Updates on ASHRAE Standards and Certified HVAC Designer (CHD)

Ir Dr. Sam C. M. Hui
Regional Vice Chair – Government Affairs, ASHRAE Region XIII
E-mail: sam.cmhui@gmail.com

http://ibse.hk/cmhui/191119_JCCC_HVAC_SamHui.pdf

Nov 2019

Contents

- Introduction
- ASHRAE Standards
- Updates on Key Standards
- ASHRAE Certification
- ASHRAE CHD

ASHRAE®

Shaping Tomorrow's Built Environment Today

ASHRAE Overview

Founded in 1894

57,000+
Volunteer Members

130+
countries

Celebrating 125 Years in 2020

7,400+
Student Members

10+
Regions

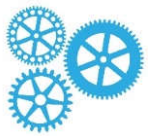
190+
Chapters

400+
Student Branches

Introduction

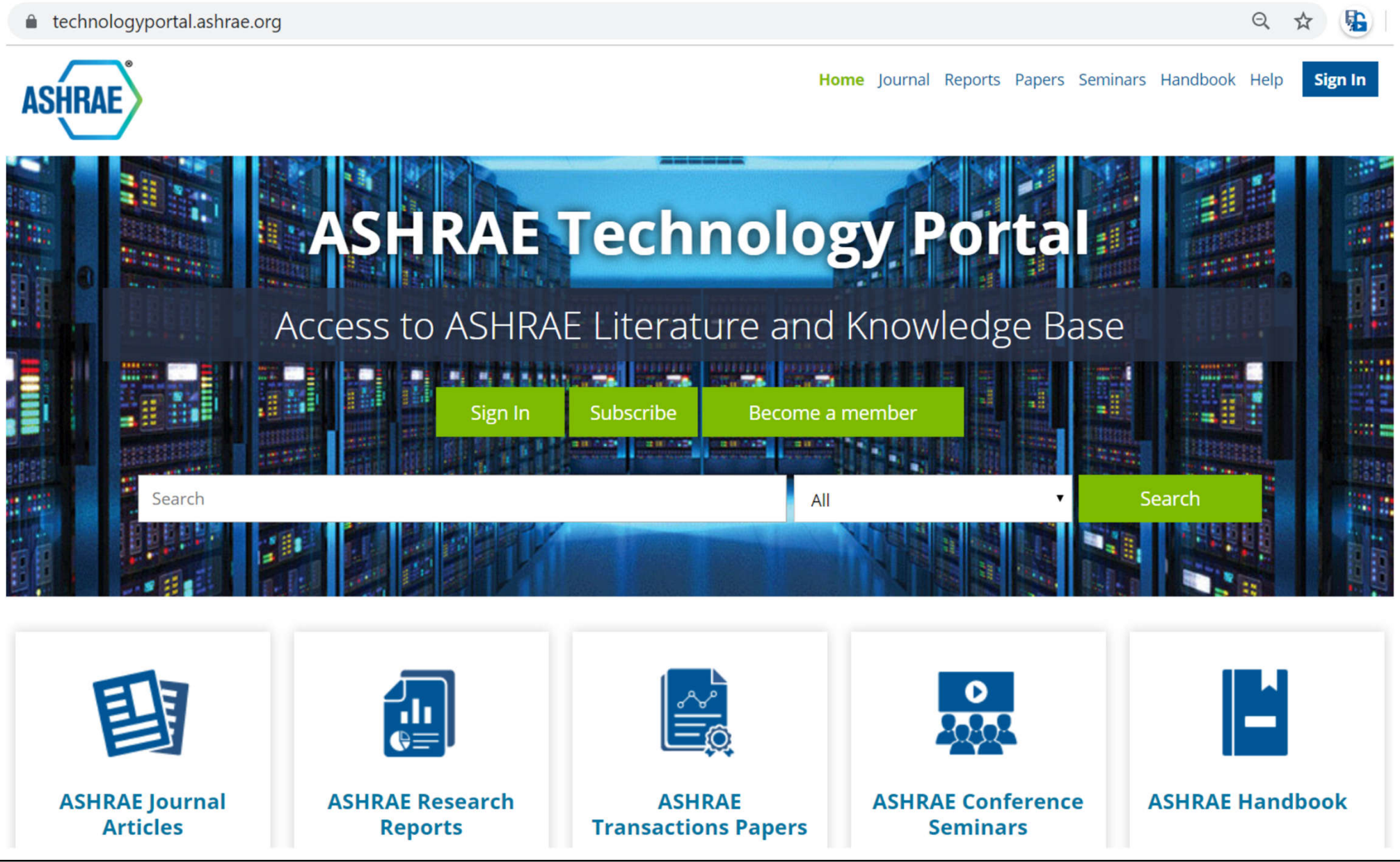
- ASHRAE 2019-2024 Strategic Plan (http://ashrae.org/strategicplan)
  - New Mission
    - To serve humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration and their allied fields.
  - New Vision
    - A healthy and sustainable built environment for all.






ASHRAE Technology Portal

https://technologyportal.ashrae.org/



Introduction

- ASHRAE writes standards & guidelines in its fields of expertise to guide industry in the delivery of goods and services to the public
  - Developing standards since 1922
  - Some 130 active standard or guideline projects
  - Standards are reviewed and republished to ensure they are up-to-date, e.g., existing code-intended standards are on a three year review cycle
  - More information: http://ashrae.org/standards

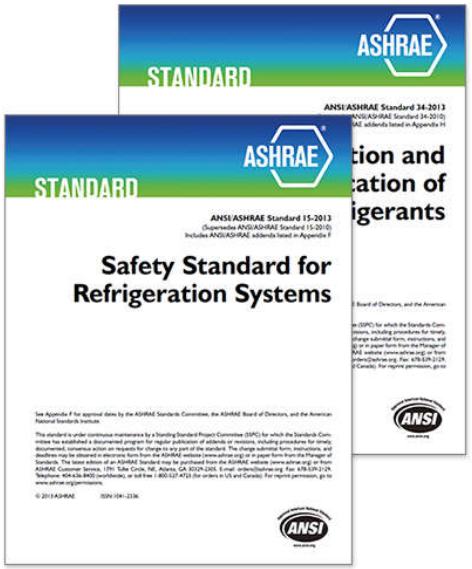
Introduction

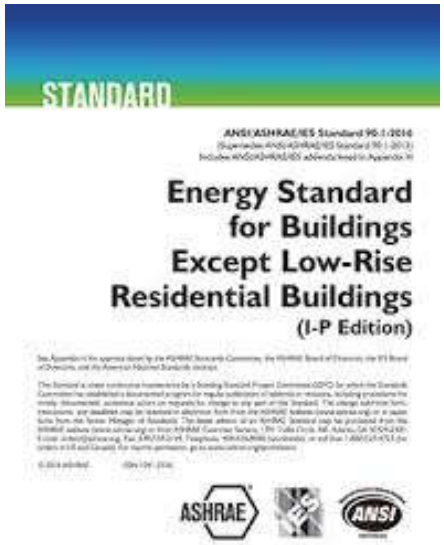
- ASHRAE standards & guidelines
  - Include uniform methods of testing for rating purposes, describe recommended practices in designing and installing equipment and provide other information to guide the industry
  - They address areas such as indoor air quality, thermal comfort, energy conservation in buildings, reducing refrigerant emissions, and the designation and safety classification of refrigerants
  - https://www.ashrae.org/technical-resources/standards-and-guidelines

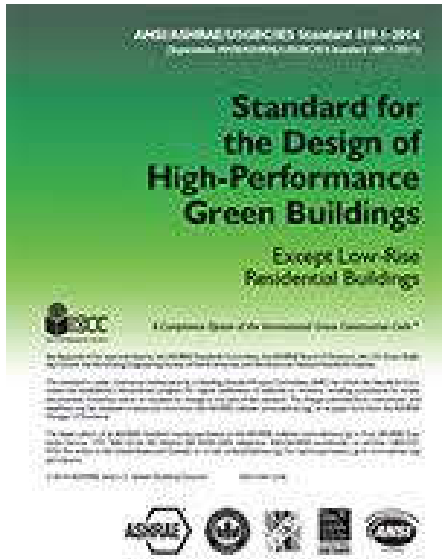
Introduction

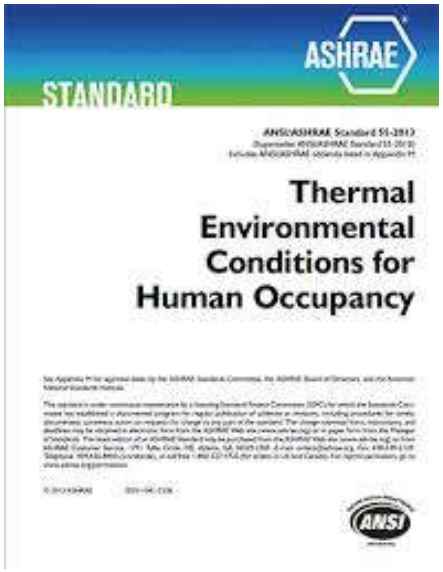
- Standards activities
  - ASHRAE Standards Committee
  - Project Committees
- Preview ASHRAE standards (read only)
  - https://www.ashrae.org/technical-resources/standards-and-guidelines/read-only-versions-of-ashrae-standards
  - Current popular standards
  - Standards referenced in code

