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ASHRAE Position Document on

ENERGY

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CONTENTS

ASHRAE Energy Position Document

Executive Summary

Energy is a fundamental ingredient of all economic systems. It is essential to the defense of nations, necessary to feed the world's population, indispensable in the production of the world's goods and services, and vital for protection from the elements.

Buildings—their construction, use, operation, maintenance, and demolition—are responsible for 30 to 40% of the world's energy use.[1] This significant proportion of global energy use must be examined and justified using the following fundamental principles:

- *Sustainability*—Sustainability is a means to provide a safe, healthy, comfortable indoor environment while sustaining the earth's resources so they are available in the future to sustain mankind.
- *Energy Efficiency*—Energy use in existing and new structures can be reduced significantly, in an economical fashion, while providing occupant health, safety, comfort, and productivity.
- *Environment*—There are environmental limits to the use of all energy resources, especially fossil fuels. Reduced reliance on these resources will enhance the long-term protection of our environment and the quality of life of future generations.
- *Energy Resources*—Reliable and secure energy resources and the capacity to deliver them to buildings are critical to maintaining and improving humanity's quality of life.
- *Balance*—All energy resources have both negative impacts and positive benefits and are not equal in terms of their abundance and availability. An appropriate balance of diverse resources is needed.

The American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc (ASHRAE) is one of the few organizations that has the expertise, the membership, and the mission to directly affect the amount and type of energy used in current and future buildings.

Currently, there are market, institutional, and regulatory barriers and imperfections that prevent the implementation of cost-effective energy efficiency measures despite significant opportunities in both new and existing buildings. Regulators, policy-makers, and building industry participants should address these barriers and promote market transformation through incentives, education and building codes.

ASHRAE is a leading proponent and participant in developing standards for energy use in buildings and believes in the value of building codes based on those standards. Present energy codes and equipment standards are minimum standards and many buildings can be economically designed and built to substantially exceed the energy efficiency of the minimum code requirements. To achieve energy efficient buildings and a sustainable environment, codes and standards must be continually updated, enforceable, and enforced.

The energy supply infrastructure and utilities are interconnected with the buildings that rely on them. Electricity supply system reliability is strongly influenced by peak power demands imposed by buildings. Electric and natural gas utilities have unique opportunities within the marketplace and therefore should be encouraged to engage in efforts supporting energy efficiency and the reduction of peak demand. Regulations and rate structures should support these efforts.

Energy sources and their environmental impacts must be considered as nations make choices about their future energy needs. Specific items to consider include the use of renewable energy resources, the role of energy efficiency in limiting potential future supply disruptions and extending the economic life of nonrenewable sources, and the diversity of energy sources and their associated environmental impacts, availability, and price.

Energy efficient buildings can provide good indoor environmental quality (IEQ) in terms of thermal comfort, ventilation, and lighting quality. An efficient system (or building) is one that meets all requirements (including IEQ) with the fewest resources.

ASHRAE promotes increased energy efficiency, environmental preservation, and responsible energy resource use and development as integral part of the ethics of ASHRAE members. ASHRAE uses its position as the technical society recognized as a global leader in HVAC&R technologies and applications to develop and disseminate technical information, standards, educational programs and research on issues of social importance to promote built environment sustainability.[2]

ASHRAE will continue to advance and create energy standards and guidelines to assist society and policy makers in meeting their energy efficiency goals with the ultimate goal of designing and building net zero energy buildings.

[1] Source: IEA ECBCS; http://www.iea.org/Textbase/techno/technologies/enduse.asp.

[2] Please see the bibliography for a listing of ASHRAE Technical Committees (TCs), publications and programs related to energy use.

ASHRAE ENERGY POSITION DOCUMENT

1. INTRODUCTION

Energy is a fundamental ingredient of all economic systems. It is essential to the defense of nations, necessary to feed the world's population, indispensable in the production of the world's good and services, and vital for protection from the elements. Buildings—their construction, use, operation, maintenance, and demolition—are responsible for 30 to 40% of the world's energy use.

Most of the energy used in the built environment is derived from nonrenewable fossil fuels that have significant environmental impact. There is no doubt that global climate change needs our attention. Immediate action is required; we must approach the policy process in a measured and meaningful manner.

