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“ASHRAE training has far exceeded my expectations. It provides a great overview of engineering concepts and fundamentals, systems design, commonly used HVAC equipment, control, codes, and much more. The content is provided in a very interactive manner where you have the opportunity to ask questions and discuss different industry practices. I highly recommend ASHRAE training to anyone and everyone.”

Caroline M. (Sales Engineer) Austin, TX
The ASHRAE Learning Institute (ALI) offers a variety of full-day Professional Development Seminars and half-day Short Courses presented at

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- ASHRAE Chapters (upon request)
- Companies (upon request)
- ASHRAE online course series
- Other industry meetings/conferences

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- Healthcare Facility Design Professional (HFDP) Certification
- High-Performance Building Design Professional (HBDP) Certification
- Operations & Performance Management Professional (OPMP) Certification

www.ashrae.org/certification
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COMMISSIONING

ASHRAE Guideline 0: The Commissioning Process
This course is ideal for building owners, facility managers, design engineers, building designers, architects, equipment manufacturers, and others interested in the commissioning process as defined by ASHRAE Guideline 0. The course focuses on commissioning objectives, activities, and deliverables. This is an entry-level course that will provide an understanding of the ASHRAE commissioning process for new construction. The course may be complemented by attending a more advanced course (such as ASHRAE’s full-day HVAC and/or enclosure commissioning course).

Instructor: Walter Grondzik, P.E., Fellow/Life Member ASHRAE, LEED® AP

Commissioning Process and Standard 202
Much confusion and misinterpretation exists today about the commissioning process. To alleviate this situation, this introductory-level course describes the fundamentals of the code-language process of the ASHRAE Standard 202-2013, Commissioning Process for Buildings and Systems. The course focuses on the ASHRAE commissioning process intent, deliverables, and activities. Standard 202 was written as a code-intended document that presents minimum acceptable characteristics for the practice of commissioning. This course complements ASHRAE’s Guideline 0-2013 course, which describes the characteristics and expectations of an ideal commissioning process.

Instructor: Walter Grondzik, P.E., Fellow/Life Member ASHRAE, LEED® AP

Commissioning Process in New and Existing Buildings
This introductory course focuses on how the building commissioning process can be applied cost-effectively to new construction and to existing facilities, with a strong emphasis on existing facilities applications. Learn the fundamentals of the commissioning process through each step of a new construction project, from predesign to occupancy and operations. The seminar will also discuss how the application of the commissioning process in existing facilities differs from new construction. Benefits of commissioning and how the process can improve the built environment, reduce environmental impacts through responsible resource utilization, improve the quality of design and construction, and raise the professional reputation of the entire commissioning team will be covered. Take away compelling information and case studies that demonstrates the value of investing in the commissioning process.

Instructor: Richard Casault, P.E., Member ASHRAE

The Commissioning Process in New and Existing Buildings (MENA)
The course teaches the fundamentals of the commissioning process through each step of a new construction project from predesign to occupancy and operations. In addition, the course covers the commissioning documentation requirements, including a review of specifications for new construction and existing buildings. Economic comparison between projects having commissioning teams versus projects that do not have will also be discussed. How to use ASHRAE Guidelines 0-2013, 0.2-2015, and 1.1-2007 on commissioning will also be discussed.

Instructor: Samir Traboulsi, Ph.D., P.Eng., Fellow/Life Member ASHRAE

Introduction to Building Enclosure Commissioning (Co-sponsored by Building Enclosure Commissioning Collaborative)
This seminar introduces the Building Enclosure Commissioning (BECx) process by outlining key quality based activities that achieve a successful building enclosure. The seminar will include overviews on such design phase BECx activities as developing the Owner's Project Requirements, the BECx plan, and critical building science and architectural issues to address in the design review and specifications, and construction phase BECx activities such as construction observation and performance testing. The seminar will aid in understanding how BECx contributes towards commissioning goals and requirements and LEED®.

Instructors: Fiona Aldous, Member ASHRAE; David Altenhofen, AIA; Joseph Deringer, AIA, Member ASHRAE, LEED® AP; Jay Enck, Member ASHRAE, HBDP, CPMP, BEAP, LEED® AP; and Rob Kistler, AIA, Member ASHRAE

ENERGY EFFICIENCY

Advanced Designs for Net Zero Buildings
This advanced course is for professional engineers and architects who want to expand their practice to include the design, construction, and operation of zero energy (net zero) buildings. The first principle of zero energy design is to make the building as energy efficient as possible. On-site renewable energy systems will then be added to achieve these efficiency goals. If adequate on-site zero energy is not feasible, then options for off-site renewable energy should be explored. The test for zero energy is at the energy meter, so proper commissioning and operator training are critical to success. The zero energy principles outlined above will be presented with case studies and examples showing how other design professionals have met the zero energy goal.

Instructors: Peter Simmonds, Ph.D., Fellow ASHRAE; and Charles Eley, P.E., AIA, CEM, Member ASHRAE, BEMP, LEED® AP

Advanced High-Performance Building Design
This advanced course is for professional engineers and architects who want to expand their practice to include the design, construction, and operation of zero energy (net zero) buildings. The first principle of zero energy design is to make the building as energy efficient as possible. On-site renewable energy systems will then be added to achieve these efficiency goals. If adequate on-site zero energy is not feasible, then options for off-site renewable energy should be explored. The test for zero energy is at the energy meter, so proper commissioning and operator training are critical to success. The zero energy principles outlined above will be presented with case studies and examples showing how other design professionals have met the zero energy goal.

Instructor: Jeff Ross-Bain, P.E., Member ASHRAE, BEMP, LEED® AP

Basics of Combined Heat and Power
Combined heat and power (CHP) is an efficient, clean, and reliable approach to generating power and energy from a single fuel source. CHP is one of the most efficient ways to burn fuel since little energy is lost as waste heat. This course focuses on the fuel savings, emissions reduction, and decentralization of energy and power supply. The basic CHP terms and definitions, rating parameters, and energy conversion
systems are discussed. The focus of this course is to understand thermal design for CHP systems and the types of technology that exists.

**Instructor:** Lucas Hyman, P.E., Member ASHRAE, LEED® AP

**Basics of High-Performance Building Design**

This course focuses on the basic application of relevant ASHRAE resources, such as ASHRAE Standards 90.1, 55, 62.1, 189.1, and the ASHRAE GreenGuide, to achieve high-performance building design. The course explains the differences in purpose and requirements between these various standards and provides recommendations on selection of what requirements to adopt into a building project, assuming it is not under the jurisdiction of ASHRAE Standard 189.1 but the design team still wanted to achieve a reasonable degree of high performance building design. Course content should be suitable for architects and engineers.

**Instructor:** Tom Lawrence, Ph.D., P.E., Member ASHRAE, LEED® AP

**Building Demand Response and the Coming Smart Grid**

This course presents applications of new technologies and design concepts that are leading the way to how buildings and their systems will interact with a coming smart electrical grid. The primary focus is on demand response measures and programs, although smart buildings and their new system concepts are also included. Finally, the course summarizes the future driving trends toward high-performance buildings across the globe.

**Instructor:** Tom Lawrence, Ph.D., P.E., Member ASHRAE, LEED® AP

**Cogeneration from Basics through Operations**

This combined heat and power (CHP) survey course provides a broad overview of cogeneration systems from concepts, to improving operational performance and efficiencies. The course includes a detailed discussion of different prime movers, appropriate applications, and the use of thermal equipment. Conducting a CHP feasibility study, the engineering design process (including basic CHP system design), required permitting efforts, and construction efforts are also covered.

**Instructor:** Lucas Hyman, P.E., Member ASHRAE, LEED® AP

**Combined Heat and Power: Creating Efficiency through Design and Operations**

The successful implementation and operation of a cogeneration plant is the focus of this course. The course progresses from design through construction and operations and concludes with three case studies. The design section includes key issues that affect equipment sizes and selections, as well as the effects of those selections on plant performance and heat recovery. The construction section provides an overview of the key steps in a project's construction phase that differ from more typical central plant or general construction projects. The operations section shows the methods that should be implemented to prolong equipment life and promote operational efficiency. Each case study provides background information for the campus and the corresponding results of the combined heat and power plant installation.

**Instructor:** Lucas Hyman, P.E., Member ASHRAE, LEED® AP

**Commercial Building Energy Audits**

This seminar provides guidance on how to perform commercial building energy audits. Best practices and other information relevant for building owners, managers and government entities are covered.

The seminar includes a summary of materials essential for performing ASHRAE Level 1, 2, and 3 audits, time-saving tips for every auditor, how to hire an auditor, what to ask for in a comprehensive audit report, and how to build a successful energy efficiency retrofit team.

**Instructor:** Jim Kelsey, P.E., Member ASHRAE, BEAP, LEED® AP

**Commercial Building Energy Audits (MENA)**

This course covers the information needed to perform commercial building energy audits. Best practices and other information relevant for building owners, managers, and government entities will be discussed. The seminar includes a summary of materials essential for performing Level 1, 2, and 3 audits, time-saving tips for every auditor, how to hire an auditor, what to ask for in a comprehensive audit report, and how to build a successful energy efficiency retrofit team. This course has been customized for the Middle East by instructors well versed in the concerns for professionals in the region.

**Instructor:** Hassan Younes, Member ASHRAE, BEAP, BEMP, HBDP, CPMP, HFDP, OPMP

**Cool Thermal Energy Storage Systems for Air Conditioning**

Building air-conditioning systems are the single greatest contributor to aggregate peak electrical demand. As a technology, thermal energy storage enables shifting a significant proportion of a facility's demand for electricity from daytime to nighttime periods. Furthermore, thermal energy storage enables flexibility in the demand for electricity by building air-conditioning systems—principally operating during time periods where renewable energy is plentiful and idling during time periods where renewable energy is sparse or unavailable. Through this course, participants will come to understand how thermal energy storage can enable greater use of renewable energy generation and learn whether an existing or new facility may benefit from the application of a thermal energy storage system.

**Instructor:** Doug Reindl, Ph.D., P.E., Fellow ASHRAE

**Designing Toward Net Zero Energy Commercial Buildings**

The course provides application knowledge of the design and operating principles for energy-efficient buildings and available technologies and systems to achieve net zero energy building design. Building design strategies; review of current policy and regulation; energy, environmental and economic assessment of building's performance; energy efficiency in HVAC, lighting and appliances; and on-site renewable energy sources are reviewed.

**Instructors:** Dunstan Macauley, P.E., Member ASHRAE, HBDP, LEED® AP; and Frank Mills, C.Eng., Member ASHRAE

**District Cooling and Heating Systems: Central Plants**

Design principles for an efficient, reliable district cooling/heating plant that serves multi-building facilities are described and demonstrated. The course addresses each component of equipment and the relationship with other equipment within the plant. Types of equipment and the choices available within a type, such as chillers, will be reviewed and the criteria for selection will be a part of the course. Included is a short discussion of special applications such as thermal storage, combined heat and power, and deep lake water cooling.