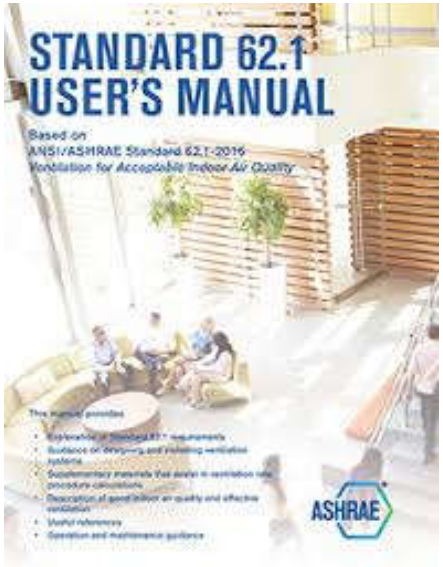
ASHRAE Standards

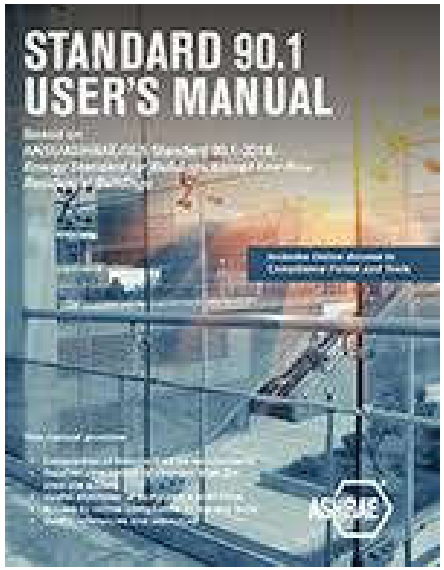


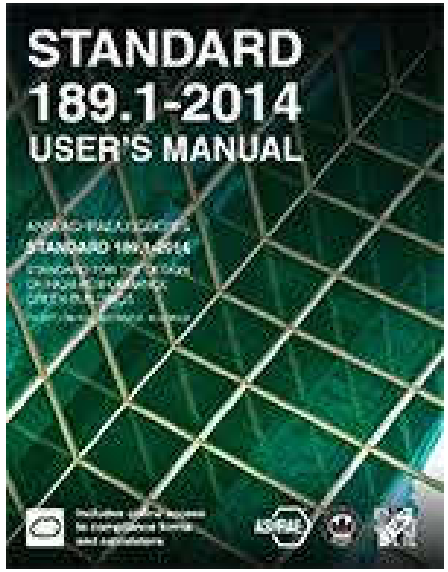












Introduction

- ASHRAE standards documents
  - Standards (e.g. for method of test & classification, design, protocol and rating)
  - Guidelines (to show good practice)
  - User's Manuals (for educational purposes)
    - Provide detailed design applications, with more practical examples & solutions
    - Go above and beyond the performance requirements of a design standard/guideline or min. compliance level
  - Code Change Proposals (revisions, updates)

Introduction

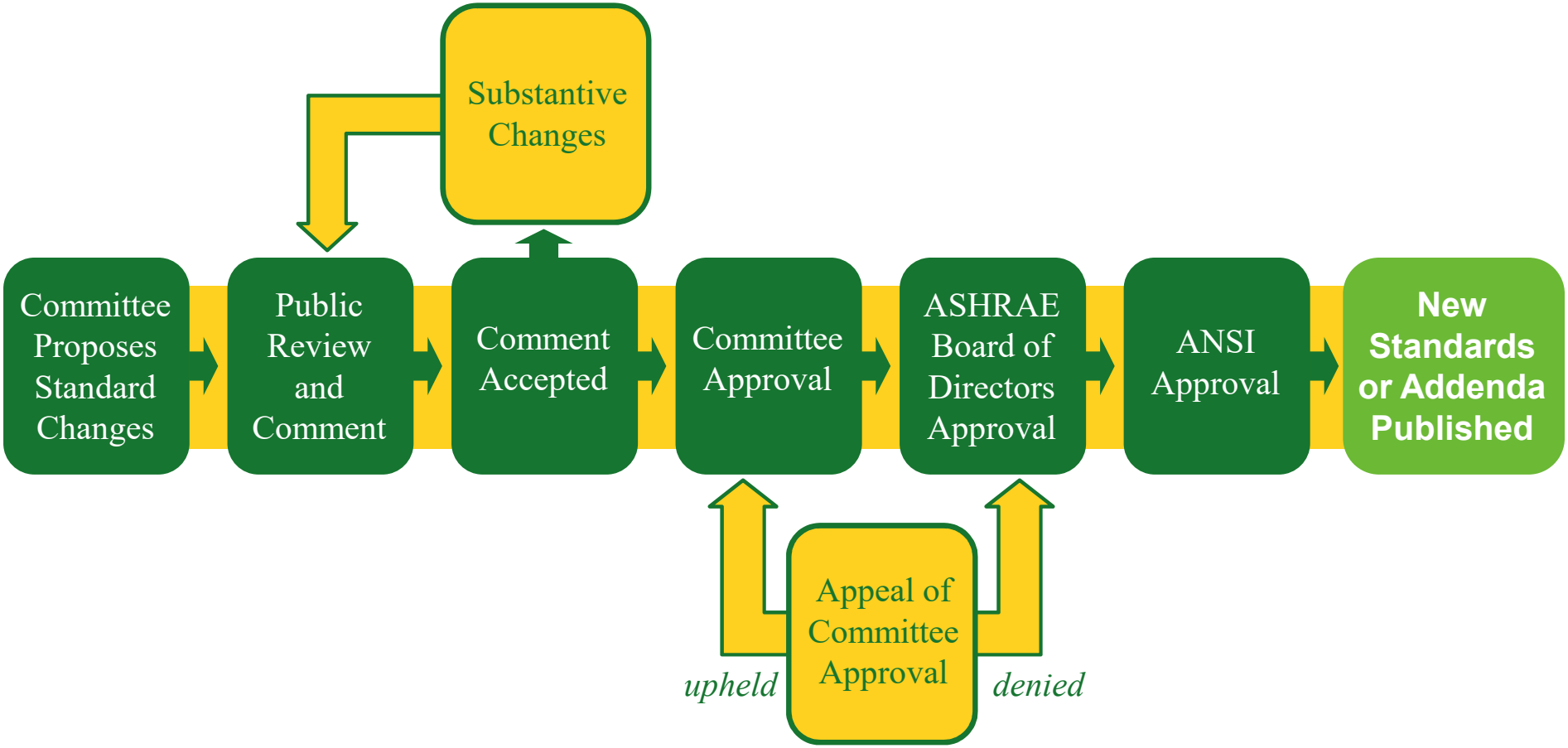
- ASHRAE Standards Actions
  - https://www.ashrae.org/technical-resources/standards-and-guidelines/standards-actions
  - Contains announcements including public review drafts open for comment, call for members on ASHRAE committees, publications, new errata and interpretations, and other information related to ASHRAE standards and standards related activities

Introduction

- ASHRAE public review process
  - ANSI rules: Openness + Balance + Due Process
- ASHRAE Online Standards Review Database
  - Allows members and non-members access to public review drafts for standards, guidelines and addenda and to submit comments
  - http://ashrae.org/publicreviews
  - https://osr.ashrae.org/

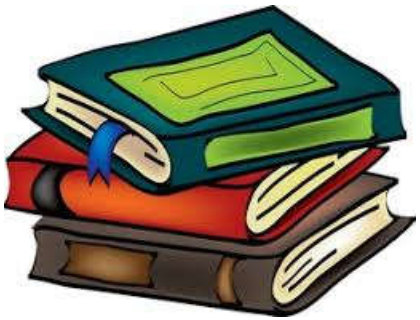
(ANSI = American National Standards Institute)

ASHRAE standard public review process



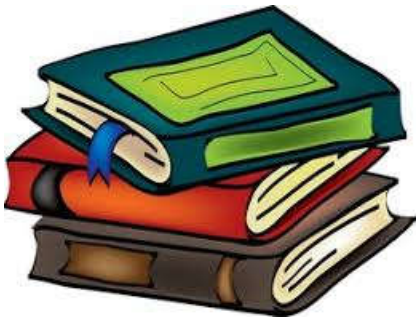
(Source: US Department of Energy)

ASHRAE Standards

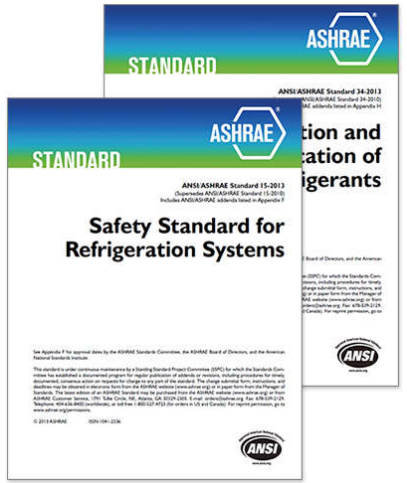


- Well-recognized ASHRAE Standards:
  - Standard 15, Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants
  - Standard 34, Designation and Safety Classification of Refrigerants
  - Standard 55, Thermal Environmental Conditions for Human Occupancy
  - Standard 62.1, Ventilation for Acceptable Indoor Air Quality
  - Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings
  - Standard 135, BACnet (building automation & control)
  - Standard 188, Legionellosis: Risk Management for Building Water Systems
  - Standard 189.1, Design of High-Performance Green Buildings

