRAE organization.

Adopting Sustainability Standards

If the Society is serious about "leading by example," it will be necessary to follow sustainability standards or guidelines. Without doing so, it will be impossible to determine if the Society is now conducting its activities in a manner that has positively affected sustainability.

One of the existing frameworks for this sustainability process is the development of an environmental management system, which can be certified under ISO 14001. This is a process by which an organization does a self-assessment of its environmental goals, setting policies which it intends to follow and establishing metrics to track its performance. It then submits to annual external assessment of the degree to which it is adhering to those policies and meeting its goals. Doing this would be a clear statement and commitment to the public of ASHRAE's serious intent to meets its goals regarding sustainability.

Deliver educational products that assist in sustainable building design, operation and evaluation

Through the ASHRAE Learning Institute, its grass roots structure, and its organization of specialized and international conferences, ASHRAE has an extensive educational infrastructure in place to move sustainable building design, construction and operation forward.

eLearning and seminars

ASHRAE is now launching an on-demand learning program. The Society should explore including Fundamentals of Sustainability with perhaps separate courses on design, building operation, and building evaluation and commissioning.

Consideration also should be given to expanding live seminar, webinars, and short courses on sustainability topics.

Provide chapters with sustainability programming

One resource that sets ASHRAE apart from other organizations is its grass roots communication opportunities. ASHRAE should consider scheduling of seminars in cooperation with chapters and ensure adequate suitability-related topics in the Distinguished Lecturers program. The latter identifies "best of class" speakers and makes them available to Society chapters for their monthly meetings.

Satellite broadcasts

One of ASHRAE's most successful chapter support programs has been its series of satellite broadcasts. These broadcasts provide chapters and other groups within the industry two- to four-hour educational sessions at no charge. Sustainability and the Building Environment is the subject of the April 2006 satellite broadcast. Because of their ability to focus the sustainability message to thousands of members worldwide in real time, more broadcasts on sustainability topics should be organized.

Implement the sustainability-oriented objectives in the ASHRAE Strategic Plan for Research

ASHRAE has adopted a strategic plan for its research program. It outlines ASHRAE's research goals for the next five years, centering on sustainability, which is defined as "the concept of maximizing the effectiveness of resource use while minimizing the impact of that use on the environment."

The plan contains goals in five targeted areas. These include energy and resources, indoor environmental quality, tools and applications, equipment, components and materials, and education and outreach. The initiatives in the plan must be pursued and the results of that research made available through ASHRAE's body of knowledge.

Maintain efforts to produce Advanced Energy Design Guide series as rapidly as possible

ASHRAE's has partnered with other design team organizations to produce the *Advanced Energy Design Guide for Small Office Buildings*. ASHRAE needs to push forward with similar design guides that address other building types and which move the industry towards achieving net zero energy buildings.

Focus on producing design tools and resources, such as standards and publications

ASHRAE standards for energy efficiency and indoor environmental quality, along with other ASHRAE publications, form the basis for engineering for sustainability. ASHRAE must expand these standards and publications as needed and should deliver support tools, such as software and users manuals, to promote their use.

In particular, ASHRAE should use its expertise in quality standards development to initiate new standards in partnership with others to address sustainability metrics for buildings and sustainable deconstruction of buildings.

Standards to Enhance Recycling Potential for HVAC Equipment

Recycling of post-consumer hard goods is an important factor in decreasing the environmental impacts of today's industrialized society. One of the major impediments to increased recycling is the difficulty in identifying the constituents of products so that their materials can be reclaimed for the highest order of re-use. ASHRAE should work with manufacturer associations to establish or improve standards that identify materials used in HVAC&R products and equipment to enhance recycling potential.

European auto manufacturers are at the forefront of facilitating the deconstruction of their consumer products by materials identification. For example, components in German cars must be permanently labeled so

that when the car is deconstructed, individual components can be sorted by material for recycling. This labeling is very specific, differentiating among types of plastics, between thermoplastics and thermo-setting plastics, types of metals, and constituencies of composite materials. Manufacturers are made responsible for labeling the component parts of their automobiles and, in the future, may be responsible for the deconstruction and recycling of the cars. Ultimately, this program could drastically reduce the amount of new raw materials necessary to produce a new automobile.

