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BUILDING ENERGY SIMULATION ANALYST - BESA OVERVIEW

**ONLINE PROFESSIONAL COURSES LED BY THE
WORLD'S TOP SPECIALISTS**

ONLINE TRAINING BY KRISHNAJI PAWAR

LEED AP(BD+C), GSAS CGP, GCP, ISO 14001

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MODULE

3

Establishing the Energy Model Scope

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BUILDING ENERGY SIMULATION ANALYST - BESA OVERVIEW

In a data-driven world, architects often react more intuitively to graphically presented information. Design simulation software provides project-specific feedback, allowing architects to understand energy use effects and develop intuition about daylighting, solar energy, and massing, improving their practice in high-performance architecture.

Learning Objectives

- Introduction
- Getting Started with BEM
- **Establishing the Model Scope**
- Building Energy Modeling Tools
- LEED, Commissioning, & Energy Conservation
- Benefits of Building Energy Modeling
- Certification for energy modeling specialists
- Summary and Resources
- Building Energy Simulation Analyst - BESA Practice Test V.4.1



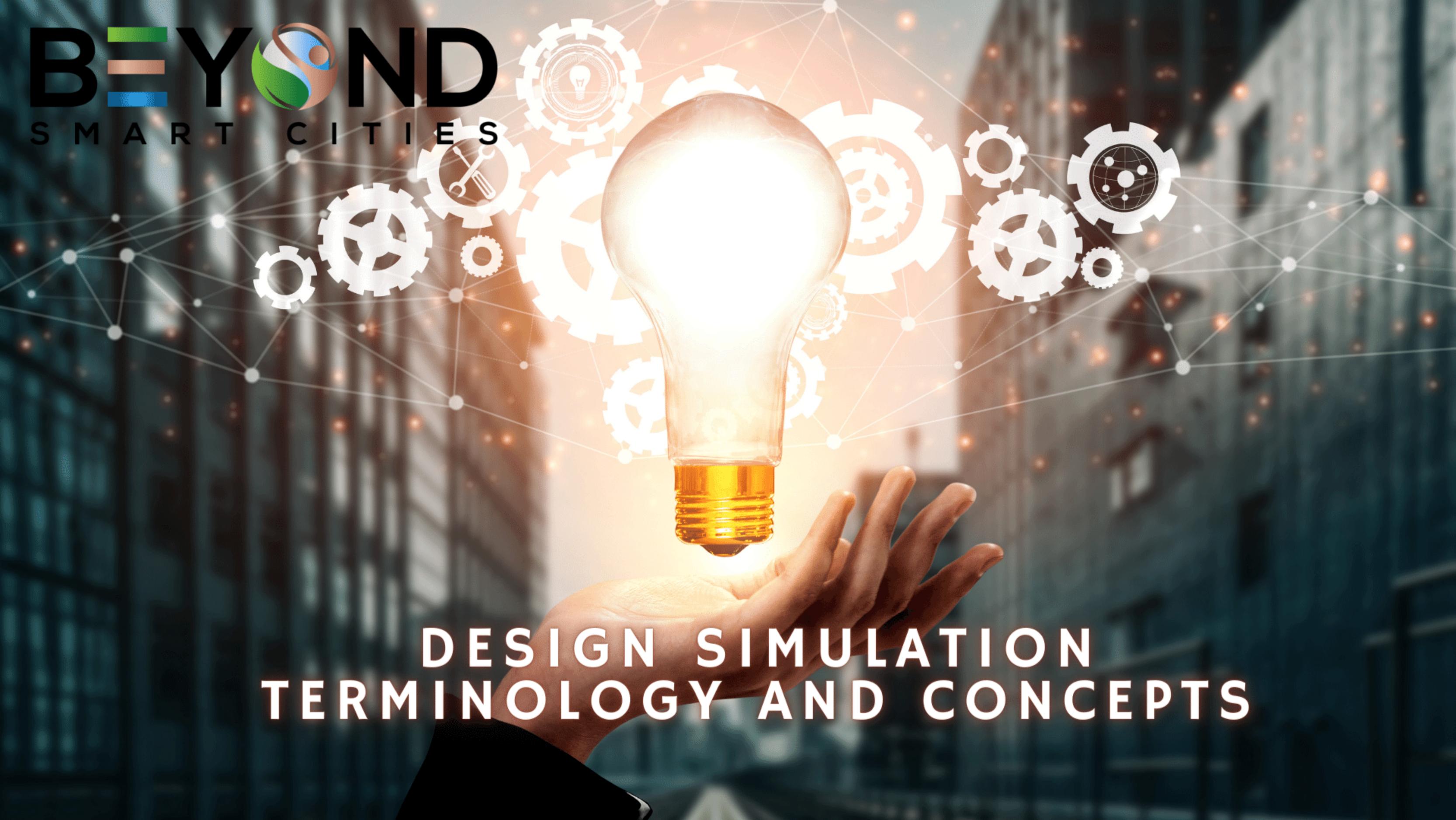
INTRODUCTION

- Architects' intuitive nature allows them to react more naturally to graphically presented information.
- Design simulation software provides project-specific feedback, allowing architects to integrate it into the design process.
- Design simulation helps architects understand the effects of their design moves on energy use.
- Architects can develop intuition about daylighting, solar energy, massing, and other factors, improving their practice of high-performance architecture.