**Instructors:** William Bahnfleth, Ph.D., P.E., Presidential/Fellow ASHRAE

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**Visit [www.ashrae.org/education](http://www.ashrae.org/education) for more details and to register.**
Effective Energy Management in New and Existing Buildings

Buildings use 40% of US energy, of which one-third can be cost effectively saved. To achieve this goal, building professionals can utilize energy management—an orderly process in which managers use resources at their disposal to accomplish clear, energy-saving objectives. This seminar weaves together energy management principles of the ASHRAE Handbook—HVAC Applications, ENERGY STAR Guidelines, and new ASHRAE Standard 100-2015, Energy Efficiency in Existing Buildings. Practical experience of successful energy managers is presented. Numerous case studies are discussed including a hospital, high-rise building, bank, and convention center. Together, these successful examples demonstrate how to take advantage of the ENERGY STAR Portfolio Manager for documented performance tracking and national recognition as an ENERGY STAR.

**Instructor:** Richard Pearson, P.E., Fellow/Life Member ASHRAE

Energy Efficiency in Data Centers

There are plenty of opportunities to save energy in data centers. Data centers are using an increasing amount of the total energy used by commercial facilities. However, these increases have a downside in that they have caused a significant increase in the power required and the heat dissipated by the computing equipment, such that it is becoming very difficult to power and cool these systems in data centers or telecommunications rooms. This course examines the best practices for data center energy efficiency by focusing on thermal guidelines for data processing, datacom facility energy efficiency, and actual high density data centers in operation today. You will gain an understanding of equipment environment specifications while learning methods for measuring performance and developing means to evaluate effectiveness of data center cooling. You will also receive instructions on the use of the U.S. DOE’s DCPro web-based energy modeling tools for data centers.

**Instructors:** Don Beatty, P.E., Fellow ASHRAE; Jack Glass, Member ASHRAE; and Roger Schmidt, Ph.D., P.E., Member ASHRAE

Energy Management Best Practices

Buildings use 40% of U.S. energy, of which one-third can be cost-effectively saved. To achieve this goal, building professionals can utilize energy management—an orderly process in which managers use resources at their disposal to accomplish clear, energy-saving objectives. This course weaves together energy management principles of the ASHRAE Handbook—HVAC Applications, ENERGY STAR guidelines, and ASHRAE/IES Standard 100-2015, Energy Efficiency in Existing Buildings. The practical experiences of successful energy managers are presented. Numerous case studies are discussed including a hospital, high-rise building, bank, and convention center. Together, these successful examples demonstrate how to take advantage of the ENERGY STAR Portfolio Manager for documented performance tracking and national recognition as an ENERGY STAR.

**Instructor:** Richard Pearson, P.E., Fellow/Life Member ASHRAE

Energy Modeling Best Practices and Applications (co-sponsored with IBPSA)

This seminar covers the fundamentals of building energy modeling and explains how to use modeling to guide design decisions, with an emphasis on HVAC. Integrating modeling into the design process from the programming stage through post-occupancy and measurements and verification will be discussed. The seminar explains modeling principles and provides modeling tips related to the building envelope, plug loads, lighting systems, and HVAC systems. Concluding with guidance on model calibration and the use of energy models for measurement and verification, this seminar also includes case studies and links to valuable modeling resources.

**Instructors:** Liam Buckley, C.Eng., Member ASHRAE, BEMP; Drury Crawley, Ph.D., AIA, Fellow ASHRAE, BEMP; Molly Curtz, P.E., Member ASHRAE, BEMP LEED® AP; Joseph Deringer, AIA, Member ASHRAE, LEED® AP; James Dirkes, P.E., Member ASHRAE, BEMP, LEED® AP; David Eldridge, P.E., Member ASHRAE, BEMP, BEAP, HBDP, LEED® AP; Ellen Franconi, Ph.D., Member ASHRAE, BEMP, LEED® AP; Erik Koldrup, P.E., Member ASHRAE, BEMP, LEED® AP; Annie Marston, Ph.D., Member ASHRAE, BEMP, LEED® AP; Sam Mason, P.E., Member ASHRAE, BEMP, LEED® AP; and McHenry Wallace, P.E., Member ASHRAE, LEED® AP

Evaluation Methods for High-Performance Green Buildings

Building performance design guidelines and evaluation metrics include LEED®, Portfolio Manager®, Green Globes, ISO 50001, IPMVP; and ASHRAE standards and guidelines, including ASHRAE/IES Standard 90.1. Each serves a specific purpose; some are focused on a single aspect, others view performance in a holistic sense. Selecting a guide or metric depends on design goals and target audience. This course introduces various guidelines and their applicability to high-performance buildings. It then discusses establishing design goals, the need for verification, performance evaluation methods, implementing specific methods, and identifying corrective actions as needed. Demonstrations of relevant tools such as Portfolio Manager and Target Finder will be conducted.

**Instructor:** Mark Stetz, P.E., Member ASHRAE, BEAP

High-Performance Building Design: Applications and Future Trends

This course presents applications of new technologies and design concepts to achieve the goal of high-performance buildings, including zero energy or nearly zero energy buildings. The course discusses exactly what a high-performance building is from the perspective of various stakeholders. High performance is more than just energy efficiency, and this course addresses issues and methods for providing high performance in areas beyond energy efficiency, such as indoor environmental quality. The course describes future possibilities for high-performance buildings across the globe and quickly summarizes how ASHRAE standards (existing and those in development) address these topics.

**Instructor:** Tom Lawrence, Ph.D., P.E., Member ASHRAE, LEED® AP

IT Equipment Design Evolution and Data Center Operation Optimization

IT manufacturers are continually responding to customer demands. Depending on the market sector, the demands call for IT equipment that is lower cost, more energy efficient, provides more storage, and provides more computing capabilities. This results in continued, significant changes in hardware, including the hardware operating conditions. This course describes the changing IT equipment and its impact on data center operating conditions. The course also shares important insight resulting from the hard work in these areas by ASHRAE Technical Committee 9.9, Mission Critical Facilities, Data Centers, Technology Spaces, and Electronic Equipment.

**Instructors:** Don Beatty, P.E., Fellow ASHRAE; Roger Schmidt, Ph.D., P.E., Member ASHRAE

Visit [www.ashrae.org/education](http://www.ashrae.org/education) for more details and to register.
Avoiding IAQ Problems Using the ASHRAE IAQ Guide
Based on ASHRAE's Indoor Air Quality Guide: Best Practices for Design, Construction, and Commissioning, this course provides a systematic overview of the key objectives that must be met to achieve good indoor air quality. A review of the most common causes of IAQ problems in buildings, as well as the process management strategies that owners and design teams can use during design, construction, and turnover to help avoid IAQ problems are discussed. The course discusses the state-of-the-art strategies to prevent IAQ problems related to moisture and mold in building assemblies, outdoor contaminants, moisture and dirt in air handling systems, material emissions, outdoor air monitoring and control, and more. Case studies and examples are provided to help make the IAQ Guide easy to use on your next project.

Instructor: Hoy Bohanon, PE, Member ASHRAE, BEAP, LEED® AP

IAQ Best Practices for Design, Construction, and Commissioning
What are the critical parts of a project that can jeopardize indoor air quality (IAQ) in your next building or building project? Knowing the key components of IAQ will help you to manage, organize, direct, design, or commission your next project. In addition to identifying key issues, this course will point out what parts of the project process are especially vulnerable to risk. There are also decisions made in the project process related to building envelope, building HVAC, and building operations and maintenance that affect the long term health of the building and its occupants. Knowledge conveyed is based upon ASHRAE's Indoor Air Quality Guide.

Instructor: Hoy Bohanon, PE, Member ASHRAE, BEAP, LEED® AP

Humidity Control I: Design Tips and Traps
In commercial buildings, excess humidity and moisture promotes mold, mildew, and uncomfortable conditions for occupants. This course, based on ASHRAE’s Humidity Control Design Guide for Commercial and Institutional Buildings and on ASHRAE Guide for Buildings in Hot & Humid Climates, helps the designer achieve true control of humidity, rather than just its moderation. The course covers how to understand and easily estimate the major humidity loads that must govern the design of the system and decisions about equipment size and configuration. Attendees will learn what equipment is used for this purpose, how it works, and how to apply it quickly, economically and reliably.

Instructors: Lew Harriman, Fellow ASHRAE; and Mark Nunnelly, PE, Member ASHRAE, BEMP, LEED® AP

Humidity Control II: Real World Problem and Solutions
Based on ASHRAE’s best-selling Humidity Control Design Guide for Commercial and Institutional Buildings, this course includes an in-depth discussion of moisture load calculations and how humidity control can be added to HVAC designs for seven different types of commercial buildings. The course also covers the effects of different humidity levels on thermal comfort, corrosion, mold growth, and airborne microorganisms—information that helps the owner and designer define the optimal humidity control level for each application.

Instructors: Lew Harriman, Fellow ASHRAE; and Mark Nunnelly, PE, Member ASHRAE, BEMP, LEED® AP

Introduction to Ultraviolet Germicidal Irradiation (UVGI) Systems
A comprehensive introduction to how ultraviolet germicidal irradiation (UVGI) can be used in conjunction with HVAC systems to improve indoor environmental quality (IEQ) and reduce airborne disease transmission is the focus of the course. The course surveys the history and development of UVGI from its beginnings in the 19th century to the present, describes the fundamentals of the germicidal action of UVGI and characteristics of UVGI sources, common system types and their applications, the economics of UVGI, and practical considerations including material degradation, maintenance and safety. Case studies are used to illustrate typical applications.

Instructor: William Bahnfleth, Ph.D., PE, Presidential/Fellow ASHRAE

Optimizing Indoor Environment: Increasing Building Value
Increase building value by meeting owner and occupant requirements. Buildings are provided to house and accommodate people individually or in groups. These structures can either help or hinder peoples’ productivity and enjoyment of the indoor environment. Indoor environmental quality (IEQ) is highly correlated to building occupants’ performance and satisfaction. ASHRAE sets the standards for minimum IEQ. ASHRAE also provides resources for understanding how to go beyond the minimum in improving IEQ conditions in buildings. Another factor in building productivity is cost. ASHRAE provides multiple resources for managing utilities costs in commercial buildings. The newest and most sophisticated tool for buildings is Building EQ. This course focuses on implementing ASHRAE guidance for improvement with background information to provide understanding of the various interrelated components that affect IEQ. Implementing the processes provided will set a direction for continuous improvement of building productivity, thus increasing value in tomorrow’s built environment.

Instructor: Hoy Bohanon, PE, Member ASHRAE, BEAP, LEED® AP

Visit www.ashrae.org/education for more details and to register.
HVAC&R APPLICATIONS

Air-to-Air Energy Recovery Applications: Best Practices
Air-to-air energy recovery provides one of the most cost-effective and efficient ways to recycle waste energy and create superior indoor environments. This course will review real-world examples of where and how air-to-air energy recovery technologies are integrated into some of the most commonly used commercially available systems. Particular configurations that are most commonly used in high-performance buildings and how they can best be used to meet stretch goals for IEQ, energy efficiency, and thermal comfort will be examined with respect to established performance metrics, peak performance results, and annual energy savings. A variety of different dedicated outdoor air systems, neutral air systems, and enhanced dehumidification strategies (with single and multiple heat exchangers) will be examined in detail. The advantages and important considerations for using air-to-air energy recovery in a variety of different applications will be covered. Best practices for mechanical design, exchanger selection, and control strategies will be discussed throughout.