HVAC&R equipment is similar to the automobile in that it is constructed of a variety of materials in close proximity to one another. This characteristic makes efficient recycling of the equipment difficult. New standards would facilitate recycling by classifying materials related to their ability to be recycled and by their compatibility with other recycled materials. For example, certain thermoplastics may be recycled together, while others should be separated. Certain materials may not be recycled at all, but may require special disposal to avoid environmental damage. This classification could be used with a census of product composition to establish projections and goals for materials recycling for the HVAC&R industry. The program could serve as a demonstration project to American industry in how to maintain economic vitality while reducing consumption of the limited amount of raw materials available on the earth.

Implement sustainability certification

ASHRAE should consider a certification program built around Engineering for Sustainability, certifying buildings that have achieved sustainable performance and the design, operational and evaluation personnel who make sustainable buildings possible.

For example, ASHRAE's on demand eLearning modules could form the basis of individual certification and quantifiable sustainability measures could be developed to support LEED certification.

ASHRAE could develop these certification programs independently or in cooperation with others.

Act on sustainability-related strategic directions included in the Society's Strategic Plan.

Many of the initiatives and recommendations identified in ASHRAE's Roadmap for Sustainability have also been identified as key concepts in ASHRAE's Strategic Plan. In order to coordinate all of ASHRAE activities as they relate to sustainability, the Strategic Plan, when approved by the Board of Directors, should be examined with an eye towards identifying sustainability directions and coordinating supporting activities with other endeavors undertaken as a result of the Roadmap.

Sustainability Roadmap Milestones

Implementation of the recommendations should be accomplished by existing ASHRAE committees and councils. It is not the desire to create additional bureaucracy to manage the sustainability initiative. However, the Society should maintain at least an ad hoc function for the first several years to oversee the sustainability efforts and to serve as internal champion to guide sustainability implementation.

To ensure the success of Roadmap implementation, the following milestones have been established:

- 2006 ASHRAE Winter Meeting – Liaisons appointed from the Society to organizations with whom ASHRAE partners on sustainability initiatives.
- Calendar Year 2006 – Implement various public relations and marketing initiatives, including creating the Green Team, exploring sustainability as a component of the AHR Expo, re-focusing the ASHRAE Technology Awards on sustainability achievements, and writing articles for related industry publications describing sustainability practices and which provide ASHRAE guidance.
- 2006 ASHRAE Annual Meeting – Conduct this meeting as a sustainable meeting, conforming to accepted sustainability guidelines for meeting organization and operation.
- 2006 ASHRAE Annual Meeting – Make the ASHRAE Headquarters renovation project a LEED EB project.
- 2006 ASHRAE Annual Meeting – Technology Council to move sustainability-related research projects up in priority and monitor their implementation to ensure timely completion.
- 2007 ASHRAE Winter Meeting – ASHRAE Technical Committee 2.8 "Building Environmental Impacts and Sustainability" review ASHRAE materials and literature and make recommendations to the Society's Technology Council and Publishing and Education Council regarding needed projects and publications.
- 2007 ASHRAE Annual Meeting – Offer online based learning for sustainability and certification program for building operators.
- 2007 ASHRAE Annual Meeting – Funding provided such that publication of the *Advanced Energy Design Guide* series is accelerated by one year from originally scheduled completion dates.
- 2008 ASHRAE Winter Meeting – Develop rating systems to certify building operational performance for sustainability.
- 2008 ASHRAE Annual Meeting – Offer a full complement of publications that provide sustainable design guidance for all types of buildings and that make available life cycle cost analysis information of building components and systems.
- 2009 ASHRAE Winter Meeting – Partner with other organizations to develop standards on all aspects of sustainable building design and operation, including recyclability as well as a standard articulating a sustainability performance metric.
- 2009 ASHRAE Winter Meeting – Publish guides for building owners that emphasize the benefits of decision making based on life-cycle-cost analysis.

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