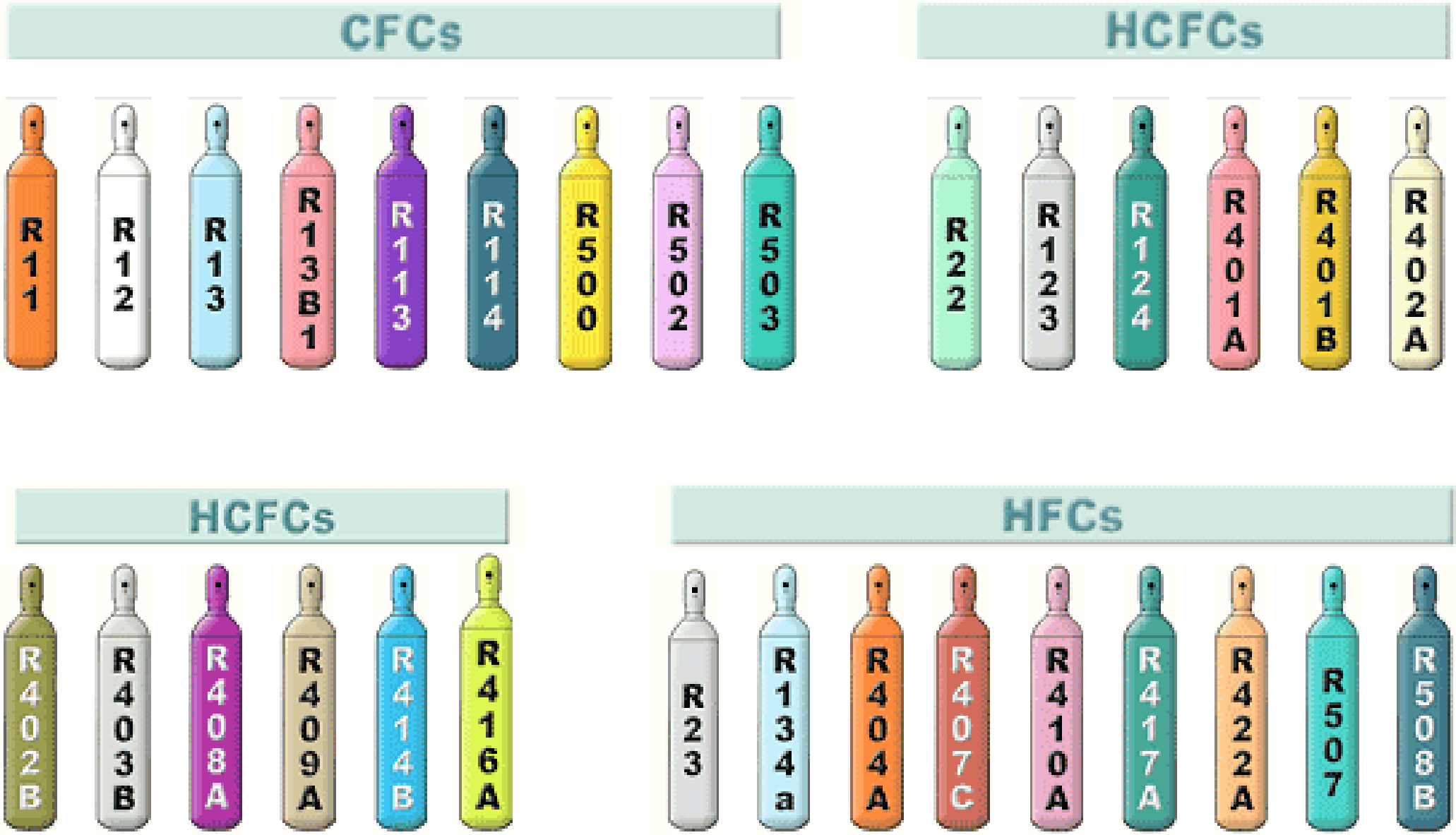
ASHRAE Standards



- Recent ASHRAE Guidelines:
  - ASHRAE Guideline 0-2019, The Commissioning Process
  - ASHRAE Guideline 34-2019, Energy Guideline for Historic Buildings
- Recent updates of ASHRAE standards:
  - Standard 15-2019, Standard 34-2019
    - => On refrigeration systems & refrigerants

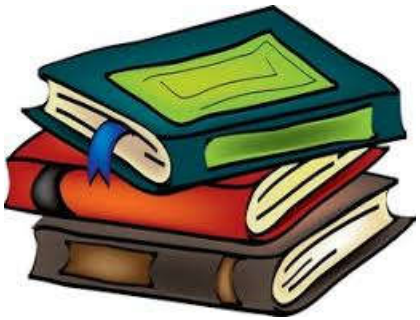


The updated ASHRAE Standards 15-2019 & 34-2019 cover a broader scope of refrigerants



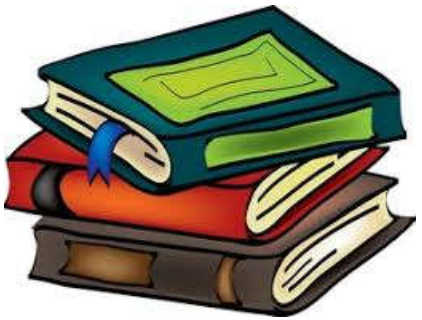
(Source: https://www.coldlinkafrica.co.za/index.php/news-events/news/497-refrigerants-added-to-ashrae-updated-standards
See also: https://www.coolingpost.com/world-news/unep-ashrae-updates-refrigerant-information/)

ASHRAE Standards



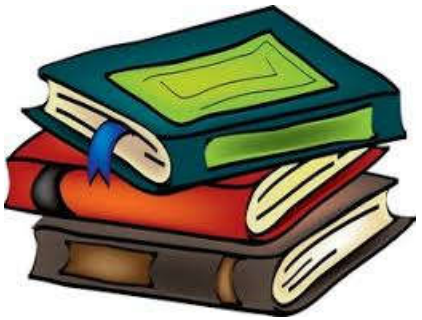
- Upcoming ASHRAE standards: (in year 2019)
  - 62.1-2019, IAQ
  - 90.1-2019, Building Energy Standard
  - 90.4-2019, Energy Standard for Data Centers
  - 135.1-2019, Method of Test for Conformance to BACnet
  - 147-2019, Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment and Systems
  - ASHRAE Guideline 12-2019, Minimizing the Risk of Legionellosis Associated with Building Water Systems

ASHRAE Standards



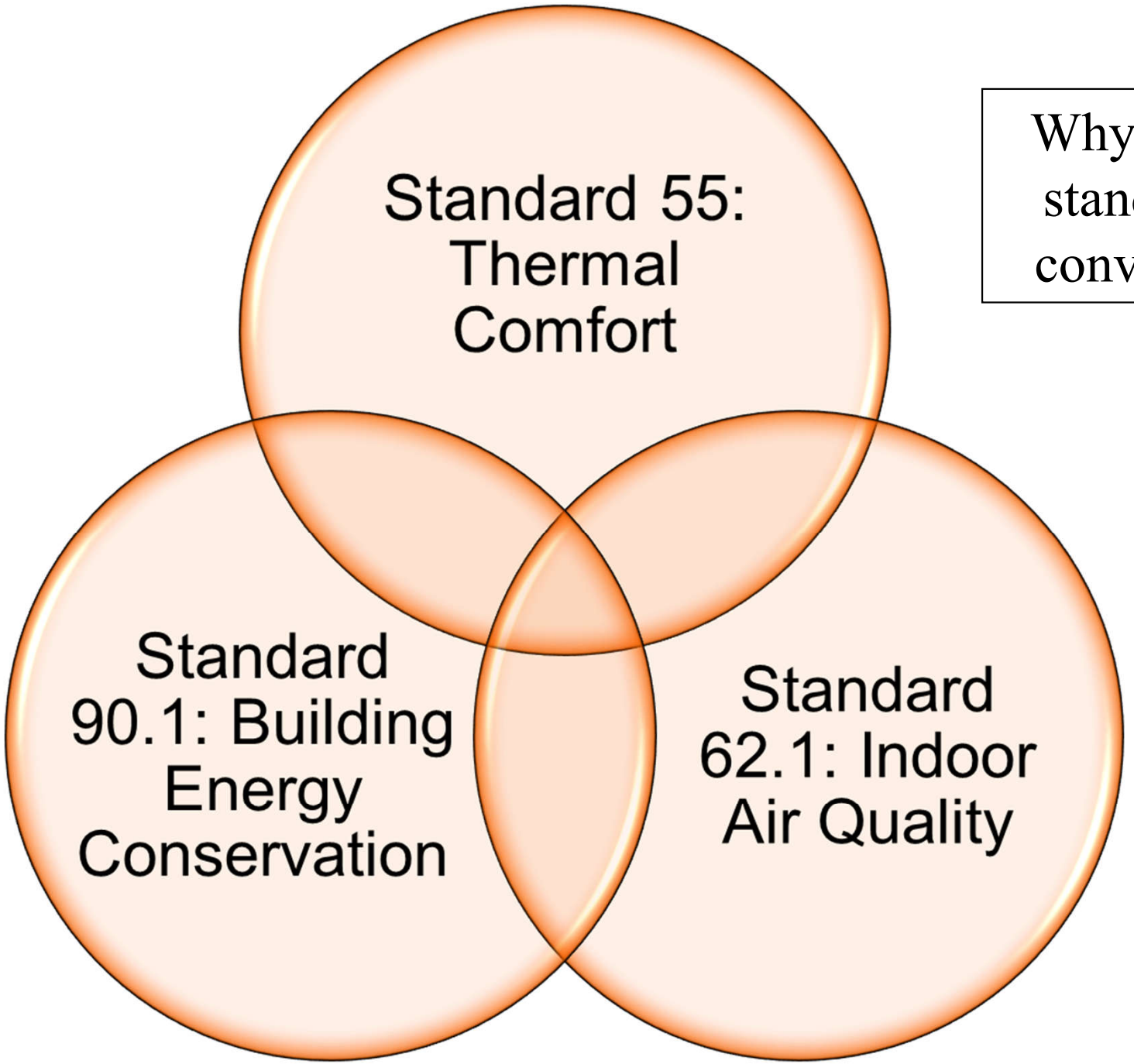
- Upcoming ASHRAE publications (design guides):
  - Smart Grid Application Guide (Late 2019)
  - ASHRAE Design Guide for Tall, Supertall and Megatall Buildings Design Guide 2nd ed. (Late 2019)
  - Air-Conditioning System Design Manual, 3rd ed. (Late 2019)
  - ASHRAE Design Guide for Hot-Climate Buildings (Late 2019)
  - Natural Ventilation Design Guide (Jan 2020)
  - ASHRAE Design Guide for Duct Systems (January 2020)