Instructor: Hassan Younes, Member ASHRAE, BEAP, BEMP, HBDP, CPMP, HFDP, OPMP

Design of Affordable and Efficient Commercial Ground-Source Heat Pump Systems
This course describes the best design practices of ground-source heat pump systems to achieve maximum customer benefit. The course examines the economic analysis of ground-source versus more traditional systems and what is necessary to design an effective and efficient ground-source system. The course covers energy analysis, equipment selection, drilling technologies, testing requirements, hydronic system design, and system controls. Participants will learn all that is necessary for the design and installation of a successful ground-source heat pump system.

Instructor: Steve P. Kavanaugh, Ph.D., Member ASHRAE

Designing and Operating High-Performance Healthcare HVAC Systems
This advanced course discusses in detail the interactions of the key elements of high performance in healthcare, infection control, comfort, reliability, safety, maintenance, energy, and sustainability. Numerous energy conservation strategies will be considered in the context of achieving all the goals of a high-performing hospital. For example, the hardware and controls for setback of temperature and airflow and the relationship to temperature, relative humidity, air exchange, filtration, and pressurization requirements are discussed.

Instructors: Daniel Koenigshofer, PE, Member ASHRAE, HFDP; and Donald Burroughs, PE, Member ASHRAE

Designing HVAC Systems to Control Noise and Vibration
Controlling noise and vibration is critical to ensuring the long-term, proper operation of any HVAC system. Proper system design can prevent many noise/vibration problems. This seminar emphasizes the important design information in ASHRAE's Practical Guide to Noise and Vibration Control for HVAC Systems. Beginning with a fundamental discussion of acoustics, the seminar focuses on the proper design and selection of HVAC equipment. Special attention is given to fans and air-distribution systems. Also discussed are noise/vibration problems associated with central plant equipment, piping systems, and outdoor equipment. Class exercises and case studies will be presented to reinforce the course information.

Instructor: E. Curtis Eichelberger, PE, Member ASHRAE

Designing Tall, Supertall, and Megatall Building Systems
The course covers the main topics in the new ASHRAE Design Guide for Tall, Supertall, and Megatall Building Systems including: analyzing/optimizing the thermal performance of the building envelope; calculating the stack effect; selecting appropriate mechanical systems and central plant alternatives; ventilation and thermal comfort; code compliance; chilled- and heated-water distribution systems; evaluating pumping systems; fire and life safety systems; vertical transportation systems; high-rise residential designs; and mechanically and naturally ventilated conditioning solutions. Also, energy modeling and energy use index (EUI) are presented to enable designers to assess the efficiency of the building and its systems. Finally, building and systems controls as well as smart grid operation are included.

Instructor: Peter Simmonds, Ph.D., Fellow ASHRAE
Healthcare Facilities: Best Practice Applications of HVAC Systems
Based on ASHRAE’s HVAC Design Manual for Hospitals and Clinics, this applications course builds on content covered in the course Healthcare Facilities: Best Practice for HVAC Design and Operation. This course focuses on room pressurization and design practices in all medical-related rooms of a hospital: operating rooms, labs, imaging suites, patient rooms, pharmacies, ICUs, emergency departments, and isolation rooms. Psychrometrics, control strategies, energy conservation, and commissioning are covered in relation to the design requirements of ASHRAE/ASHE Standard 170, Ventilation of Health Care Facilities, and the focus on patient outcome essential to healthcare facilities.

Instructors: Robert Cox, P.E., Member ASHRAE; Daniel Koenigshofer, P.E., Member ASHRAE, HFDP; and Michael Sheerin, P.E., Member ASHRAE

Healthcare Facilities: Best Practice for HVAC Design and Operation
Based on the ASHRAE book HVAC Design Manual for Hospitals and Clinics, this course introduces many unique and up-to-date healthcare design considerations and applications. The course covers Chapters 1-4, 6-11, and 13-16. Common medical terminology is introduced, and terminology differences between the medical and engineering fields are examined. Infection particles and their transport mechanisms are covered, followed by infection control methods. A major emphasis is placed on the necessary considerations for various diagnostic and treatment and support areas. The second half of the course focuses on air-distribution designs for surgical and patient rooms. Various control and energy efficiency techniques for cooling and heating plants are presented along with O&M and other commissioning topics. Smoke control and life safety best practices and application issues finish the course.

Instructor: Daniel Koenigshofer, P.E., Member ASHRAE, HFDP

High Performing Healthcare Facilities, Design Consideration and Applications (MENA)
This course provides a discussion of fundamentals of system design for healthcare facilities, design considerations, basic methodology of HVAC design, psychrometrics, energy, and sustainability goals of high-performance healthcare facilities. In addition, this course will cover definitions of the key elements of high-performance in healthcare, control sequences and set points, and energy conservation strategies and relationships to temperature/relative humidity requirements.

Instructor: Hesham Safwat, Ph.D., Member ASHRAE

Integrated Building Design
This seminar will provide a working knowledge of the integrated building design process, explaining the basic concepts involved and outlining the fundamental application of this approach. Course content will explain the advantages and benefits of integrated building design and how this process differs from conventional design practice. The program structure will identify the necessary sequencing and scope of activities that should be implemented to support development of collaborative solutions. In addition to design-related philosophy, course content will explore the critical elements of TEAM activity and management of collaborative teams. This seminar will benefit any person who has a role in the planning, design, construction, and operation of a built solution. Attendees will be able to strategically position themselves in the market place by understanding the value of project fundamentals and the importance of holistic interdependencies. Emphasis will be placed on transitioning traditional processes that aggregate isolated silos of knowledge into collaborative thought and shared outcome.

Instructors: Charles Gulledge, P.E., Member ASHRAE, HBDP, LEED® AP; Lisa Rosenow, Member ASHRAE, LEED® AP; and Dennis Knight, P.E., Fellow ASHRAE

Introduction to BACnet®
This course helps students understand some of the elements required to successfully plan for BACnet® and some of the complex issues that must be addressed to achieve interoperability. Students learn that interoperability covers a wide range of possible options, and how to simplify interoperability by defining specific areas where interoperability is required. Also discussed are the basic components of any multi-vendor or multi-discipline BACnet® control system, how different systems can be merged together using BACnet®, and how BACnet® facilitates the integration of older systems with BACnet®-based systems. The course does not discuss specific manufacturers, or alternatives to BACnet® or BACnet® specification writing.

Instructor: David Fisher, Member ASHRAE

Laboratory Design: The Basics and Beyond
A comprehensive overview of HVAC design for laboratories is examined in this course. The course focuses on the essential elements of the design process that are unique to laboratory HVAC systems. Topics include planning steps, determining exhaust/supply requirements, load calculation, pressure mapping, evaluating system options, layout of ducts and rooms, sizing primary air systems, designing exhaust stacks, sustainability in laboratories, and control strategies. Example problems and case studies will also be presented.

Instructor: John Varley, P.E., Member ASHRAE, HBDP, LEED® AP

Latest in High-Performance Dedicated Outdoor Air Systems (DOAS)
The dedicated outdoor air system (DOAS) has become a very popular means to provide ventilation for buildings, particularly for low-energy, max tech, and zero energy buildings. DOAS and the accompanying room-level heating/cooling units provide many benefits, including low energy use, cost-effective humidity control, redundancy, and control simplicity. This new course covers the latest in DOAS application, design, and control.

Instructor: Arthur Hallstrom, P.E., Fellow/Life Member ASHRAE, BEMP

New ASHRAE-Classified Refrigerants to Meet Society's Changing Needs
There has long been use of flammable and toxic materials as refrigerants, such as propane and ammonia, but their use has been restricted to appropriately designed industrial systems, as described in ASHRAE Standard 15 and other safe-use guidelines. Presently, concern about global climate change is driving the cooling industry to consider new classes of chemicals to be used as refrigerants. With the new chemicals are new safety classifications for flammability, including Class 2L. This short course explains how the changing needs of society are creating requirements for new refrigerants to be developed and used. The course also explains the new safety classifications that are being proposed and some of the ramifications of these new classifications.

Instructor: Thomas Leck, Ph.D., P.E., Member ASHRAE

Visit [www.ashrae.org/education](http://www.ashrae.org/education) for more details and to register.

Seminars/Courses subject to change without notice.
The Future of Refrigerants: Challenges and Opportunities (MENA)
This training provides a background review of international treaties and initiatives that support the transition from hydrochlorofluorocarbon (HCFC) and hydrofluorocarbon (HFC) refrigerants towards non-ozone-depleting, low-global-warming-potential substances. A review of proposed refrigerants and how they can be used in different HVAC&R applications based on theoretical and empirical analyses is discussed. Challenges and opportunities associated with the different types of refrigerants are presented, including hydrofluorocarbons and natural refrigerants. Current and future refrigerant options suit the region are covered, as well as related standards and codes of systems and substances. Finally, the course wraps up with a discussion on the systems perspective and how to best understand the opportunities for energy-efficiency improvements along with hands-on experience with free software, such as life-cycle climate performance web applications and the heat pump design models.
Instructors: Omar Abdelaziz, Ph.D., Member ASHRAE; and Karim Amrane, Ph.D., Member ASHRAE

Understanding and Designing Chilled-Beam Systems
This course is primarily designed for mechanical engineers with at least three years of experience in the design of commercial HVAC systems. Chilled-beam systems save on cooling and transport energy by decoupling most or all of the space sensible loads from the air-distribution system and removing them with water, a much more efficient heat transfer medium. Attendees will review HVAC fundamentals as they relate to chilled-beam system design. Attendees will understand the system benefit, be able to identify suitable applications, and design chilled-beam systems to optimize the energy and operational benefits. Properly identifying and controlling equipment and components that optimize design are also major components of this course. Efficient design of a chilled-beam system requires some departure from practices and conventions used to design all-air VAV systems. As most North American HVAC designers have almost exclusively used VAV systems, they are often not aware of the energy benefits that can be derived by departure from some of these VAV-system rule-of-thumb design procedures.
Instructor: Ken Loudermilk, P.E., Member ASHRAE

Variable Refrigerant Flow System Design and Application
Variable refrigerant flow (VRF) systems are now being applied in many building types across North America. This course provides non-manufacturer-specific concepts of how to apply VRF systems to buildings. The course supplements the fundamental technology presented in the 2016 ASHRAE Handbook—HVAC Systems and Equipment, offering consulting engineers who already have a basic knowledge of VRF technology comprehensive system design and application guidance using building-specific scenarios. This course is geared towards mechanical engineers, design/build contractors, consulting engineers, HVAC system designers, and facility engineers.
Instructors: Paul Doppel, Member ASHRAE; Jocelyn Léger, P.Eng., CEM, Member ASHRAE, LEED® AP

