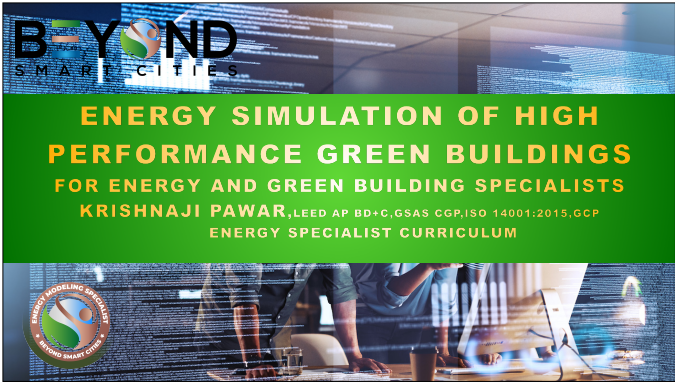




ENERGY SIMULATION OF HIGH PERFORMANCE GREEN BUILDINGS

FOR ENERGY AND GREEN BUILDING SPECIALISTS

KRISHNAJI PAWAR, LEED AP BD+C, GSAS CGP, ISO 14001:2015, GCP
ENERGY SPECIALIST CURRICULUM





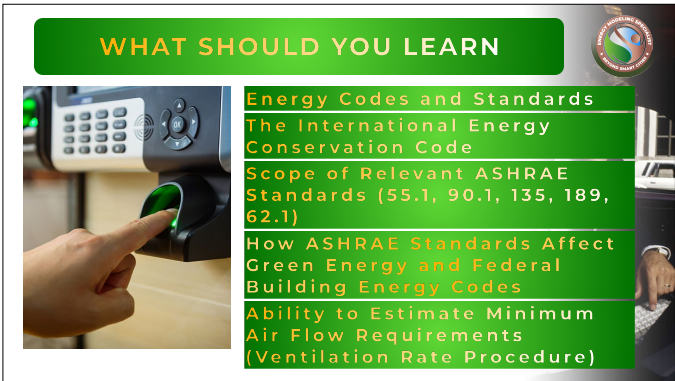
CODES AND STANDARDS

FOR ENERGY AND GREEN BUILDING PROFESSIONALS

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WHAT SHOULD YOU LEARN



Energy Codes and Standards

The International Energy Conservation Code

Scope of Relevant ASHRAE Standards (55.1, 90.1, 135, 189, 62.1)

How ASHRAE Standards Affect Green Energy and Federal Building Energy Codes

Ability to Estimate Minimum Air Flow Requirements (Ventilation Rate Procedure)

ENERGY CODES AND STANDARDS

✓ Energy codes – specify how buildings must be constructed or perform, and are written in mandatory, enforceable language. Regional or local governments adopt and enforce energy codes for their jurisdictions.

✓ Energy standards – describe how buildings should be constructed to save energy cost-effectively. They are published by professional organizations such as the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE). They are not mandatory, but serve as national recommendations, with some variation for regional climate.



ENERGY CODES AND STANDARDS +

✓ Regional and local governments frequently use energy standards as the technical basis for developing their energy codes.

✓ Some energy standards are written in mandatory, enforceable language, making it easy for jurisdictions to incorporate the provisions of the energy standards directly into their laws or regulations.



INTERNATIONAL ENERGY CONSERVATION CODE

✓ The International Code Council (ICC) publishes and maintains the International Energy Conservation Code (IECC), which is a model energy code that makes allowances for different climate zones.

✓ Because it is written in mandatory, enforceable language, state and local jurisdictions can easily adopt the model as their energy code.

✓ Before adopting the IECC, state and local governments often make changes to reflect regional building practices.



STANDARDS ORGANIZATIONS AND CODE ORGANIZATIONS

- ✓ American Society of Heating and Air-Conditioning Engineers (ASHAE)
- ✓ 180 Technology Parkway NW Peachtree Corners, GA 30092
<https://www.ashrae.org>
- ✓ ICC - International Code Council - ICC
- ✓ 500 New Jersey Avenue, NW 6th Floor, Washington, DC 20001.
<https://www.iccsafe.org>