ASHRAE Standards



- Key ASHRAE Standards:
  - 55: thermal comfort
  - 62.1: indoor air quality
  - 90.1: building energy conservation
- Recent development trends
  - Convergence of Standards 90.1, 62.1 & 55: To provide acceptable indoor air quality and thermal environmental conditions for human occupancy while optimizing energy efficiency in built environment.

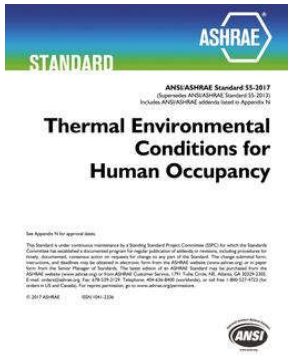
Convergence of ASHRAE Standards 90.1, 62.1 & 55



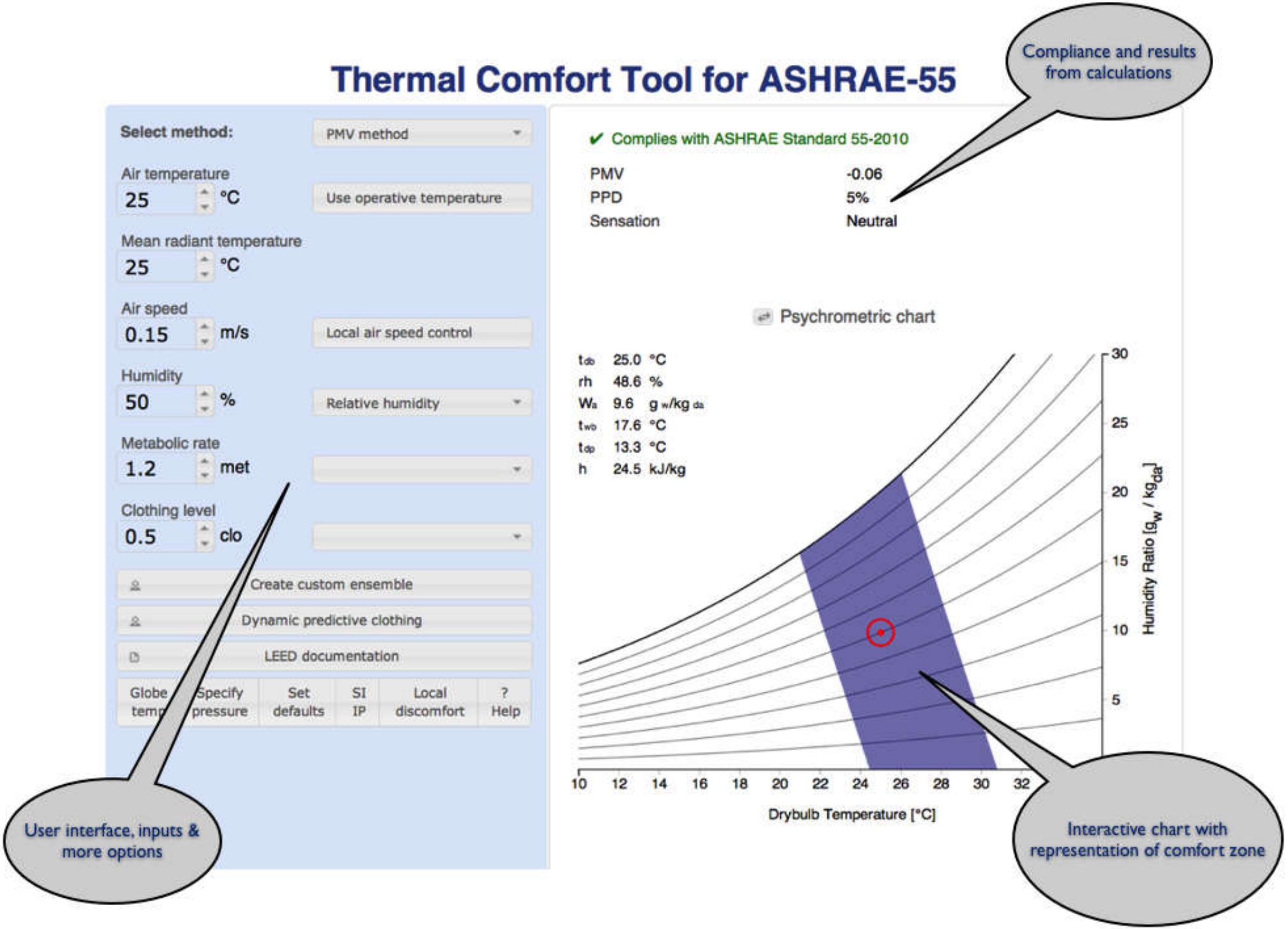
Why these standards converge?

Updates on Key Standards

- ASHRAE Standard 55-2017, Thermal Environmental Conditions for Human Occupancy (current version)
  - Also, Standard 55 User's Manual
  - 3 compliance methods:
    - A graphic method for simple situations
    - An analytical method for more general cases
    - A method using elevated air speed to provide comfort
  - A method for determining acceptable thermal conditions in occupant-controlled naturally conditioned spaces
  - Computer software & web-based thermal comfort tools
  - Assess thermal comfort for green buildings



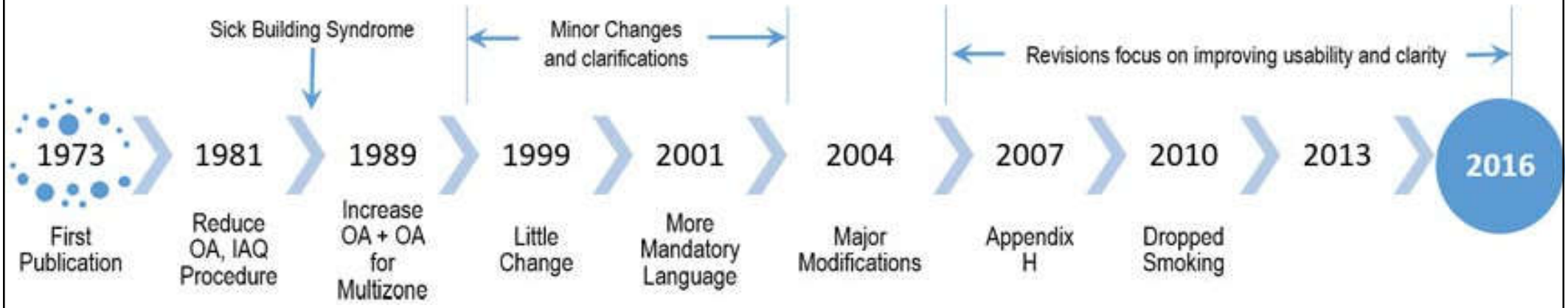
(See also: ASHRAE Standing Standard Project Committee 55 http://sspc55.ashraepcs.org/)



(Image source: http://comfort.cbe.berkeley.edu/static/html/help.html)

Updates on Key Standards

- ASHRAE Standard 62.1: Ventilation for Acceptable Indoor Air Quality
  - History and evolution of the standard:



  - 2019 version major changes:
    - A new Natural Ventilation Rate Procedure (NVRP), a new Indoor Air Quality Procedure (IAQP) and changes to the Ventilation Rate Procedure (VRP)

(Update Standard 62.1 https://www.ashrae.org/news/hvacrindustry/updated-standard-62-1)

(See also: ASHRAE Standing Standard Project Committee 62.1 http://sspc621.ashraepcs.org/)

Major changes proposed in ASHRAE Standard 62.1-2019

Overall Direction: make the quality of indoor air more comparable between the different pathways

The new Natural Ventilation Rate Procedure (NVRP):

- Relocated from section 5 to section 6 and became a ventilation procedure
- Modified to require mechanical ventilation with certain exceptions
- Provides specific requirements for the exception & a clear compliance path
- Recognizes that there are inherent health issues with outdoor air in many locations in the world and updates the prescriptive requirements based on recent studies and airflow evaluations

The new Indoor Air Quality Procedure (IAQP):

- Identify contaminants of concern
- Determine indoor and outdoor sources
- Identify a concentration limit and exposure period
- Specify percentage of building occupants to be satisfied with perceived IAQ and perform a mass balance analysis for selected compound