Society needs to carefully consider which policy roads are the right ones and how to continue to make progress towards our final destination: workable solutions that are economically feasible. We must address the real issue: how to develop a long-term energy plan that stresses conservation, renewable resources, technology, and diversification so our buildings are sustainable and environmentally responsible.

The American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc (ASHRAE) is one of the few organizations that has the expertise, the membership capabilities and the mission to directly affect the amount and type of energy used in current and future buildings. ASHRAE members working together, sharing ideas and advancing the standards of practice provides exceptional value to both members and the public.

2. FUNDAMENTAL PRINCIPLES

ASHRAE has identified five basic principles that are relevant to ASHRAE's mission and expertise and makes the following statements regarding them.

Sustainability—Sustainability is a means to provide a safe, healthy, comfortable indoor environment while sustaining the earth's resources so they are available in the future to sustain mankind.

Energy Efficiency—Energy use in existing and new structures can be reduced significantly, in an economical fashion, while providing occupant health, safety, comfort, and productivity.

Environment—There are environmental impacts from the use of all energy resources, especially fossil fuels. Reduced reliance on these resources will enhance the long-term protection of our environment and the quality of life of future generations.

Energy Resources—Reliable and secure energy resources and the capacity to deliver them to buildings are critical to maintaining and improving humanity's quality of life.

Balance—All energy resources have both negative impacts and positive benefits and are not equal in terms of their abundance and availability. An appropriate balance of diverse resources both renewable and nonrenewable is needed.

3. ISSUES

Numerous global, national, and local issues are impacted by these principals. ASHRAE has identified the following issues that have significant impact on the built environment and our quality of life and offers the following positions regarding each issue.

3.1 Maintaining a Secure, Economical Energy Supply

A long-term secure supply of energy is critical to maintaining and improving quality of life. Government policies have a significant impact on the types and economics of various resources that meet this need.

ASHRAE believes:

Policy discussions should include the following considerations:

Energy Efficiency—Policy development should recognize that improved energy efficiency in both new and existing buildings can limit exposure to risk associated with supply disruptions and can extend the economic life of existing nonrenewable energy resources. There are significant economic and quality of life benefits from energy efficiency that are not always captured in current economic models. These benefits must be quantified and explicitly considered in policy decisions.

Regulation—Regulation of the energy industry should be based on sound engineering principles that include full life-cycle assessment, balanced with the need for proper regulatory oversight.

Diversity—Energy sources vary in terms of their abundance and availability. For long-term security, state and national policies must support the development and use of robust and diverse energy portfolios that can provide long-term, sustainable energy supplies. Policies should include increased support for the development of renewable energy resources.

3.2 Environmental Impacts of Energy Development and Use

Development and consumption of nonrenewable energy resources have significant and predominantly negative environmental impacts. Some of these impacts are included in the price of developing these resources, such as emissions control technology, mine reclamation costs, groundwater protection, and waste treatment and disposal. However, other costs, including air and water pollution, resource depletion, and global climate impacts, are not included in the price for nonrenewable energy. Reducing energy consumption through efficiency and the use of renewable energy both have significantly lower environmental impact than the use of fossil resources.

ASHRAE believes:

The environmental impacts of new and existing energy resources, including energy efficiency and renewable resources, should be considered in all new energy resource decisions—both regulated and free market.

3.3 Impact of Buildings on the Energy Supply Infrastructure

Building use patterns are significant contributors to summer and winter peak demands on the electric supply grid. Electricity supply systems' reliability is strongly influenced by peak power demands imposed by buildings. Building energy use also has significant impact on natural gas delivery infrastructures. Buildings can be designed and operated in ways that help relieve these peak demands, but there is often limited economic incentive to do so. Demand responsive and energy efficient buildings, micro-turbines, fuel cells, thermal storage, and advanced controls can all be used to lower the peak impact on the energy supply grid.

ASHRAE believes:

Improved market structures, such as expanded use of time-of-day utility rates and seasonal pricing, would clarify the impacts of energy use on the supply infrastructure and provide incentives to market participants to design and operate buildings that respond to these impacts.