Variable Refrigerant Flow Systems: Technology Introduction
This course provides an overview of variable refrigerant flow (VRF) technology including equipment and system types, heating/cooling operation, heat recovery and the benefits of VRF systems. Also described is the VRF design process, with a particular focus on load profile analysis, unit sizing, ventilation air strategy, refrigerant piping design, and system monitoring/controls. Refrigerant safety considerations are explained, and there is a discussion of ASHRAE Standards 15 and 34. The course concludes with a focus on human comfort and sustainable design featuring example buildings, ventilation systems, and VRF system layouts.
Instructor: Dermot McMorrow, P.Eng., Member ASHRAE

HVAC Design Essentials (MENA)
ASHRAE’s HVAC Design Essentials MENA training provides instruction that accelerates participants’ transformation into effective members of a design, construction, or facilities maintenance team. Developed by industry-leading professionals selected by ASHRAE, the training provides attendees with the fundamentals and technical aspects of HVAC design. In addition to gaining in-depth knowledge and understanding, attendees will receive real-world examples of HVAC systems based on the renovated ASHRAE Headquarters building and on buildings in the MENA region. The training also teaches a systematic approach to guide a design team to a solution that optimally meets the client’s expectations.
Instructors: Walid Chakroun, Ph.D., P.E., Fellow ASHRAE; Hassan Younes, Member ASHRAE, BEAP, BEMP, HBDF, CPMP, HFDP, OPMP; and Samir Traboulsi, Ph.D., P.Eng., Fellow Life Member ASHRAE

HVAC Design: Level I—Essentials
When graduates from technology or engineering schools enter the workforce, they are often ill-equipped to deal with the challenges of their positions. This three-day training provides participants with training that accelerates their transformation into effective members of a design, construction or facilities maintenance team. Attendees will gain practical and immediately useful skills and knowledge to design and maintain HVAC systems.
Instructors: Donald Brandt, Life Member ASHRAE, BEAP; Julia Keen, Ph.D., P.E., Fellow ASHRAE, BEAP, HBDF; Joel Primeau, Eng., Member ASHRAE, HBDF, LEED® AP; and Dennis Wessel, P.E., Fellow/Life Member ASHRAE, LEED® AP
HVAC Design: Level II—Applications
Gain advanced instruction on HVAC system designs for experienced HVAC designers or those who have completed the HVAC Design: Level I Essentials training. This two-day training provides complex information about designing, installing, and maintaining HVAC systems, resulting in skills that can be put to immediate use. Gain an in-depth understanding of ASHRAE Standards 55, 62.1, 90.1, and ASHRAE’s Advanced Energy Design Guides.
Instructors: Donald Brandt, Life Member ASHRAE, BEAP; Julia Keen, Ph.D., P.E., Fellow ASHRAE, BEAP, HBDP; Joel Primeau, Eng., Member ASHRAE, HBDP, LEED AP; and Dennis Wessel, P.E., Fellow/Life Member ASHRAE, LEED AP

Improving Existing Building Operation
This training focuses on the built environment and existing HVAC systems. The proper operation and maintenance of existing HVAC systems are discussed. The course also introduces different methods for evaluating potential improvements to a building and its systems. This two-day training provides the techniques to measure existing building performance to make their facilities operate more efficiently and economically.
Instructor: Julia Keen, Ph.D., P.E., Fellow ASHRAE, BEAP, HBDP

STANDARDS AND GUIDELINES

Application of Standard 62.1-2010: Multiple Spaces (Equations and Spreadsheets)
Applying ASHRAE Standard 62.1-2010 to multiple spaces can be challenging even for advanced HVAC practitioners. This advanced course covers the new Appendix A method and focuses on using the new spreadsheet from the 2010 user’s manual. The material includes both constant-volume and VAV applications and then examines certain cases where secondary recirculation applies. The course intent is to develop proficiency in using the spreadsheet tool for improving design solutions that will comply with the 2010 standard. A copy of the spreadsheet will be provided and along with explanations for use, particularly regarding the effect on total outdoor air required when changing different design parameters. In-class exercises will be conducted, so attendees will benefit from using their own laptops.
Instructor: Hoy Bohanon, P.E., Member ASHRAE, BEAP, LEED® AP

Application of Standard 62.1-2013: Multiple Spaces (Equations and Spreadsheets)
Applying ASHRAE Standard 62.1-2013 to multiple spaces can be challenging even for advanced HVAC practitioners. This advanced course covers the new Appendix A method and focuses on using the new spreadsheet from the 2013 user’s manual. The material includes both constant-volume and VAV applications and then examines certain cases where secondary recirculation applies. The course intent is to develop proficiency in using the spreadsheet tool for improving design solutions that will comply with the 2013 standard. A copy of the spreadsheet will be provided and attendees are strongly encouraged to bring their laptops to learn the spreadsheet’s power and the effect on total outdoor air required when changing different design parameters.
Instructor: Hoy Bohanon, P.E., Member ASHRAE, BEAP, LEED® AP

ASHRAE 90.1 Code Compliance and Plan Review for Authorities Having Jurisdiction
This seminar provides guidance on how to specify and manage the compliance procedures conducted and recognize issues that surface under both design/bid/build and design/build project arrangements. The prescriptive compliance section focuses on reviewing ASHRAE forms and relevant ComCheck submissions and cross checking the information on standard design documents. The seminar explains the requirements of the standard and how the requirements are presented in the energy model input and output. Examples of several different energy simulation model platforms are given.
Instructor: McHenry Wallace, P.E., Member ASHRAE, LEED® AP

Complying with Standard 90.1-2010
Targeted at design professionals, code officials, and building owners, the various versions of ASHRAE/IES Standard 90.1 have been the benchmarks for commercial building energy codes in the United States and a key basis for standards in more than 15 countries around the world. The 2010 update of ASHRAE/IES Standard 90.1 is a major revision, with a goal of saving 30% more energy than the 2004 version. The 2010 version includes changes to Scope and Purpose along with other changes based on the 122 addenda that were considered.
Instructors: McHenry Wallace, P.E., Member ASHRAE, LEED® AP; and Joseph Deringer, AIA, Member ASHRAE, LEED® AP

Complying with Standard 90.1-2013
Targeted at design professionals, code officials, and building owners, the various versions of ASHRAE/IES Standard 90.1 have been the benchmarks for commercial building energy codes in the United States and a key basis for standards in more than 15 countries around the world. The 2013 update of ASHRAE/IES Standard 90.1 is a major revision, containing more than 100 changes from the 2010 version.
Instructors: McHenry Wallace, P.E., Member ASHRAE, LEED® AP; and Joseph Deringer, AIA, Member ASHRAE, LEED® AP

Complying with Standard 90.1-2016
The 2016 update of ASHRAE/IES Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings is a major revision, containing more than 125 changes from the 2013 version. This seminar is designed to give the participants a good understanding of how to comply with the requirements of ASHRAE/IES Standard 90.1-2016. This seminar is highly interactive and includes example buildings plus several in-class exercises (for building envelope, lighting, and HVAC) with problems that participants can solve individually or in teams. Files for the example buildings and in-class exercises will be available for download from ASHRAE. Participants are strongly encouraged to bring their laptops to the seminar for use with ComCheck software and other exercises.
Instructors: McHenry Wallace, P.E., Member ASHRAE, LEED® AP; and Joseph Deringer, AIA, Member ASHRAE, LEED® AP
Complying with Standard 90.1-2016: Appendix G

Learn how to use the innovative new performance rating method in Appendix G of ASHRAE/IES Standard 90.1-2016. Apply the new rules and procedures via whole-building energy simulations to demonstrate that a building has much better energy performance than a building that just meets the requirements of ASHRAE/IES Standard 90.1-2016. See how Appendix G-2016 can be used to show compliance with ASHRAE/IES Standard 90.1-2016; this is the first time Appendix G has been usable in this manner. Also learn to use Appendix G 2010 in conjunction with LEED V4 to obtain LEED® points. Key performance rating method rules and requirements for HVAC, lighting, and building envelope systems are also discussed.

Instructors: McHenry Wallace, P.E., Member ASHRAE, LEED® AP; and Joseph Deringer, AIA, Member ASHRAE, LEED® AP

Complying with Standard 90.1-2010: Envelope/Lighting

This course provides an overview of the entire standard and then emphasizes compliance with the envelope and lighting requirements. Course topics include compliance with the mandatory and prescriptive requirements for both the building envelope and lighting systems. Air barrier and daylighting requirements are presented. Design professionals, code officials, and building owners will benefit from this course.

Instructor: Joseph Deringer, AIA, Member ASHRAE, LEED® AP

Complying with Standard 90.1-2013: Envelope/Lighting

The 2013 update of ASHRAE/IES Standard 90.1 is a major revision, containing more than 100 changes from the 2010 version. This course focuses on the importance of the significant changes in the lighting and envelope requirements and how they reduce loads on the HVAC systems and on overall energy use. Topics include significant changes in mandatory requirements for air barriers and daylighting.

Instructor: Joseph Deringer, AIA, Member ASHRAE, LEED® AP

Complying with Standard 90.1-2016: Envelope/Lighting

ASHRAE/IES’s Standards 90.1-2010 and 90.1-2013 together produce almost 40% energy savings from the 2004 version, with the envelope and lighting requirements contributing substantially to these reductions. This course focuses on the importance of the recent changes in the lighting and envelope requirements and how they reduce loads on the HVAC systems and on overall energy use. Topics include the significant new mandatory requirements for air barriers and daylighting. The 2016 update of ASHRAE/IES Standard 90.1 contains 8.5% source energy savings, 7.6% site energy savings, and more than 100 changes from the 2013 version. This course is highly interactive and includes several in-class exercises with problems that participants can solve individually or in teams. Participants are strongly encouraged to bring their laptops.

Instructor: Joseph Deringer, AIA, Member ASHRAE, LEED® AP

Complying with Standard 90.1-2010: HVAC/Mechanical

This course presents the mechanical requirements from ASHRAE/IES Standard 90.1-2010. Design professionals, code officials, and building owners will benefit from this course, which presents the HVAC requirements and methods of compliance. The 2010 standard is a major revision, with a goal of saving 30% more energy than the 2004 version. The HVAC/SWH sections of the standard, included in this course, have more than 50 updated requirements including first-time requirements for pipe sizing.

Instructor: McHenry Wallace, P.E., Member ASHRAE, LEED® AP

Complying with Standard 90.1-2013: HVAC/Mechanical

Design professionals, code officials, and building owners must keep up with the new, more stringent requirements to comply with the quickly evolving ASHRAE/IES Standard 90.1-2013. This course describes the new and updated mandatory and prescriptive requirements for HVAC and service water heating systems, along with insights on how to comply during building design and construction. The 2013 edition added an 8.5% source energy savings and 7.6% site energy savings, for a total of nearly 40% below that required for a 2004-compliant building. The U.S. Department of Energy issued a ruling that establishes ASHRAE/IES Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings, as the commercial building reference standard for state building energy codes.