Changes in the Ventilation Rate Procedure (VRP):

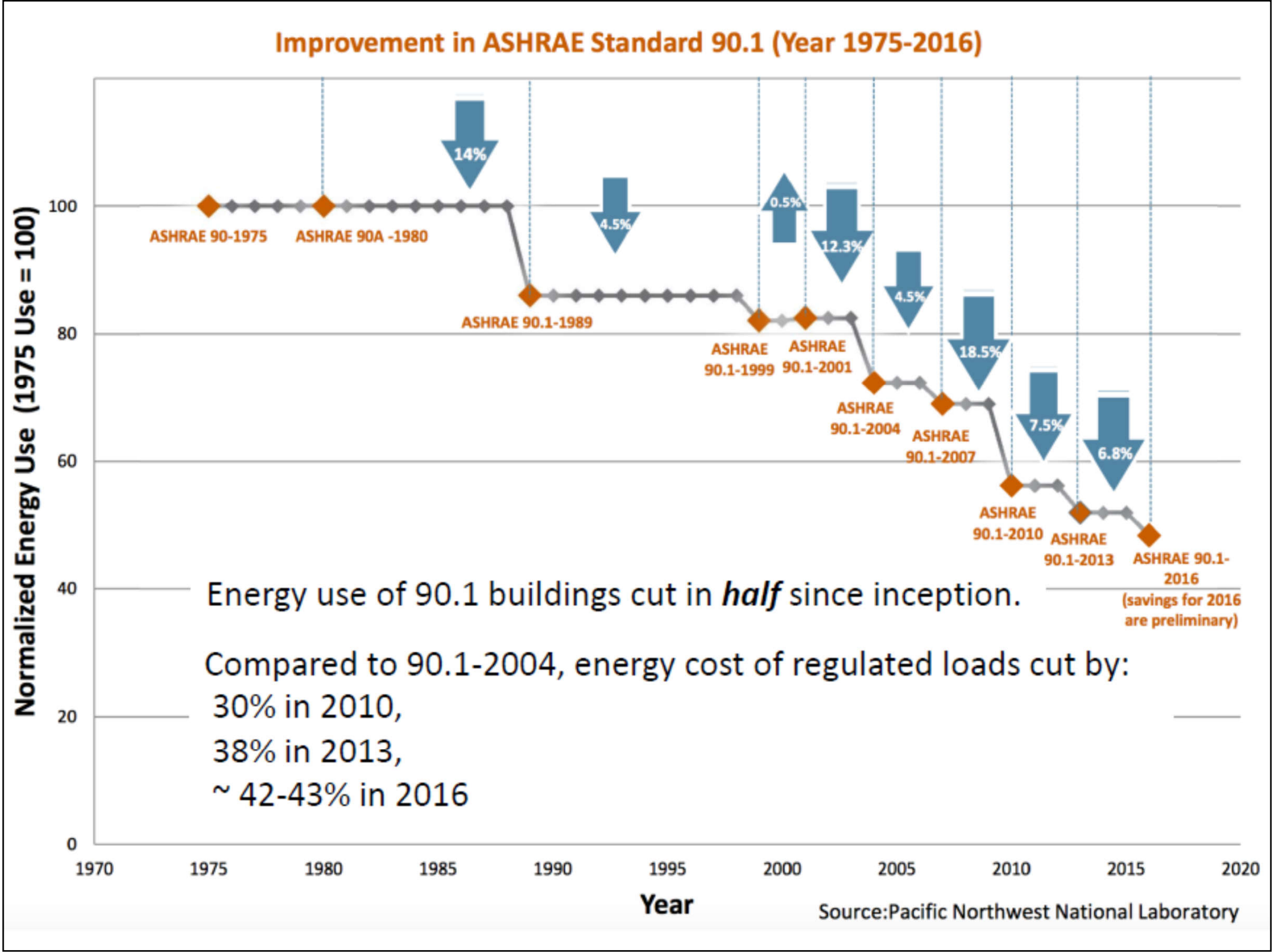
VRP minimum rates are based on contaminant sources and source strengths that are typical for the listed occupancy categories; a simplified VRP is used as a default

Updates on Key Standards

- ASHRAE/IES Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings
  - A benchmark to set MEPS (minimum energy performance standards) and energy codes
  - 2019 version: > 100 changes from the 2016 version
  - Increased energy performance requirements
  - More stringent requirements for envelope thermal efficiency, solar control, HVAC systems & lighting
  - Enhanced information on performance simulation path
  - Target to save > 40% by compliance

(2019 Update of Standard 90.1 https://www.ashrae.org/news/hvacrindustry/2019-update-of-standard-90-1)

(See also: ASHRAE Project Committee 90.1 http://sspc901.ashraepcs.org/)


Improvement in ASHRAE Standard 90.1 (Year 1975-2016)
Normalized Energy Use (1975 Use = 100)
100
80
60
40
20
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Year
ASHRAE 90-1975
ASHRAE 90A -1980
ASHRAE 90.1-1989
ASHRAE 90.1-1999
ASHRAE 90.1-2001
ASHRAE 90.1-2004
ASHRAE 90.1-2007
ASHRAE 90.1-2010
ASHRAE 90.1-2013
ASHRAE 90.1-2016
(savings for 2016 are preliminary)
14%
4.5%
0.5%
12.3%
4.5%
18.5%
7.5%
6.8%
Energy use of 90.1 buildings cut in *half* since inception.
Compared to 90.1-2004, energy cost of regulated loads cut by:
30% in 2010,
38% in 2013,
~ 42-43% in 2016
Source:Pacific Northwest National Laboratory

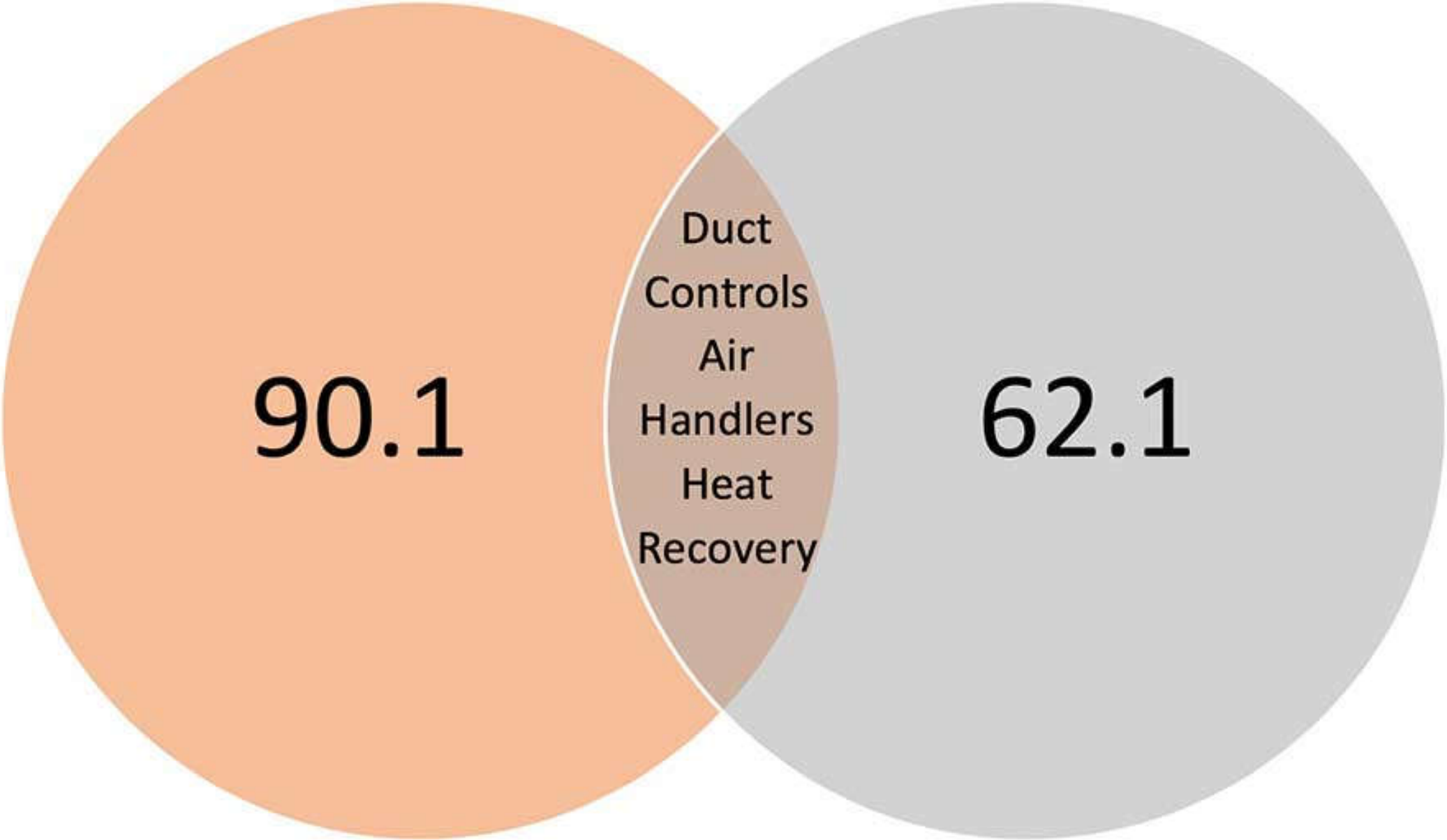
Examples of design impacts from ASHRAE Standards 90.1 & 62.1

Item	90.1 Section	Impacted Systems	Consequence
1	6.5.1.1 Air Economizers	Duct, Controls	Outdoor air duct increases in cross section over that required for minimum ventilation air. Complexity is added to controls related to building pressurization
2	6.5.3.1 Fan System Power and Efficiency	Motors, Fans, Duct, Air Handlers	To maintain motor size within standard requirements, duct and air handler cross sections increase.
3	6.5.6.1 Exhaust Air Energy Recovery	Duct, Pipe, Air Handlers, Fans, Controls	Increases air handler footprints. If coils are added to system the added pressure drop will be offset by larger duct.