Building operators should have systems in place to manage the energy use in the building. Good energy management of buildings has the goal of reducing energy expenses to the lowest level possible without sacrificing comfort, productivity or functionality. ASHRAE provides guidance to the public on establishing and implementing effective, ongoing energy management programs, as well as information on planning and implementing energy management projects.

Decentralized supply systems (such as micro-turbines, fuel cells and photovoltaics) at the building level and thermal storage offer effective methods for reducing demand on the energy supply infrastructure.

3.4 Utility Regulation

As the provider of energy and a direct point of contact with energy users, electric and natural gas utilities are obvious organizations for educating consumers and encouraging energy use that meets society's goals. However, current utility regulations (particularly in the United States) limit, and even discourage, efforts to implement building strategies incorporating energy efficiency measures and the use of renewable energy.

In many areas, current government mandated utility rate structures tie utility profits directly to the amount of energy they provide—resulting in a strong disincentive for utilities to encourage the efficient use of energy. Additionally, as a result of the deregulation of the industry, many utilities have drastically reduced or even eliminated energy efficiency programs in an attempt to raise profits and increase competitiveness in the deregulated market.

ASHRAE believes:

Utility regulations should allow and encourage adoption of technologies, rate mechanisms and grid access protocols that minimize the total costs to energy consumers and maximize energy efficiency and the use of renewable resources.

Electric and natural gas utilities should not be penalized (and should be rewarded) for actions that they take to improve customer efficiency. This will require updated rate mechanisms including decoupling of revenues from sales of electricity and natural gas.

Barriers to increased use of renewable energy and distributed generation, including burdensome restrictions or prohibitions on net metering, must be overcome to allow development and implementation of increasingly energy efficient (and ultimately net zero energy) buildings.

3.5 Barriers to Improved Energy Efficiency in Buildings and Potential Opportunities

Energy efficiency in both existing and new buildings can be significantly improved over current practice. However, there are barriers and imperfections that prevent the market from obtaining cost-effective energy efficiency. Some of these barriers are institutional, while others are political and regulatory in nature.

Specific barriers that should be addressed include, but are not limited to:

- Failure to recognize and accommodate the life-cycle impacts of improved efficiency, i.e., too much focus on first cost.
- Prevention of offsetting increased first costs for more energy efficient equipment with decreased operating costs because of separations of capital/construction budgets and operations and maintenance budgets.
- Lack of effective guidelines, targets, and tools for measuring the performance of buildings during their entire life cycle.
- Failure to apply existing guidelines, targets, and tools for the design and measurement of the performance of buildings during their entire life cycle.
- Design fee structures that do not encourage energy-efficient building design.
- Building code requirements and enforcement that discourage improved design initiatives.
- Fear of potential litigation as a deterrent to innovative design and construction.
- Split incentives created when different parties are responsible for design costs, construction costs, operation costs, and building services.

ASHRAE believes:

Regulators, policy makers and building industry participants should address these barriers and promote market transformation in support of increased efficiency and use of renewable energy.

Governments at all levels should encourage the design, construction, and operation of energy efficient buildings

through the adoption of incentive programs including, but not limited to, tax deductions and credits, accelerated depreciation schedules, expedited permitting, and increased density allowances. Such programs will help overcome increased first costs for some energy efficiency measures and encourage increased energy efficiency in existing buildings.

Codes and standards for new building design should require energy efficient building systems and encourage the use of innovative energy saving technologies and strategies.

Building owners and operators should have access to and training on affordable and effective tools to facilitate the ongoing monitoring and analysis of energy system performance.

3.6 Appropriate Energy Codes and Standards for New Buildings

ASHRAE is a leading proponent and participant in developing standards for energy use in buildings and believes in the value of building codes based on those standards. The U.S. federal government and most states have adopted minimum energy codes based primarily on ASHRAE standards. ASHRAE acknowledges that present energy codes and equipment standards are minimum standards and that many buildings can be economically designed and built to substantially exceed the energy efficiency of the minimum code requirements. Currently most energy codes are based, at least in part, on average energy prices that do not provide accurate indications of the economic consequences of energy-related decisions and may also be outdated within the period the code is in place. Many energy codes in the U.S. are not enforced rigorously due to a lack of training of code officials and limited resources for enforcement. In other parts of the world the infrastructure to support code enforcement may be lacking as well.