Instructor: McHenry Wallace, P.E., Member ASHRAE, LEED® AP

Complying with the Requirements of Standard 62.1-2016

This seminar provides an overview of the requirements of ASHRAE Standard 62.1-2016, Ventilation for Acceptable Indoor Air Quality, with an emphasis on changes from the previous version and practical application of the standard to modern VAV systems. New requirements to the indoor air quality procedure for determining minimum ventilation rates are discussed. In the 2016 version, changes were made in determining air class for laboratory exhaust systems and the use of sensors for demand control ventilation. The course presents sample calculations for code review and for physical operation using the latest ASHRAE spreadsheet.

Instructors: Hoy Bohanon, P.E., Member ASHRAE, BEAP, LEED® AP; and Chandra Sekhar, Ph.D., Fellow ASHRAE

Designing for IAQ: Complying with the Requirements of Standard 62.1 (MENA)

This seminar focuses on the basic requirements of ASHRAE Standard 62.1-2016, Ventilation for Acceptable Indoor Air Quality. The newest version of the standard includes a major change to the scope of the standard by which residential occupancies are moved from ASHRAE Standard 62.1 to 62.2. This course provides an overview of the requirements of the new standard with emphasis on changes from the previous version and practical application of the standard to modern VAV systems. New requirements to the indoor air quality procedure for determining minimum ventilation rates are discussed. In the 2016 version, changes were made in determining air class for laboratory exhaust systems and the use of sensors for demand control ventilation, and these changes are discussed as well. The course presents sample calculations for code review and for physical operation. This course has been customized for the Middle East by instructors well versed in the concerns for professionals in the region.

Instructor: Hassan Younes, Member ASHRAE, BEAP, BEMP, HBDP, CPMP, HFDP, OPMP
Exceeding Standard 90.1-2013 to Meet LEED® Requirements (Available as a half-day course and full-day seminar)

This course explores how to obtain significant energy savings and obtain LEED® credits by following the new, more stringent requirements of ASHRAE/IES Standard 90.1-2010 and 2013, and using Appendix G rules and procedures. Appendix G is especially applicable to LEED® credits and to U.S. energy tax credits. ASHRAE/IES Standards 90.1-2010 and 90.1-2013 together produce almost 50% energy savings from the 2004 version. So, by substantially surpassing the 2013 standard requirements, buildings should achieve well over 50% energy savings. This course uses OpenStudio/EnergyPlus examples, including live demos and hands-on exercises in OpenStudio, to present an overview of applying key ASHRAE/IES Standard 90.1-2010/2013 requirements and Appendix G rules. This course is targeted at design professionals and building owners.

Instructors: McHenry Wallace, P.E., Member ASHRAE, LEED® AP; and Joseph Deringer, AIA, Member ASHRAE, LEED® AP

Fundamentals and Applications of Standard 55

Based on ASHRAE Standard 55, Thermal Environmental Conditions for Human Occupancy, this course covers the theory and principles of the standard. It is intended to bridge the gap between the design practitioner's knowledge of the built environment and its thermal relationship to the occupant's physiology and psychology. Using examples, the course illustrates how to achieve compliance with the standard for the purposes of satisfying the requirements of various building performance programs such as LEED®.

Instructors: Peter Alspach, PE, Member ASHRAE, LEED® AP; Robert Bean, R.E.T., P.L. (Eng.), Member ASHRAE; and Lawrence Schoen, PE, Fellow ASHRAE

Fundamental Requirements of ASHRAE Standard 62.1-2010

In the 2010 version of ASHRAE Standard 62.1, the IAQ procedure is rewritten and the natural ventilation procedure is revised. Many of the standard's general requirements apply regardless of the procedure used. This course covers the scope, application, and multiple compliance paths available in the standard, including the ventilation rate procedure, indoor air quality procedure, and natural ventilation procedure. The different application conditions for the ventilation rate procedure are also described.

Instructor: Hoy Bohanon, P.E., Member ASHRAE, BEAP, LEED® AP

Fundamental Requirements of ASHRAE Standard 62.1-2013

This introductory course focuses on the basic requirements of ASHRAE Standard 62.1-2013, Ventilation for Acceptable Indoor Air Quality. The course covers the scope, application, and multiple compliance paths available in the standard including the ventilation rate procedure, indoor air quality procedure, and natural ventilation procedure. Many of the standard's general requirements apply regardless of the procedure used. The different application conditions for the ventilation rate procedure are also described. In the 2013 version, changes were made affecting filtration, humidification, and some ventilation rates. This course is highly recommended for all HVAC designers and engineers.

Instructor: Hoy Bohanon, P.E., Member ASHRAE, BEAP, LEED® AP

Fundamental Requirements of ASHRAE Standard 62.1-2016

This introductory course focuses on the basic requirements of ASHRAE Standard 62.1-2016, Ventilation for Acceptable Indoor Air Quality. The course covers the scope, application, and multiple compliance paths available in the standard including the ventilation rate procedure, indoor air quality procedure, and natural ventilation procedure. Many of the standard's general requirements apply regardless of the procedure used. The different application conditions for the ventilation rate procedure are also described. In the 2016 version, changes were made affecting residential scope, demand control ventilation, IAQ procedure, and some ventilation rates. This course is highly recommended for all HVAC designers and engineers.

Instructor: Hoy Bohanon, P.E., Member ASHRAE, BEAP, LEED® AP

Save 30% Complying with Standard 90.1-2013

The 2013 version of ASHRAE/IES Standard 90.1 is widely used by many state and government entities. Learn the background and development of ASHRAE/IES Standard 90.1, its requirements and compliance paths, and how to understand and apply the requirements. Key updates for each of the major building systems will be discussed. This includes the HVAC system, lighting system, building envelope, service water heating, and power. You will learn key mandatory and prescriptive requirements applicable to each system, as well as whole-building compliance options. Case studies and in-class exercises are included as appendices to the classroom presentation. During the course, a number of examples are provided for how to improve building energy efficiency and save money.

Instructors: McHenry Wallace, P.E., Member ASHRAE, LEED® AP; and Joseph Deringer, AIA, Member ASHRAE, LEED® AP

Significant Changes to Standard 90.1-2010

ASHRAE/IES Standard 90.1-2010 marked an acceleration in the race to reduce energy usage in commercial buildings. More than three times the typical number of addenda were added to this edition, marking the largest change to the standard in a decade. These changes were targeted at a 30% reduction in energy use as compared to the ASHRAE/IES 90.1-2004 requirements. This course provides an in-depth overview of the changes to the envelope, lighting, and mechanical sections, using as a basis the publication Significant Changes to the International Energy Conservation Code and ANSI/ASHRAE/IES Standard 90.1.

Instructor: McHenry Wallace, P.E., Member ASHRAE, LEED® AP

Significant Changes to Standard 90.1-2010 and IECC 2012 (co-sponsored with IECC)

ASHRAE/IES Standard 90.1-2010 and the 2012 International Energy Conservation Code (IECC) mark an acceleration in the race to reduce energy usage in commercial buildings. More than three times the typical number of addenda have been added to these editions, marking the largest change in a decade. This course provides an in-depth overview of these publications, answering the questions: “What changed from their previous editions?” and “How are the code and the standard alike, and how do they differ?” Changes to the envelope, lighting, and mechanical sections in both editions are discussed, using Significant Changes to the International Energy Conservation Code and ANSI/ASHRAE/IES Standard 90.1 as a basis.

Instructor: McHenry Wallace, P.E., Member ASHRAE, LEED® AP

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Standard 90.1: HVAC/Mechanical and Appendix G (MENA)
This course focuses on the major requirements of ASHRAE/IES Standard 90.1-2016, including incorporated addenda. The Standard 90.1: HVAC/Mechanical and Appendix G (MENA) course will also cover highlights of the envelope, mechanical, HVAC, and lighting requirements in Appendix G and its new compliance path and performance rating method. Baseline building conditions and climate zone information on many cities in the MENA region will also be provided.

Instructor: Samir Traboulsi, Ph.D., P.Eng., Fellow/Life Member ASHRAE

Successfully Managing the Risk of Legionellosis Using ASHRAE Standard 188-2015 (Co-sponsored by NSF)
Legionellosis is a health and safety concern for facility owners and operators and those who manage and oversee building water cooling systems. ASHRAE Standard 188-2015 establishes the minimum legionellosis risk management requirements for the design, construction, installation, commissioning, operation, maintenance, and service of centralized building water systems and components. This course describes the environmental conditions that promote the growth of Legionella in water systems and the locations where Legionella control measures can be applied in new and existing buildings. A comprehensive management strategy for the prevention of legionellosis is also discussed. The course focuses on the compliance with ASHRAE Standard 188-2015 to provide a safer and healthier building environment.

Instructors: Michael Patton, Member ASHRAE; and William Pearson, Member ASHRAE

Using Standard 90.1-2010 to Meet LEED® Requirements
ASHRAE/IES 90.1 Appendix G was added to the standard in 2004 to set the rules for modeling a building that exceeds the energy performance of a base building that complies with ASHRAE/IES Standard 90.1. Appendix G is now widely used by LEED®, utility incentive programs, and energy tax credit programs to show that a proposed building will use less energy than a baseline building designed to meet the 90.1 standard. This presentation covers the requirements of Appendix G as they apply to the Envelope, Lighting, and Mechanical sections of the standard. We will use successful examples of LEED®-certified buildings to introduce possible energy savings measures and introduce the Appendix G rules and procedures to document the savings.

Instructors: McHenry Wallace, P.E., Member ASHRAE, LEED® AP; and Joseph Deringer, AIA, Member ASHRAE, LEED® AP

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**Omar Abdelaziz**, Ph.D., Member ASHRAE, has 15 years of R&D and project management experience in building energy-efficient technologies, sustainable energy production and utilization, energy storage, technology evaluation and prioritization, thermodynamic analysis, thermo-fluid engineering, computational fluid dynamics, engineering optimization, alternative cooling and heating technologies, and alternative lower global warming refrigerants. He actively collaborates with leading appliance and equipment manufacturers on the development of advanced and state-of-the-art HVAC&R equipment. He has strong academic and research connections and is quite involved in ASHRAE.

**Fiona Aldous**, Member ASHRAE, is a principal with Wiss Janney Elstner Associates. She has performed comprehensive, technical building enclosure commissioning on numerous buildings. Fiona has extensive, hands-on knowledge of building enclosures and the commissioning process. Her experience includes design, detailing, and installation of various high-performance enclosures, comprising curtain wall and window systems, air barriers, waterproofing of below-grade and plaza systems, low-slope and steep roofs, and the interfaces of the various enclosure components.

**Peter Alspach**, PE, Member ASHRAE, LEED® AP, is an associate principal with Arup, the mechanical discipline leader in Arup’s Seattle office, and Arup’s regional mechanical engineering skills leader. He is a specialist in the design of low-energy buildings, focusing on HVAC, energy systems, thermal comfort, and the indoor environment. As a mechanical engineer, building physicist, and façade engineer, Peter develops holistic solutions to the built environment.

**David Altenhofen**, AIA, is the East Coast Director for The Facade Group LLC, a consulting firm specializing in assisting owners, architects, and builders in the delivery of durable and high-performing building enclosures. His focus is the application of practical field experience and building science combined with multiple forms of digital modeling to ensure that performance goals set during design are delivered in the constructed building. At The Facade Group Mr. Altenhofen has lead building enclosure commissioning efforts on three net zero projects and provided consulting services for many projects with an emphasis on energy savings.