Item	62.1 Section	Impacted Systems	Impacts
1	5.5 Outdoor Air Intakes.	Duct, Dampers	Distance between intakes adds duct length.
2	5.3 Ventilation System Controls.	Controls	Measurement and verification of outside air adds complexity to controls.
3	6.2 Ventilation Rate Procedure.	Air handlers, Duct, Energy recovery	Minimum outside air rates require added coil capacity. May trigger energy recovery requirement of 90.1

(Source: https://www.esmagazine.com/articles/99273-examining-the-nexus-of-ashrae-standards-901-and-621)

Intersection of ASHRAE Standards 90.1 & 62.1



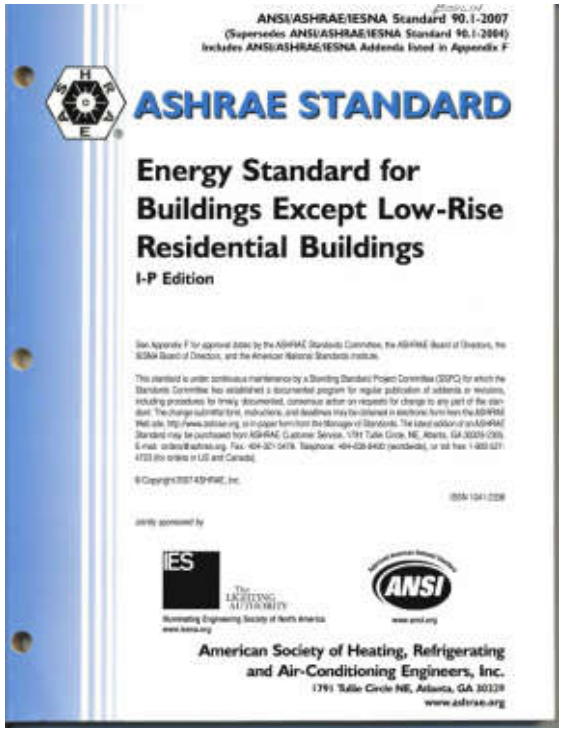
(Source: https://www.esmagazine.com/articles/99273-examining-the-nexus-of-ashrae-standards-901-and-621)

Updates on Key Standards

- Why ASHRAE Standards 90.1 is important?
  - It is the reference standard for US Energy Policy Act and many building energy codes in USA
  - It has been adopted in many countries as a model for energy efficiency guidelines and codes
  - It is the professional "standard of care" set by ASHRAE consensus, with support from
    - IES (Illuminating Engineering Society) or IESNA
    - ANSI (American National Standards Institute)
  - Required for LEED green building certification

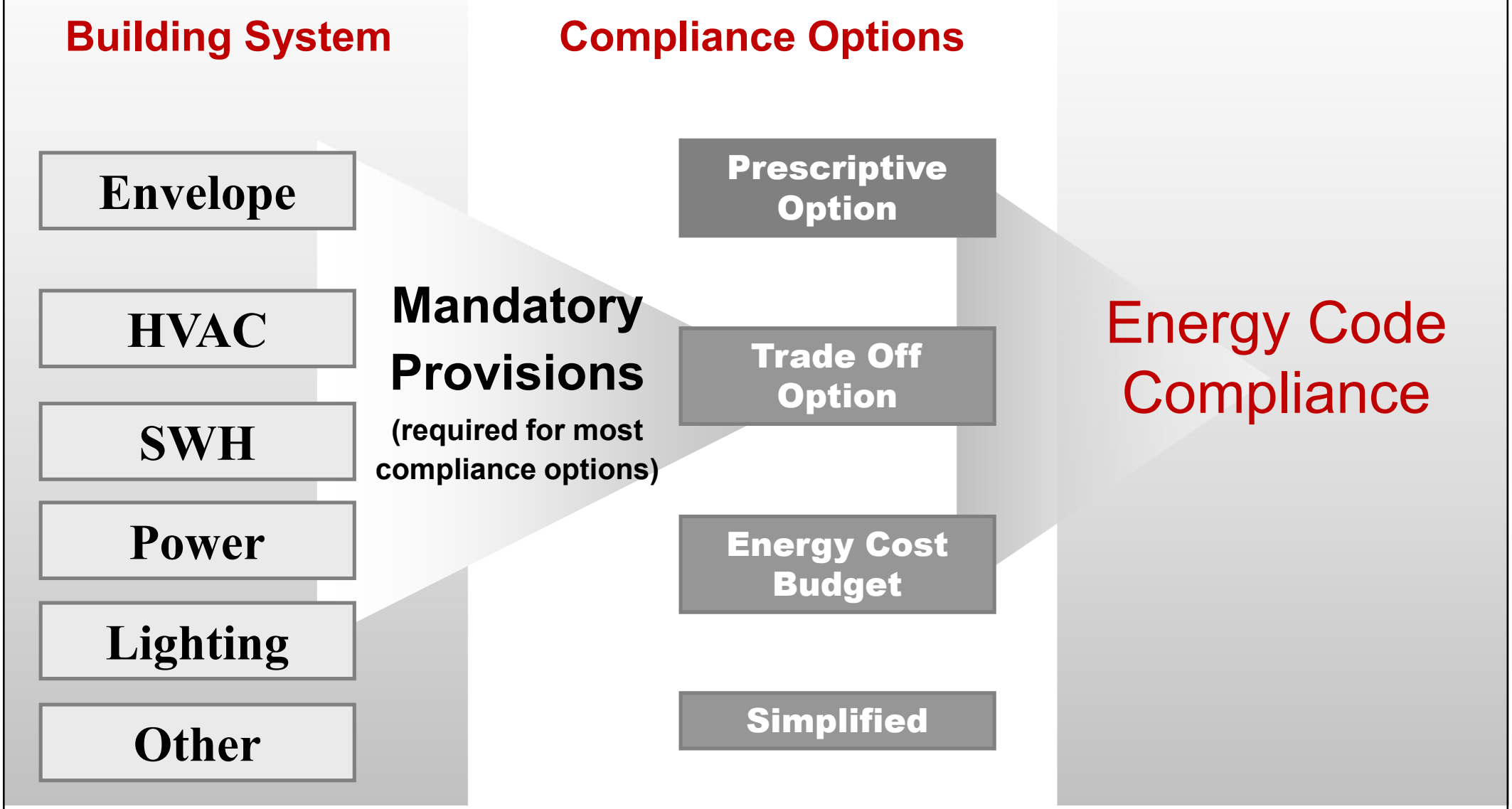
Updates on Key Standards

- ASHRAE 90.1 timeline*:
  - 90-1975: first issued
  - 90A-1980: updated
  - 90.1-1989: updated
  - 90.1-1999: major rewrite
  - 90.1-2001: minor revisions
  - 90.1-2004: updates, reorganization
  - 90.1-2007: updates
  - 90.1-2010: updates
  - 90.1-2013: expanded & updates
  - 90.1-2016: updates
  - 90.1-2019: up coming



(*See also: http://en.wikipedia.org/wiki/ASHRAE_90.1)