ASHRAE believes:

ASHRAE's energy standards should serve as a basis for minimum code requirements and, in many cases, buildings can and should be designed and built cost-effectively to substantially exceed these minimums.

Energy codes and standards must provide accurate economic incentives to owners and operators of buildings by accommodating local variations in energy prices.

Energy codes and standards must be continually updated, enforceable, and enforced to achieve energy efficient buildings and a sustainable environment.

3.7 Energy Efficiency and Indoor Environmental Quality (IEQ)

ASHRAE recognizes that indoor environmental quality and energy efficiency may be perceived as opposing goals. Recent experiences and technology show that energy efficient buildings can exhibit good IEQ and often provide a higher level of IEQ in the areas of thermal comfort, ventilation, and lighting quality. Traditional methods of dealing with indoor air quality rely on increased ventilation air, which requires additional energy to condition. However, an efficient system (or building) is one that meets all requirements with fewer resources, and indoor environmental quality is a basic requirement in all buildings. Hence, the issue becomes one of maintaining indoor air quality in the most energy efficient manner possible. Improved technology, innovative design solutions, and improved equipment can achieve this.

ASHRAE believes:

Standards and policies should provide for health, safety, and comfort needs while attaining a high level of energy efficiency.

4. RECOMMENDATIONS

ASHRAE promotes increased energy efficiency, environmental preservation, and responsible energy resource use and development as an integral part of the ethics of ASHRAE members, government, and the public. ASHRAE will use its position as a global leader in HVAC&R technologies and applications to develop and disseminate technical information, standards, educational programs and research on issues of social importance to promote built environment sustainability.

4.1 Research and Technology Development

ASHRAE will:

Continue to identify, encourage, coordinate, sponsor, and conduct research on energy use and improved energy efficiency in buildings.

Continue to support efforts to improve all forms of energy efficiency and energy conversion technology.

Continue to identify and encourage the development of methods, systems, and equipment that improve the effective use of renewable energy resources, such as solar, geothermal, biomass, hydro, and wind.

Continue to improve analysis tools to help engineers, designers, and owners make choices that are economically and environmentally sound over the building lifetime.

Accelerate development of advanced building design guides to facilitate designs that significantly exceed the minimum criteria in Standard 90.1.

Increase collaborative efforts with other organizations to develop performance-rating systems and advanced design standards and guidelines that go beyond minimum standards.

Continue to support whole-building commissioning and re-commissioning while continuing to develop commissioning tools for performance monitoring and verification.

Address the quality of the indoor and outdoor environment by supporting improved technology, innovative design solutions, and improved equipment design.

4.2 Policy Development

ASHRAE will:

Continue to provide technical information to all parties involved in policy making for use in formulating policies, laws, and regulations relating to the efficient use of energy resources in buildings, equipment, and systems.

Work with government bodies to improve energy efficiency through building codes, incentives and other mechanisms.

Facilitate ASHRAE members in becoming actively involved worldwide with policy-setting entities to encourage sound, balanced, and innovative actions to address long-range energy problems and objectives.

Recognize and reward members who are making noteworthy contributions to energy policies.

Continue to encourage the development and use of performance-based design approaches that promote energy-efficient design.

Encourage members to provide technological expertise to support public and private programs that seek to achieve large-scale market-based improvements in energy efficiency.

Continue to encourage use of ASHRAE standards in building codes and regulations.

Continue to participate in the development of international energy standards through active involvement with international standards development bodies.

4.3 Education and Outreach

ASHRAE will:

Inform designers and decision makers about new and improved practices that lower the risk of environmental degradation and its damaging effects on health and the economy worldwide through activities such as the development of green building design guides.

Provide continuing education for ASHRAE membership such as Distinguished Lecturers program, certification programs, publications, online education and Web sites, chapter programs and satellite broadcasts, technical seminars, and technical conferences.