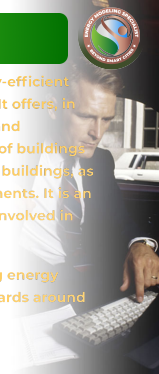
BUILDING CODES - ENERGY COMPONENT

- ✓ Most states in the US use the ASHRAE 90 standard as the basis for the energy component of their building codes.
- ASHRAE = American Society of Heating, Refrigerating, and Air Conditioning Engineering
- ✓ ASHRAE 90.1 for commercial buildings
- ✓ ASHRAE 90.2 for residential buildings
Some states have quite comprehensive building codes (e.g. Building Energy Efficiency Standards - Title 24)



ABOUT STANDARD 90.1-2019

- ✓ This standard provides the minimum requirements for energy-efficient design of most buildings, except low-rise residential buildings. It offers, in detail, the minimum energy-efficient requirements for design and construction of new buildings and their systems, new portions of buildings and their systems, and new systems and equipment in existing buildings as well as criteria for determining compliance with these requirements. It is an indispensable reference for engineers and other professionals involved in design of buildings and building systems.
- ✓ Standard 90.1 has been a benchmark for commercial building energy codes in the United States and a key basis for codes and standards around the world for more than 35 years.



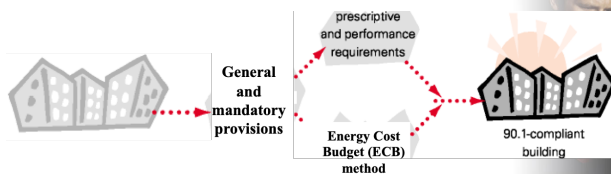
ANSI/ASHRAE/IES STANDARD 90.1-2019

- ✓ Requires minimum performance measures for energy efficiency of equipment.
- ✓ New commissioning requirements in accordance with ASHRAE/IES Standard 202
- ✓ Requires minimum lighting levels in Lux; and in W per square metre. Co-sponsor of 90.1 is IESNA – the lighting professionals.
- ✓ Requires lighting performance measures and operation. Requires lighting controls.
- ✓ Prescriptive thermal requirements.
- ✓ Energy Cost Budget (ECB) Method (Section 11)
- ✓ New simplified method for lighting for contractors and designers of renovated office buildings and retail buildings up to 25,000 ft² (2300 m²).

ENERGY COST BUDGET METHOD

- ✓ The ECB method permits tradeoffs between building systems (lighting and fenestration, for example) if the annual energy cost estimated for the proposed design does not exceed the annual energy cost of a base design that fulfills the prescriptive requirements.
- ✓ Using the ECB approach requires simulation software that can analyze energy consumption in buildings and model the energy features in the proposed design.
- ✓ Standard 90.1 sets minimum requirements for the simulation software; suitable programs include Energy Plus, Equest, DOE-2, and TRACE.

ASHRAE 90.1 COMPLIANCE



ANSI/ASHRAE STANDARD 62.1-2019



Standard 62.1 has been fully revised for the first time since 2004 to include three procedures for ventilation design: the IAQ Procedure, the Ventilation Rate Procedure, and the Natural Ventilation Procedure. 62.2 New technology and the latest research ensure that the information in the standard is means of achieving this goal have evolved.

- ✓ Example for offices in a commercial office building (VRP) Prescriptive -- 10 LPS outside air per person Performance -- Measure CO₂ in return ducts of zone and keep CO₂ less than 1000 PPM. This is also called Demand Control Ventilation, or DCV. Requires sensors, control system, and active damper. Actually 700 ppm above ambient (300 – 350 ppm)

SIGNIFICANT PARTS OF ASHRAE.62.1



- ✓ Ventilation for Acceptable Indoor Air Quality
- ✓ The scope is changed to remove commentary and to more specifically identify occupancies previously not covered.
- ✓ The Ventilation Rate Procedure is modified with a new simplified version for determining E_v and a more robust option for determining values of E_z .
- ✓ The Natural Ventilation Procedure is significantly modified to provide a more accurate calculation methodology and also define the process for designing an engineered system.
- ✓ Natural ventilation now requires considering the quality of the outdoor air and interaction of the outdoor air with mechanically cooled spaces.
- ✓ Example for offices in a commercial office building (VRP) Prescriptive 10 LPS outside air per person Performance Measure CO₂ in return ducts of zone and keep CO₂ less than 1000 PPM. This is also called Demand Control Ventilation, or DCV. Requires sensors, control system, and active damper. Actually 700 ppm above ambient (300 – 350 ppm)

BEYOND
SMART CITIES



THANK YOU

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MARKETPLACE**