ASHRAE 90.1 compliance approaches

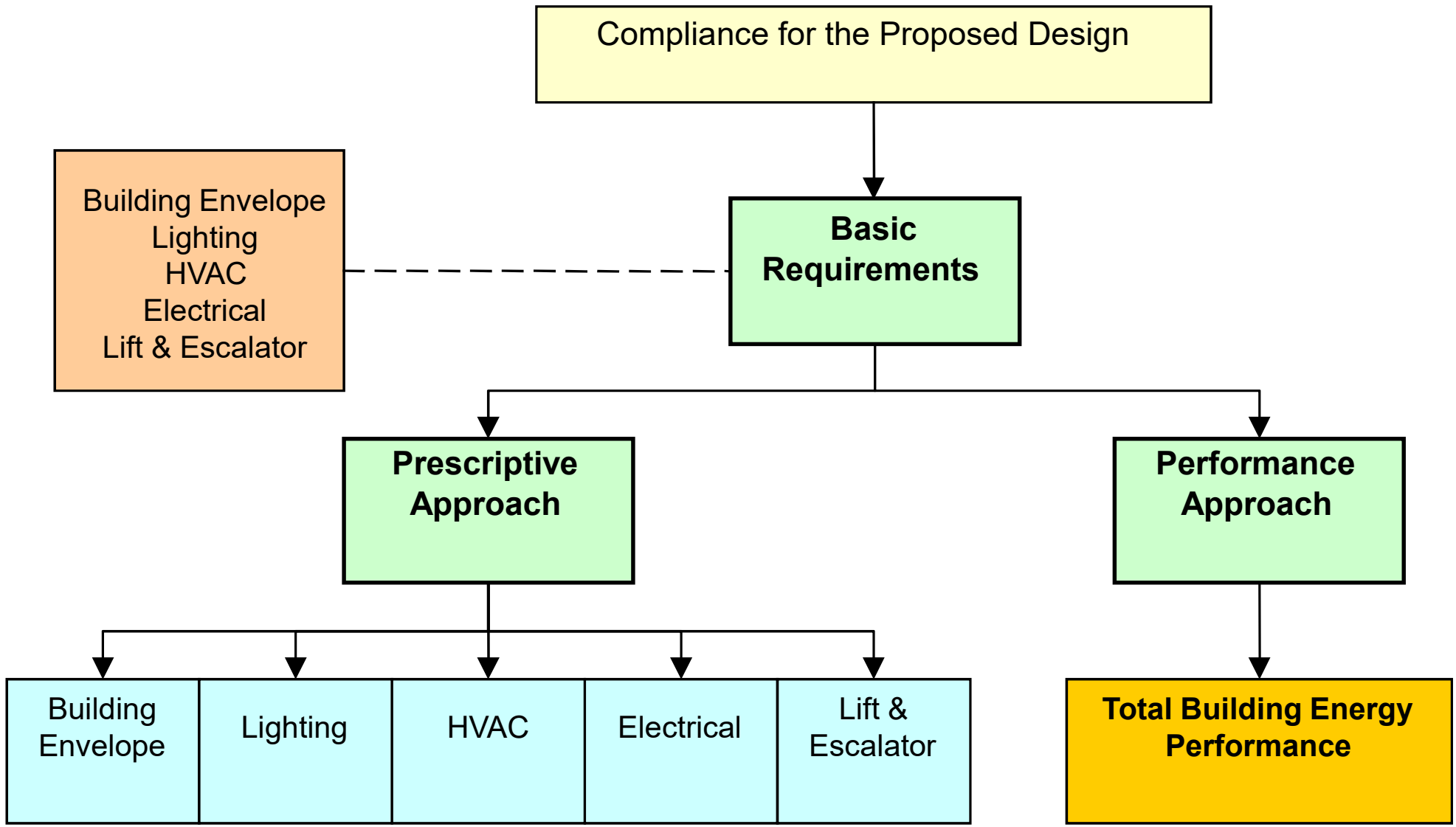


(Source: US Department of Energy)

(Source: EMSD)

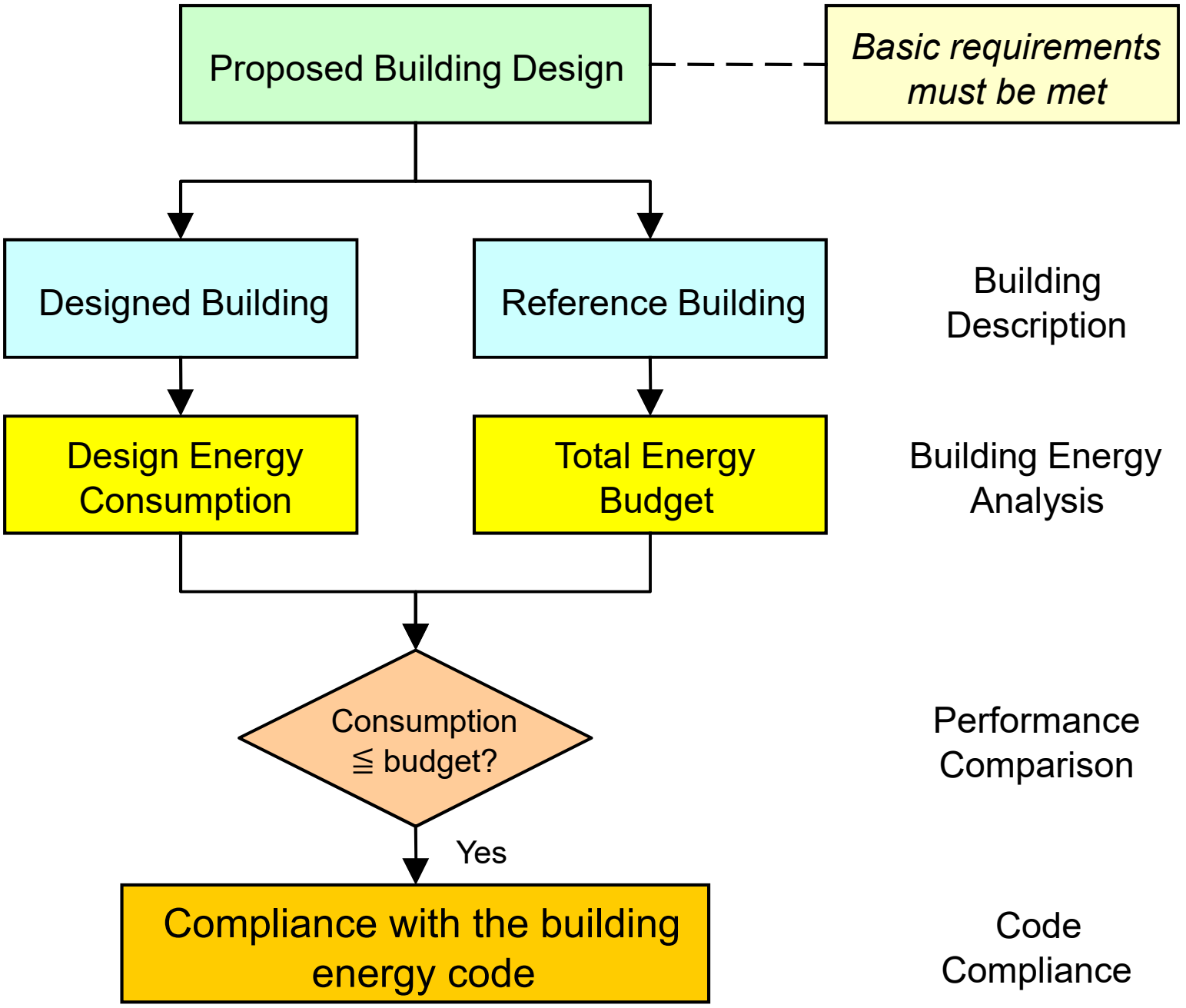
(See http://www.beeo.emsd.gov.hk for details)

Proposed framework of the comprehensive BECs in Hong Kong



(Source: EMSD)

Performance compliance for building energy code



ASHRAE Certification

Shine in a Rising Field

ASHRAE Certification

- ASHRAE certification programs:
  - Created to meet industry needs as identified through market research, based on best practices
  - Developed by ASHRAE-identified practitioners, so ASHRAE Certifications are reliable, credible, unbiased
  - Computer-based examinations at local testing centers worldwide (or pencil-based examinations)
  - Benchmarking with ANSI standards