**Karim Amrane**, Ph.D., Member ASHRAE, is owner and president of KA Consulting Services, LLC, where he provides strategic consulting services to HVAC&R businesses regarding federal and state regulations, legislation, codes and standards, alternative refrigerants, and energy efficiency. He is also an adjunct professor at the University of Maryland, where he teaches graduate courses in mechanical engineering. Dr. Amrane has over 25 years of experience in the air-conditioning and refrigeration industry. He is a member of ASHRAE, the International Institute of Refrigeration (IIR), and ASME. He is the recipient of ASHRAE’s Distinguished Service Award.

**Vikrant Aute**, Ph.D., Member ASHRAE, serves as director of the Integrated Systems Optimization Consortium. Dr. Aute has twelve years of experience in the development of simulation and optimization software for thermal systems. His current research focuses on approximation assisted multi-objective multidisciplinary optimization and its application to design of thermal systems and the continued development of heat exchanger and vapor compression system simulation tools.

**William Bahnfleth**, Ph.D., PE, Presidential/Fellow ASHRAE, is a professor and director of the Indoor Environment Center in the Department of Architectural Engineering at The Pennsylvania State University-University Park. He holds a doctorate in Mechanical Engineering from the University of Illinois at Urbana-Champaign and is a Registered Professional Engineer. He has more than 30 years of experience as a consulting engineer, researcher, and educator.

**Robert Bean**, R.T.E., PL, (Eng.), Member ASHRAE, is president of Indoor Climate Consulting Inc. and director of www.healthyheating.com. Bean is a past ASHRAE Distinguished Lecturer and recipient of ASHRAE’s Lou Flagg Award. Currently, he serves on ASHRAE SSPC 55, TC 6.1, TC 6.5, and TC 7.4. Bean also is a special expert on IAPMO’s new Uniform Solar Energy and Hydronics Code committee. He has developed and teaches numerous courses related to the business and engineering of buildings, indoor climates, and radiant-based HVAC systems.

**Don Beaty**, PE, Fellow ASHRAE, has over 30 years experience in consulting engineering and founded DLB Associates Consulting Engineers in 1980. He is a licensed professional engineer in over 40 states and has international licenses as well. Don co-founded and was the first chair of ASHRAE TC 9.9 and currently serves as its publications chair. He is also a frequent keynote speaker on behalf of ASHRAE TC 9.9 for the data center industry, having presented over 100 times and in more than 37 countries on various data center-centric topics. He has also served on ANSI/ASHRAE Standards Committee 90.1 (energy), including as vice chair; Standards Committee 127 (Method for Testing for Rating Computer and Data Processing Room Unitary Air-Conditioners) as secretary; and ASHRAE TC 7.6 (Systems Energy Utilization). Beaty is a major contributor to many data center books (including 10 ASHRAE Books).

**Hoy Bohanon**, PE, Member ASHRAE, BEAP, LEED® AP, is president of Hoy Bohanon Engineering PLLC. Bohanon has written technical papers and articles on indoor air quality, operations, and maintenance and is very active in ASHRAE. He is chair of ASHRAE SSPC 62.1, vice-chair of the Building Energy Quotient Committee, and a member of the Building Performance Ad-Hoc Committee. He is a member of ISO-TC 205 and corresponding member of TCS 5.5 and 9.10. He is an ASHRAE Distinguished Lecturer, writes and teaches courses for the ASHRAE Learning Institute, and is a recipient of the ASHRAE Distinguished Service Award.

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Donald Brandt, Life Member ASHRAE, BEAP, has devoted his career to the HVAC industry. During his decades-long tenure with the Trane Company, Don has been active in ASHRAE, serving at the Chapter, Regional and Society Levels, including DRC for Region X from 2002–2005, Standards Committee from 2005–2009, and Nominating Committee from 2010–2016. He received the ASHRAE Distinguished Service Award in 2005 and the Exceptional Service Award in 2015.

Liam Buckley, C.Eng, Member ASHRAE, BEMP, is a business development manager with IES and a project manager with IES-Consulting. Liam’s consulting work includes lighting design, daylighting, natural ventilation, CFD airflow, HVAC, renewable energy and whole-building energy simulation and optimization. Liam has 10 years’ experience with MEP/HVAC Engineering design and building performance modeling, certification, and code compliance. As an expert in the industry, Liam has trained hundreds of energy consultants in California on Title 24 Compliance of non-residential buildings, primarily through California’s Public Utilities. In North America, Liam has trained thousands of engineers, architects, sustainability consultants, professors, students, and utility incentive providers on various technical elements of building energy performance and simulation.

Richard Casault, P.E., Member ASHRAE, is the president of Seattle-based Casault Engineering, founded in 1994. He provides new building commissioning services from planning through occupancy, retrocommissioning services for existing systems, and building commissioning master planning. He has commissioned hospitals, offices, greenhouses, libraries, corrections facilities, performing arts centers, teaching and research lab facilities, boiler plants, and schools.

Walid Chakroun, Ph.D., P.E., Fellow ASHRAE, is a professor in the Mechanical Engineering Department at Kuwait University. His interests include experimental and numerical thermal and fluid sciences in general and in air-conditioning systems and indoor air quality in particular. He served previously as Director for the Region At Large for ASHRAE, and he is currently serving as Vice President for the ASHRAE Publishing and Education Council and a liaison coordinator between ASHRAE and UNEP. Dr. Chakroun has authored and co-authored more than 75 journal articles and conference papers. He also co-authored a book, An Experimental Course in Thermal Engineering. He is the recipient of the prestigious ASHRAE John F. James Award and Distinguished Service awards.

Robert Cox, P.E., Member ASHRAE, is a registered professional engineer with nearly three decades of consulting engineering experience primarily focused on engineering for institutional and governmental clients, including health-care facilities, colleges and universities, and state, local, and federal government clients. He has particular experience in energy conservative design for facilities and facilities commissioning. He is a senior project manager with Carter Burgess. Cox is currently the Chair of TC 9.8, the research chair of TC 9.6, and Program Chair of TC 9.7. He is the primary author of several chapters of HVAC Design Manual for Hospitals and Clinics.

Drury Crawley, Ph.D., AIA, Fellow ASHRAE, BEMP, Fellow IBPSA, is a Bentley Fellow and Director of Building Performance with Bentley Systems Inc., focusing on building performance, design, BIM, sustainability, resilience, net zero energy buildings, analytics, interoperability, and building operation. With more than 35 years of experience in energy efficiency, renewable energy, and sustainability, Dr. Crawley has worked in engineering software development, government research, and standards development organizations, as well as building design and energy consulting companies.

Molly Curtz, P.E., LEED® AP, BEMP, is a mechanical engineer at Arup with a focus on energy efficiency in the built environment. She has thirteen years of experience working with building energy models. Molly applies energy simulation to provide design teams with valuable analysis for design assistance, energy code compliance, and rating system assessment. Her work is anchored by a solid understanding of building physics and mechanical engineering design. She is one of the co-founders of the IBPSA Seattle Chapter, and she serves as a voting member on ASHRAE SPC 209s. Molly leads the energy analysis team for Arup’s Seattle office and is a key member of their firm-wide energy analysis team, providing consulting and review for projects across the globe.

Joseph Deringer, AIA, Member ASHRAE, LEED® AP, is executive director of the Institute for the Sustainable Performance of Buildings (SuPerB). Mr. Deringer has over 35 years’ experience in the design, analysis, and simulation of sustainable, energy-efficient buildings worldwide. His work has focused especially on energy codes, design assistance, training, and the development of interactive online design and training tools. He has over 20 years’ involvement in developing energy codes for buildings, and has helped seven countries develop first-generation energy codes. Mr. Deringer has served on ASHRAE’s Standard 90.1 committee for 15 years and chaired its envelope subcommittee for 10 years. He is also active as international energy and environmental consultant to the World Bank, UNDP, and USAID, consulting on projects in over a dozen countries in Southeast Asia, the Caribbean, Latin America, the Middle East, and Eastern Europe.

James Dirkes II, P.E., Member ASHRAE, BEMP, LEED® AP, is the president of The Building Performance Team. While HVAC systems have been his principal focus, Dirkes also has extensive experience with most mechanical systems as well as electrical and digital control systems. He has conducted energy analysis for numerous new and existing facilities using EnergyPlus, Retroficiency, EZ Sim, and bin method tools. Dirkes has authored several energy analysis tools including ASEAM-UM and a spreadsheet-based HVAC front end for EnergyPlus.

Paul Doppel, Member ASHRAE, has worked for Mitsubishi Electric Cooling & Heating since 2002, and was a brand manager before being promoted to his current position of senior director of Industry and Government Relations in 2012. A 39-year HVAC industry veteran, Doppel served as chairman of the TC 8.7 committee of ASHRAE from 2010 to 2012 and as the chairman for the Ductless (VRF) product section of AHRI from 2011 to 2015. He is currently the chairman of the ASHRAE GPC-41. Doppel also works with the DOE, utility companies, state governments, and green building groups to enhance VRF technology education and applications. In 2009, Doppel was honored by AHRI with the Richard C. Schulze Distinguished Service Award, which is presented annually to individuals recognized for their unique contributions to the HVACR industry.

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E. Curtis Eichelberger, PE., LEED Green Associate, Member ASHRAE, is a senior staff engineer with the Building Efficiency Division of Johnson Controls in York, PA. He has over 40 years of experience in engineering projects relating to acoustic and vibration technologies. Currently, he is responsible for the sound quality and application of YORK/Johnson Controls brand HVAC equipment and systems. An ASHRAE Member, Eichelberger is presently the research chair for ASHRAE TC 2.6 on sound and vibration control. He is also a member of the Institute of Noise Control Engineering (INCE), the American Society of Mechanical Engineers (ASME), and is a LEED Green Associate.

Charles Eley, E., AIA, BEMP, CEM, Member ASHRAE, LEED® AP, is an architect, mechanical engineer and author with 40 years’ experience in energy-efficient and sustainable design. During his career, he has made significant contributions to the California energy standards, ASHRAE/IES Standard 90.1, and energy codes in Hong Kong, Hawaii, Guam, American Samoa, and Australia. He has also developed a number of important technical manuals and publications, served as the founding executive director of the Collaborative for High Performance Schools, developed a number of energy analysis software applications, and served as energy consultant for a number of landmark green buildings.

David Eldridge, PE, LEED® AP, BEMP, BEAP, HBDP, is a Project Manager at Grumman/Buthkus Associates in Chicago. His specialty is sustainable consulting services including analysis of energy efficient MEP design, energy modeling, performance of energy audits of all levels, LEED and Green Globes consulting services, and tax deductions for energy-efficient commercial property. David has served on the IBPSA-USA Board of Directors since 2008, has been a research assistant at Oklahoma State University (1999 – 2001), and has served in the BLAST support office at the University of Illinois (1998 – 1999). David is a voting member on several ASHRAE committees: TC 7.6, TC 9.6, Certification Committee, and SPC 211, developing a new standard for energy audits.