Increase the public's awareness of the value and benefits of energy-efficient buildings, systems, and equipment through collaborative efforts with other organizations by providing technical expertise and technical content for mass media campaigns.

Engage other organizations within the buildings community to encourage recognition of the need to address energy conservation and energy efficiency.

Educate building owners and operators on effective use of life cycle cost techniques to empower them to make the best investment decisions.

Provide the data necessary to encourage the incorporation of more energy-efficient processes, equipment, materials, and techniques in buildings.

Recognize and promote case studies of high performance buildings that achieve high levels of energy efficiency and significant reductions in environmental impact.

Work with educators to incorporate sustainability and energy conservation practices into the curriculum of engineering and design schools.

Work with educators and school board administrators to improve science, technology, engineering and mathematics (STEM) education across all grade levels to raise scientific literacy and public recognition of energy-related issues.

5. BIBLIOGRAPHY

There is a tremendous amount of published information on the topics of energy resources, use, and development. Summarizing this information to provide background for this document would inevitably leave out significant information. Rather than attempt such a summary, we have provided the following bibliography as a starting point for those interested in further exploring the issues addressed in this document.

ASHRAE DOCUMENTS

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ANSI/ASHRAE Standard 62.1-2007, Ventilation for Acceptable Indoor Air Quality

ANSI/ASHRAE Standard 62.2-2007, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings

ANSI/ASHRAE Standard 100-2006, Energy Efficient Standard for Existing Buildings except Low-Rise Residential Buildings

BSR/ASHRAE Standard 170P, Ventilation of Health Care Facilities

BSR/ASHRAE Standard 188P, Prevention Practices for Legionellosis Associated with Building Water Systems

ANSI/ASHRAE Standard 90.1-2007, Energy Standard for Buildings except Low-Rise Residential Buildings

ANSI/ASHRAE Standard 90.2-2007, Energy Efficient Design of Low-Rise Residential Buildings

BSR/ASHRAE Standard 189.1P, Standard for the Design of High-Performance, Green Buildings except Low-Rise Residential Buildings

2004 ASHRAE Handbook—HVAC Systems and Equipment

2005 ASHRAE Handbook—Fundamentals

2006 ASHRAE Handbook—Refrigeration

2007 ASHRAE Handbook—HVAC Applications

Advanced Energy Design Guides (30%)

Small Office Buildings

Small Retail

K-12 Schools

Warehouses (expected early 2008)
Highway Lodging (begin work summer 2007)
Healthcare facilities (begin work summer 2007)
Existing Buildings (in progress)
Advanced Energy Design Guides (50%–70%)
K-12 Schools (planned)
Small Office Buildings (planned)
Small Retail (planned)
ASHRAE Indoor Air Quality Position Document
ASHRAE/CIBSE Joint Statement on Climate Change
ASHRAE Sustainability Roadmap
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Commissioning (planned)
Operations and Management (planned)
Sustainability (planned)
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TC 2.3, Gaseous Air Contaminants/Removal Equipment
TC 2.4, Particulate Air Contaminants/Removal Equipment
TC 2.5, Global Climate Change
TC 2.8, Building Environmental Impacts and Sustainability
TC 4.3, Ventilation Requirements and Infiltration
TC 4.10, Indoor Environmental Modeling
TC 4.7, Energy Calculations
TC 5.3, Room Air Distribution
TC 5.5, Air-to-Air Energy Recovery
TC 6.2, District Energy
TC 6.7, Solar Energy Utilization
TC 6.8, Geothermal Energy Utilization
TC 6.9, Thermal Storage
TC 6.10, Fuels & Combustion
TC 7.1, Integrated Building Design
TC 7.5, Smart Building Systems
TC 7.6, Systems Energy Utilization
TC 7.8, Owning and Operating Costs
TC 7.9, Building Commissioning
TG1, Exergy Analysis for Sustainable Buildings
TRG4, Sustainable Building Guidance and Metrics
TRG7, Tools for Sustainable Building Operations, Maintenance and Cost Analysis

Many other ASHRAE technical committees are involved with energy and sustainable buildings, for additional information on ASHRAE technical committees go to: http://www.ashrae.org/technology/page/104

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