Be Recognized as a *High Performer*

Be ASHRAE Certified

www.ashrae.org/certification

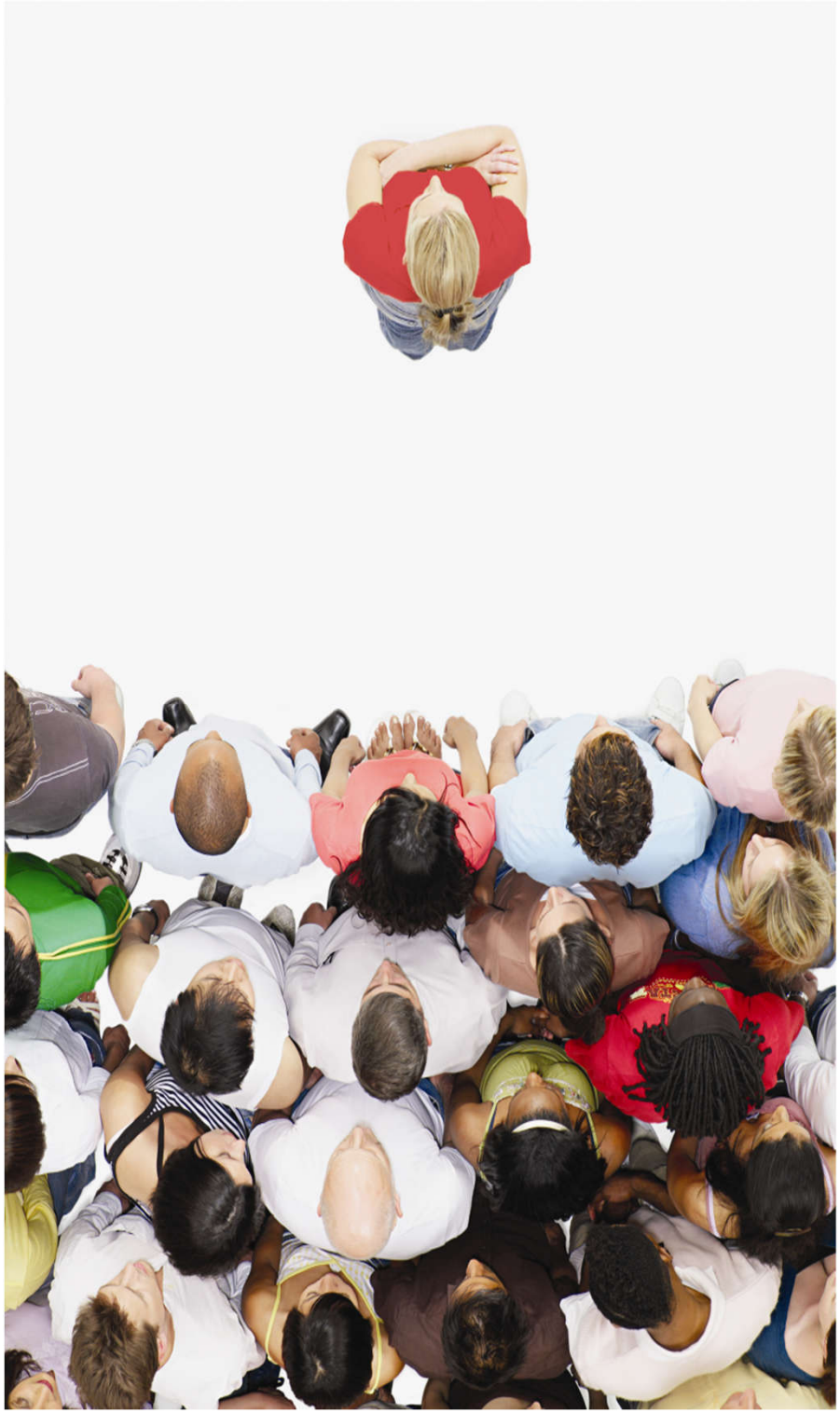
ASHRAE Certification

- What's the Value?
  - *"Stand out from the Crowd."* Be identified with cutting edge building design and operation
  - *"The Certification ASHRAE Stands Behind."* Your earning a certification is ASHRAE's acknowledgement that you understand the relevant body of knowledge and meet educational and experience requirements
  - *"Feel Qualified?"* Although ASHRAE identifies resources to prepare for its certifications, there is no requirement to purchase a book or attend a class. You simply must meet the eligibility criteria

ASHRAE®

Certified

- Energy Assessment
- Energy Modeling
- Commissioning
- Healthcare Facility Design
- High-Performance Building Design
- Building Operations
- HVAC Design



ASHRAE Certification

- Certification for People
  - BEAP, BEMP, CPMP, CHD, HFDP, HBDP, OPMP

ASHRAE Certified

- Certification for Buildings
  - Building Energy Quotient (bEQ)
    - On building energy performance
    - https://www.ashrae.org/technical-resources/building-eq

Building eQ POWERED BY ASHRAE

ASHRAE Certification

- Benefits to Certification Earners*
  - Enhance your credibility
  - Expand your industry knowledge
  - Demonstrate your commitment to improving yourself, your work product, and the industry
  - Improve your options for being hired or promoted and to generate new business

* Video: The Value of ASHRAE Certification (4:12)
http://www.youtube.com/watch?t=5&v=8ZphnrHDrjo

ASHRAE Certification

- Benefits to Employers
  - Demonstrate corporate commitment to excellence by employing qualified engineers
  - Improve morale by supporting professional advancement
  - Distinguish your firm from the competition by employing ASHRAE-certified engineers
  - Know whom to hire, promote and assign important projects

ASHRAE Certification

- Recognition
  - Certification earner directory on the ASHRAE Website*
  - New certificants listed in Insights
  - News release prepared and sent from ASHRAE
  - Certification designation and ASHRAE-Certified logo on business cards, letterhead, email and websites, as well as in proposals/bids.

* Find an ASHRAE Certified Professional
https://www.ashrae.org/certification/find-an-ashrae-certified-professional

ASHRAE Certification

- ASHRAE Certification Digital Badge
  - https://www.ashrae.org/professional-development/ashrae-certification/ashrae-certification-badges
  - Add your ASHRAE Certification Digital Badge to your email signature, LinkedIn Profile, Facebook Page or Twitter account to validate your professional and technical expertise

ASHRAE Certification

- ASHRAE currently offers 7 certification programs
  - Building Energy Assessment Professional (BEAP)
  - Building Energy Modeling Professional (BEMP)
  - Commissioning Process Management Professional (CPMP)
  - Healthcare Facility Design Professional (HFDP)
  - High-Performance Building Design Professional (HBDP)
  - Operations & Performance Management Professional (OPMP)
  - HVAC Design (CHD) [new]

Certification Program	Relevant Experience and Knowledge
Building Energy Assessment Professional (BEAP)	Building energy audit, building energy management, building services systems (design, installation, and/or management)
Building Energy Modeling Professional (BEMP)	Building energy simulation, energy modeling software, building energy analysis, building services systems (design and/or installation)
Commissioning Process Management Professional (CPMP)	Building testing and commissioning, facilities operations/management, construction, design, or consulting
Healthcare Facility Design Professional (HFDP)	Healthcare HVAC&R design, medical equipment & procedures, healthcare facilities operation & maintenance
High-Performance Building Design Professional (HBDP)	HVAC&R design, sustainability concepts, energy analysis, indoor environment, controls, energy and environmental performance, water conservation, commissioning, building operation & maintenance
Operations & Performance Management Professional (OPMP)	Facility operations/management, construction, design, or consulting, Facility life cycle, O&M program, building performance management, communications, environmental, health & safety

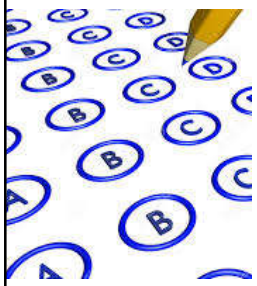
ASHRAE Certification

- Preparation for the exam
  - The best preparation is your work experience, as it is an exam on competence in critical job tasks, and their related knowledge, skills and abilities
  - Resources on the related web page:

    - Candidate Guidebook
      - Detailed Content Outline (DCO)
    - A list of exam study tips, three sample exam items and a list of key resources for possible study
    - A convenient, 30-question, online practice exam

ASHRAE Certification

- About the exam
  - Each exam is closed book/notes and has 115 multiple-choice items [A, B, C, or D] of which 100 will be scored (15 items for pre-test or trial)
  - Duration: 2 hours for HFDP, 2.5 hours for all other exams
  - The Candidate Guidebook will show
    - Major content areas (and number of items devoted to each area)
    - Number of items at each cognitive level in each area



ASHRAE Certification

- About the exam (cont'd)
  - The three cognitive levels are tested:

    - 1. Recall: The ability to remember or recognize specific information
    - 2. Application: The ability to comprehend, relate, or apply knowledge to new or changing situations
    - 3. Analysis: The ability to synthesize information – sometimes from a variety of sources, determine solutions, and/or evaluate the usefulness of a solution
  - Be sure to provide an answer for each question. There is no penalty for guessing.

ASHRAE Certification

- After the exam
  - Candidates will receive a result of "pass" or "fail," as well as a numerical score, but ASHRAE does not publish the scores need to pass
  - The passing score can be different for different certification exams
- If one fails the exam, he/she must wait at least 90 days before retaking the exam

ASHRAE Certification

- Two formats of the exam:
  - Online (computer-based)

    - Before the actual timed exam, a candidate will be given a practice session to try answering questions on the computer
    - An exam question may be left unanswered for return later, or it may also be bookmarked for later review
  - Pencil-based

    - Onsite exams during ASHRAE Winter and Annual Meetings, at some conferences, or arranged by some local ASHRAE chapters

ASHRAE Certified HVAC Designer (CHD)

http://ashrae.org/chd/

ASHRAE CHD

- Certified HVAC Designer (CHD)
  - Launched March 2019
  - The CHD certification validates competency of the HVAC Designer to do the following:
    - Design HVAC systems to meet building/project requirements, including load calculations, equipment selection and sizing, mechanical equipment room design, duct and piping design and layout for the development of HVAC plans for permit and construction
  - http://ashrae.org/chd/

ASHRAE CHD

- Earning the CHD certification
  - Will let your employer, peers and customers know that you have the knowledge, skills and abilities needed to get the job done, and position you for continued recognition and success
- Who can participate
  - An applicant should meet education and work experience eligibility requirements and successfully complete the program's examination
  - Membership in ASHRAE is not a must

ASHRAE CHD

- Education & work experience
  - Bachelor's degree in engineering or a related field and two (2) years of HVAC Design work experience, OR
  - Associate's degree or Technical degree or certificate in design, construction, or a related field and three (3) years of HVAC Design work experience, OR
  - High School diploma or equivalent and five (5) years of HVAC Design work experience

ASHRAE CHD

- Code of Ethics
  - As a condition of earning & maintaining certification, applicants for the CHD person must agree to uphold and abide by a Code of Ethics
- CHD Exam
  - The CHD certification exam was developed by the ASHRAE CHD Exam Subcommittee following an industry-wide, 2018 job task analysis study conducted to determine the frequency and importance of HVAC designer job tasks

ASHRAE CHD

- Application Fees (US$)
  - ASHRAE Member: $395.00; Non-member: $545.00
  - ASHRAE Member Exam Retake: $175.00; Non-member: $225.00
  - ASHRAE Member Second Exam Retake $395.00; Non-member $545.00

ASHRAE CHD

- Resources for exam preparation
  - CHD Practice Exam
  - Related ASHRAE publications:
    - ASHRAE Handbooks
    - ASHRAE Standards 55, 62.1, 90.1, 202, 209
    - Principles of HVAC, by ASHRAE
  - Professional development seminars & short courses by ASHRAE Learning Institute (ALI) and eLearning Center

ASHRAE CHD

- CHD Certification Exam Blueprint
  - 1. System Design (40%)
  - 2. Design Calculations (30%)
  - 3. Procedural (10%)
  - 4. Coordination (20%)
- CHD Recertification
  - Each CHD certificant is required to renew their certification every three years, with 30 professional development hours (PDHs)

THANK YOU 謝謝 !!

ASHRAE®

CELEBRATING 125 YEARS