Jay Enck, Member ASHRAE, HBDP, CPMP, BEAP, LEED® AP, is co-founder and chief technical officer of Commissioning and Green Building Solutions, Inc. He has conducted commissioning for more than $4 billion in construction projects, of which 80% have included building enclosure commissioning. Enck has 40 years of experience in building operation, design, and construction, and over 20 years investigating the causes of building enclosure problems. He holds the certifications of LEED Fellow, CxAP, HBDP, CPMP, BEAP, and LEED AP BD+C.

David Fisher, Member ASHRAE, is president of PolarSoft Inc., a Pittsburgh-based company specializing in BACnet software development, consulting, and training. He was a charter voting member of ASHRAE’s SPC135P and has been very active in the development of ANSI/ASHRAE Standard 135-2012, BACnet – A Data Communication Protocol for Building Automation and Control Networks since its inception. He remains very involved with the SSPC-135 standing committee as a participant and a principal author.

Ellen Franconi, PhD., BEMP, Member ASHRAE, LEED® AP, is a senior consultant with RMI. Ellen has 25 years of experience in building systems engineering through her work with research institutes and private industry. She is a longtime member of the International Performance Measurement and Verification Protocol Committee and is an M&V content expert for LEED for the USGBC. In recent work within the private sector, Ellen developed and formalized methods to deliver energy modeling services to support sustainable design assistance for over 50 commercial building projects. Ellen led the development of in-house pre- and post-processing tools, provided trainings for new analysts, and completed quality assurance reviews. One of her modeling claims to fame is performing over 3500 DOE-2 runs to characterize the entire commercial building sector.

Laurie Gilmer, PE, LEED® AP, Member ASHRAE, is a vice president at Facility Engineering Associates and leads FEAs facility asset management, building energy management, and sustainability services. Laurie has assisted facility managers in improving building systems operations, creating and implementing energy management plans, identifying energy saving opportunities, and obtaining LEED certification for existing buildings. Her experience includes sustainability/LEED, systems analysis, energy audits, commissioning, building systems planning, and controls review.

Jack Glass, Member ASHRAE, is the director of Global Data Center Planning with Citigroup in New York City. He is responsible for engineering and planning of critical systems in the Citigroup Technology Infrastructure organization. He has over 20 years experience in the design and operation of technology environments supporting the financial industry. He is a professional engineer and a long-time member of ASHRAE. He is the past Chairman of TC 9.9.

Walter Grondzik, PE, Fellow/Life Member ASHRAE, LEED® AP, is an architectural engineer and a professor of architecture at Ball State University. He is author of Principles of Building Commissioning and co-author of Mechanical and Electrical Equipment for Buildings (12th ed.) and The Green Studio Handbook (2nd ed.). Walter’s interests include building commissioning, sustainability and high-performance building initiatives, and all areas of environmental control systems and their effects on buildings and occupants.

Charles Gulledge, PE., Member ASHRAE, HFDP, LEED® AP, is a senior mechanical engineer with AC Corporation in Greensboro, NC. A licensed professional engineer, Gulledge has over 20 years experience in the HVAC industry. Currently, he is a member of the ASHRAE Handbook Committee and Building Information Modeling and Interoperability Ad Hoc Committee, and liaison to the Construction Specifications Institute (CSI). Gulledge has received the Chapter Service Award, Regional Award of Merit, Distinguished Service Award, and Dan Mills Technical Award.

Arthur Hallstrom, PE., Fellow/Life Member ASHRAE, BEMP, has over 35 years of extensive applications and experience in air-side systems, equipment, and computer modeling with a major HVAC manufacturer. He became an ASHRAE Fellow for his work in innovative acoustical modeling software. Mr. Hallstrom was one of the DOAS systems consultant on the ASHRAE Headquarters redesign project. Since retiring, he has become executive director and president of AD Hall and focuses on teaching building energy codes.
Lew Harriman, Fellow ASHRAE, is the director of research and consulting at Mason-Grant in Portsmouth, New Hampshire. He is a Fellow of ASHRAE, and has over 39 years of experience with humidity control systems in a broad variety of commercial, industrial, and institutional applications. Lew was the lead author of both ASHRAE’s Humidity Control Design Guide and the ASHRAE Guide for Buildings in Hot and Humid Climates. He is currently Chair of ASHRAE Task Group for developing a quantitative definition of a damp building (one which is damp enough to pose a health risk). He was also the lead author for the new Chapter 62 of the 2015 ASHRAE Handbook—Applications (Moisture Management in Buildings).

Lucas B. Hyman, P.E., Member ASHRAE, LEED® AP, has planned and designed central heating and cooling plants, TES systems, cogeneration plants, steam plant systems, utility distribution systems, laboratory systems, HVAC improvements, energy conservation measures, landfill gas collection systems, fuel storage and distribution systems, as well as other mechanical system. His engineering experience includes developing studies, master plans, construction documents (designs), performing construction management, and acting as the commissioning agent. He has also participated as the mechanical engineer member in value engineering project reviews and conducted and led forensic engineering studies.

Steve Kavanaugh, Ph.D., Fellow ASHRAE, is professor emeritus of mechanical engineering at the University of Alabama-Tuscaloosa. He is a past chair of ASHRAE TC 6.8 and past chair of TC 9.4. He is also a Fellow of the American Society of Mechanical Engineers. Kavanaugh is the author of several ASHRAE publications including Geothermal Heating and Cooling: Design of Ground Source Heat Pump Systems, HVAC Simplified, and Ground-Source Heat Pumps: Design of Geothermal Systems for Commercial and Institutional Buildings.

Julia Keen, Ph.D., P.E., Fellow ASHRAE, HBOP, BEAP is a professor of Architectural Engineering and Construction Science at Kansas State University with a specialty in HVAC, energy codes, and integrated building design. She owns her own consulting engineering company Keen Designs, PA. Julia is a licensed Professional Engineer and currently serves on ASHRAE’s Planning and Building EQ standing committees. She is past-chair of TC 6.1.

Jim Kelsey, P.E., Member ASHRAE, BEAP, LEED® AP, is the founder and President of KW Engineering. He chairs the committee for Standard 211 and is a committee member of Standard 100. Jim led the development of TC 4.7’s revision of the ASHRAE publication Procedures for Commercial Building Energy Audits. He serves on the Board of the California Energy Efficiency Industry Council where he works with industry, utilities, and state regulators to develop energy-efficiency policies that meet environmental and business goals. Jim’s passion is for finding new ways to make energy audits effective and credible.

Rob Kistler, AIA, Member ASHRAE, is a principal of The Facade Group LLC, which focuses on design and documentation solutions in all aspects of the building enclosure, from subgrade to facade to roof. Rob has over 25 years of experience as an architect and consultant and over 15 years as a contractor. He established the Portland chapter of the Building Enclosure Council and was chair from 2006–2010. He was also co-chair of the Building Enclosure Council National from 2007–2011 and served as chair of the Building Enclosure Technology and Environmental Council.

Daniel Koenigshofer, P.E., Member ASHRAE, HFDP, is the vice president for health care at Dewberry Engineers Inc. He has over 35 years of engineering and project management experience, specializing in master planning, troubleshooting, and solving engineering problems in healthcare facilities. Koenigshofer has presented numerous training sessions on health-care design, both nationally and internationally. He has taught classes for the ASHRAE Learning Institute in over 25 major cities worldwide, using entertaining stories of "mistakes he has made" in engineering.

Erik Kolderup, P.E., Member ASHRAE, BEMP, LEED® AP, has provided energy consulting services since 1990, serving as vice president of Eley Associates and associate principal at Architectural Energy Corporation in San Francisco before starting Kolderup Consulting in 2007. He has trained design professionals through organizations such as the Collaborative for High Performance Schools, PG&E, and the State of Hawaii and has taught hundreds of engineers and architects in the use of VisualDOE. He is a lecturer at Stanford University where he teaches a course on energy-efficient building systems.

Dennis Knight, P.E., Fellow ASHRAE, has over 43 years of experience providing engineering, design-, and construction-related services within the building industry. Active at the local, state, and national levels with various agencies and professional societies, he works to help develop sustainable, integrated building design guidelines. Nationally, as a member of ASHRAE, Mr. Knight is the recent past Chair of the BIM Multi-Disciplinary Task Group (MTG), is the former Chair of TC 7.1 on integrated building design, and served as the Chair of the ASHRAE Building Performance Analysis Specialty Conference for six of the past eight years it has been held.

Tom Lawrence, Ph.D., P.E., Fellow ASHRAE, LEED® AP, is a senior public service associate and coordinator for the mechanical engineering degree program at the University of Georgia, with over 30 years of professional engineering experience. Before going back for his PhD in Mechanical Engineering, he spent approximately 20 of those years in industry and consulting. Dr. Lawrence is a member of the ASHRAE Board of Directors, a past chair of ASHRAE TC 2.6, and a member of the committee that wrote ASHRAE Standard 189.1 on high-performance green buildings. As an ASHRAE Distinguished Lecturer, he gives presentations and workshops on green building design around the world. He is the chair of the editorial committee that will produce the 5th edition of the ASHRAE Green Guide.

Thomas Leck, Ph.D., Member ASHRAE, LEED® AP, Leck is a chemist who spent the majority of his working career with the DuPont and Chemours companies. At DuPont he supported the transition from CFC and HCFC refrigerants to non-ozone depleting HFCs. Later he helped developed the low global warming refrigerant class of HFO based molecules for refrigerant use. His research in refrigerant related technologies included lubricant evaluation and qualifications, material compatibility determinations, chemical and thermal stability studies, and flammability measurements. During his 36 years at DuPont and Chemours he worked in fluoropolymers, nylon intermediates process development, chemical catalysis, coatings development and manufacture, but mostly in refrigerant related technologies. He has earned 47 U.S. Patents during that career.
Dunstan Macauley, PE, Member ASHRAE, HBDR, LEED® AP, has nearly 15 years of experience in the HVAC industry specializing in the design of a variety of systems for commercial and institutional projects. He joined Encon Group in 2008 as an associate director and currently serves as the mechanical department manager. Macauley is actively involved in project management and design, including several projects for the pharmaceutical and biotechnology, telecommunications, and broadcast communication industries.

Annie Marston, Ph.D., Member ASHRAE, BEMP, LEED® AP, is head of the Building Performance Group at Ebert & Baumann Consulting Engineers. She is an expert in energy modeling and related simulation applications, such as CFD modeling and daylight modeling. Her energy modeling experience includes simulating single buildings for LEED, conducting parametric studies for conceptual design work, choosing energy efficient solutions for high-profile projects, and modeling scenarios to reduce the energy consumption of entire cities and counties by 30%–50%. Annie is proficient in many modeling and simulation programs and related applications, such as EnergyPlus, DesignBuilder, Google SketchUp, IES, Ecotect, Radiance, Star CCM+, and FLUENT.

Sam Mason, PE, BEMP, LEED® AP, is the principal at Encompass Energy, LLC. He provides energy analysis, code assessment, and design assistance services for developers, contractors, architects, and engineering firms across North America. He has ten years of experience in the design and construction industry, with a focus on pragmatic approaches to energy efficiency and sustainability. His expertise includes detailed HVAC design and he is an expert in whole-building energy simulation and optimization.

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Paul Pieper, P.Eng., Member ASHRAE, is the product line general manager for Venmar CES Unitary Products and also represents Mammoth-Venmar with AHRI on the Air-to-Air Energy Recovery Ventilation Equipment section. Pieper has been a Distinguished Lecturer for ASHRAE and a Past Chair of ASHRAE Technical Committee 8.12, Desiccant Dehumidification Equipment and Components. He is currently the Vice-Chair for ASHRAE TC 5.5 and an instructor for the ASHRAE Learning Institute for two short courses relating to air-to-air energy recovery ventilation.

Joel Primeau, Eng., Member ASHRAE, HBDE, LEED® AP, is a sales engineer with over 27 years of HVAC experience. He has lead and assisted teams of engineers and technicians in the design and construction of high-performance sustainable facilities. Joel’s experience spans a wide range of engineering design and construction projects. His expertise is in the design of high-efficiency HVAC systems that enhance indoor air quality and comfort.

Reinhard Radermacher, Ph.D., PE, Fellow ASHRAE, is an internationally recognized expert in heat transfer and working fluids for energy conversion systems—heat pumps, air conditioners, refrigeration systems, and integrated cooling and heating power systems. He introduced ternary working fluid mixtures for absorption heat pumps technology. His contributions to the use of working fluid mixtures in vapor compression systems resulted in advanced cycles with new degrees of freedom for special applications. His work led to an energy savings of more than 50% in domestic refrigerators.

Lisa L. Rosenow, EED® AP, is a senior energy program manager with the Northwest Energy Efficiency Council (NEEC). She manages the commercial energy code technical support program for Washington State, providing technical expertise for all disciplines covered in the energy code. She assisted AIA Seattle, Architecture 2030, and the Northwest Energy Efficiency Alliance to develop training content for the AIA+2030 Professional Series that focuses on the integrated design approach, and co-developed content for the integrated design training program for the ASHRAE Learning Institute. Ms. Rosenow has a mechanical engineering degree from the University of Washington and a sustainable building advisor certification (NaCSBA): savings of more than 50% in domestic refrigerators.

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Jeff Ross-Bain, PE, Member ASHRAE, BEMP, LEED® AP, is the founder and Principal of Ross-Bain Green Building, LLC, a green building consultancy providing comprehensive energy and environmental expertise to building owners, architects, engineers, and contractors. Services include energy simulation, energy auditing, commissioning, LEED administration and consulting, and facility maintenance management. Jeff has worked exclusively in the field of green building for the past 12 years and has had direct project administration roles on over 60 LEED registered or certified projects. He has led green building project teams and performed the energy simulations for LEED Certified, Silver, Gold, and Platinum buildings.

Hesham Safwat, Ph.D., Member ASHRAE, has years of experience in the industry and in applied engineering science. His expertise includes sustainability practices and green buildings, especially with geothermal ground-source heat pumps and energy and atmosphere concerns for LEED® for Middle Eastern commercial projects. Previous to joining the British University in Egypt in 2014 as lecturer in the Department of Mechanical Engineering, Dr. Safwat served as both instructor and a technical manager for Miraco Carrier where he was responsible for chillers, air handing units, fan coil selection, and pricing. He has extensive knowledge in HVAC design and energy modeling, HAP LEED® courses, and high-performance building, ASHRAE Standard 62.1, and ASHRAE/IES Standard 90.1.

Larry Schoen, P.E., Fellow ASHRAE, is principal engineer for Schoen Engineering Inc., which does analysis and design of mechanical and electrical systems with a focus on energy efficiency and quality of the indoor environment. Previously, Larry was engineering manager for property operations at The Rouse Company, with a portfolio of 50 million ft² of retail, office, hotel, and mixed-use facilities and every kind of HVAC, plumbing, electrical, and elevator systems. He currently serves as vice chair of SSPC 55.

Roger Schmidt, Ph.D., PE, Member ASHRAE, IBM Fellow, National Academy of Engineering Member, IBM Academy of Technology Member and ASME Fellow, has over 35 years experience in engineering and engineering management in the thermal design of IBM’s large scale computers. He was IBM’s chief engineer on data center energy efficiency; He has led development teams in cooling mainframes, client/servers, parallel processors, and test equipment utilizing such cooling mediums as air, water, and refrigerants.

Chandra Sekhar, Ph.D., Fellow Member ASHRAE, is currently a professor and programme director (Building Performance and Sustainability) and co-director (Centre for Integrated Building Energy and Sustainability in the Tropics) in the Department of Building at the National University of Singapore (NUS). He is also a founding director of Enhanced Air Quality Pte Ltd, a NUS spin-off company. Dr. Sekhar is an ASHRAE Fellow and a Fellow of ISIAQ. He has been an ASHRAE Distinguished Lecturer since 2006. Dr. Sekhar is a past Chair of the Environmental Health Committee, was a member of the IEQ Global Alliance Ad Hoc Committee (2013-2016) and is currently a member of SSPC 62.1, TC 2.1, EHC, and TC 4.3. He has also served the ASHRAE Singapore Chapter in various capacities, including as its President during 2010-2011 and as a BOG member.

Michael Sheerin, P.E., Member ASHRAE, LEED® AP, is a chief executive officer of TLC Engineering for Architecture. He serves as the director of Healthcare Engineering for TLC, leading their design, planning, and marketing efforts. He has focused solely on health-care facility design since joining TLC in 1995. Sheerin is a mechanical engineer licensed in multiple states and currently serves as Chairman of TC 9.6. He is the Vice Chairman of ASHRAE SSPC 170 and has been involved in this standard since its inception. He also serves as Chair of ASHRAE SPC 189.3.
Peter Simmonds, Ph.D., ASHRAE Fellow, is managing director/principal of Building and Systems Analytics LLC. Simmonds has been involved in the design and operation of tall, supertall, and megatall buildings around the world for more than 30 years. An ASHRAE member since 1989, Peter has twice chaired TC 9.12 and is a member of TC 2.1 and TC 7.5. He also serves on the Standards Committee and is Secretary of the College of Fellows. Peter is a recognized authority in the field of radiant heating and cooling systems. The main goals of his research and applications have been to understand the heat transfer and performance of radiant systems and occupant comfort for both heating and cooling. His studies on the thermal performance of radiant systems led to a unique way to enhance these systems.

Mark Stetz, P.E., Member ASHRAE, BEAP, is principal and co-owner of Stetz Consulting LLC. His company provides energy-efficiency consulting services, energy audits, measurement and verification, economic analysis, and training. With over 20 years in the energy efficiency field, he has contributed to the IPMVP and FEMP measurement and verification protocols, supported the DOE FEMP performance contracting program, provided input into LEED 2012, and conducted training workshops worldwide.

Mitchell Swann, P.E., Member ASHRAE, has over 30 years of experience in the areas of engineering design, project management, and consulting for a wide array of clients in diverse industries in the U.S. and abroad. Mr. Swann’s career has included engineering design of HVAC, piping and control systems; project and department management, commissioning, forensic engineering and expert witness engagements; and dispute resolution and project execution consulting. He is active in several Technical Committees within ASHRAE, including TC 1.7, General Business, Management & Legal Education; TC 2.8, Sustainable Design; TC 7.1, Integrated Design; TC 7.2, HVAC Design-Build; and TC 9.11, Clean Spaces.

Samir Traboulsi, Ph.D., P.Eng., Fellow/Life Member ASHRAE, BEAP, is currently a senior lecturer at the American University of Beirut and has taught a variety of subjects including building services technical courses, MEP design of green buildings, HVAC design courses, thermodynamics, operations research, the engineering economy, and engineering ethics. Dr. Traboulsi is the founder and was the president of the Lebanese chapter of ASHRAE, as well as director at large for ASHRAE. He also served as co-founder and former president of the Lebanon Green Building Council. Dr. Traboulsi is the author of numerous publications and is the recipient of both the ASHRAE Distinguished Service Award and the ASHRAE Exceptional Service Award.

John Varley, P.E., Member ASHRAE, HBDP, LEED® AP, has been a professional in the building sciences industry for over 30 years. He has extensive design experience in a variety of laboratory types, including wet chemistry, biomedical, microbiological, animal, and academic laboratories. Varley is a past chair of ASHRAE TC 9.10 and TC 9.11. His work and ideas on laboratory design and industrial ventilation have been published in the ASHRAE Journal, ASHRAE Transactions, and STBE.

Mack Wallace, P.E., Member ASHRAE, LEED® AP, has been a mechanical contractor, consulting engineer, and a registered engineer in Texas for over 30 years. Mack is heavily involved on the front lines of the energy conservation industry, having served the past 19 years on the ASHRAE Standard 90.1 Committee. Mack was the engineer of record for many award-winning projects, including the historic preservation of the Texas State Capitol Building. Mack was director of design build services for TXU Energy and responsible for developing and guaranteeing the savings on many energy savings projects. He has trained thousands of engineers and architects worldwide on ASHRAE 90.1, and he is the co-author of Significant Changes to International Energy Conservation Code and ANSI/ASHRAE/IES Standard 90.1. Currently, Mack splits his time between Jacobs and his own company, WiseWatt LLP.

Dennis Wessel, P.E., Fellow/Life Member ASHRAE, LEED® AP, retired as a senior vice president and director of Marketing with Karpinski Engineering and has more than 45 years of engineering experience. Dennis was an ASHRAE director-at-large (2012–2015) and past chair of the Planning Committee, the Conferences & Expositions Committee, and Handbook Committee. He was also past chair of both TC 9.1 and TC 9.12. He is currently a member of the Technical Activities Committee and a TC Section Head.

Grant Wichenko, P.Eng, Member ASHRAE, is a professional engineer with 30 years of experience in the controls business and is the president of Appin Associates. He has been on the ASHRAE SSCP 135 BACnet committee since 1996. Wichenko is also a member of the Elevator Working Group and Chair of the Applications Profile Working Group. He has been a member of SGPC 13 BAS Specification committee since 1996. Mr. Wichenko has taught a number of courses and given numerous presentations on BACnet and networked controls to address the needs of owners, facility managers, and the various trades involved in the installation and implementation of automated control systems.

Hassan Younes, Member ASHRAE, BEAP, BEMP, HBDP, CPMP, HFDP, OPMP, is a technical director and partner at Griffin Consultants. He has extensive experience in the fields of design, sustainability, commissioning, project execution and management, energy efficiency, and value engineering. He holds all ASHRAE certifications and is a certified energy manager, a certified measurement and verification professional, and a LEED®-accredited professional. Mr. Younes is a Grassroots Government Advocacy Committee (GGAC) member in the ASHRAE Region-at-Large, as well as a GGAC Chair in the UAE local chapter. Mr. Younes was awarded the Middle East Energy Professional of the Year award in 2015 by AEE, Middle East Young Engineer of the Year 2010, and was part of the Griffin Consultant’s team awarded the Energy Consultant of the Year 2017 award by Retrofit Tech and the Middle East Boutique Consultancy of the Year 2014 award.