- Simulations provide immediate feedback about the consequences of design decisions, validating and honing an individual's intuition regarding the effects of design moves on energy use.

DESIGN SIMULATION IN ENGINEERING/ARCHITECTURE: ENHANCING INTUITION AND UNDERSTANDING



- Real-time, iterative software can teach the intuitive nature of designers easier than memorization of charts and equations.
- Architects can re-engage in design simulation, re-learning how to achieve performance through passive design.
- Architects who learn to simulate can understand and design for energy performance, facilitating a more integrated decision-making process.

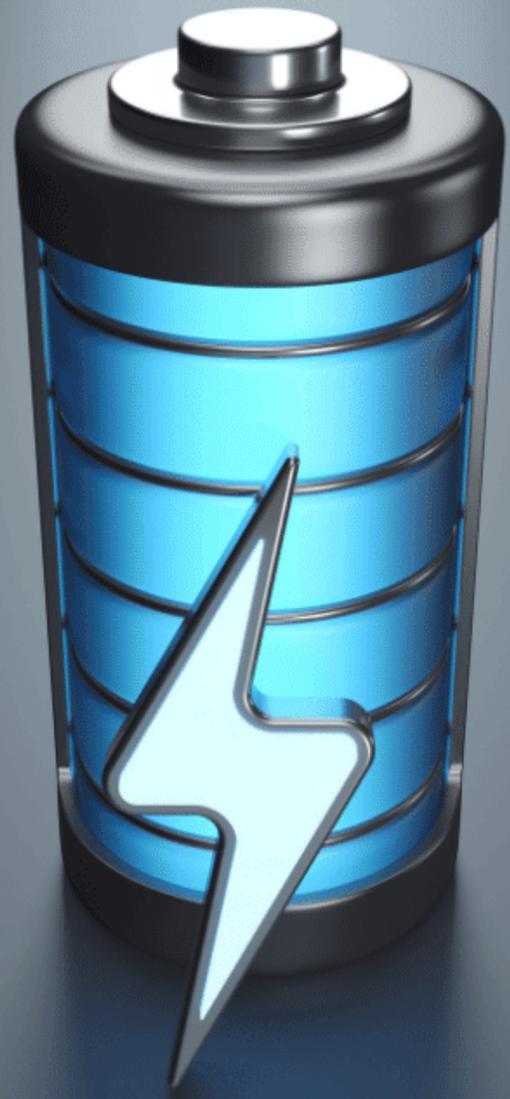
A hand holding a glowing lightbulb, symbolizing an idea or innovation. The lightbulb is surrounded by several white gears of various sizes, some of which contain icons like a lightbulb, a wrench and pencil, and a globe. The background is a blurred cityscape with a network of white lines and dots connecting various points, suggesting a smart city or digital infrastructure.

**DESIGN SIMULATION
TERMINOLOGY AND CONCEPTS**

BASELINE OPTIONS AND PERFORMANCE IMPROVEMENT

- Baseline options are often compared against design options to determine performance improvement.
- Baseline selection can be arbitrary and based on research.
- The baseline building energy use is unique to every design, leading to misunderstandings about a building's modeled and actual energy performance.





POINT-IN-TIME (PIT) ANALYSIS



- PIT analyses focus on a single moment in time, useful for peak heating and cooling loads, thermal comfort, and glare.
- It can be run quickly and with high accuracy, but requires conducting numerous analyses to identify trends over time.
- The accuracy of a simulation is partly dependent on the number of sequential iterations that a user runs.

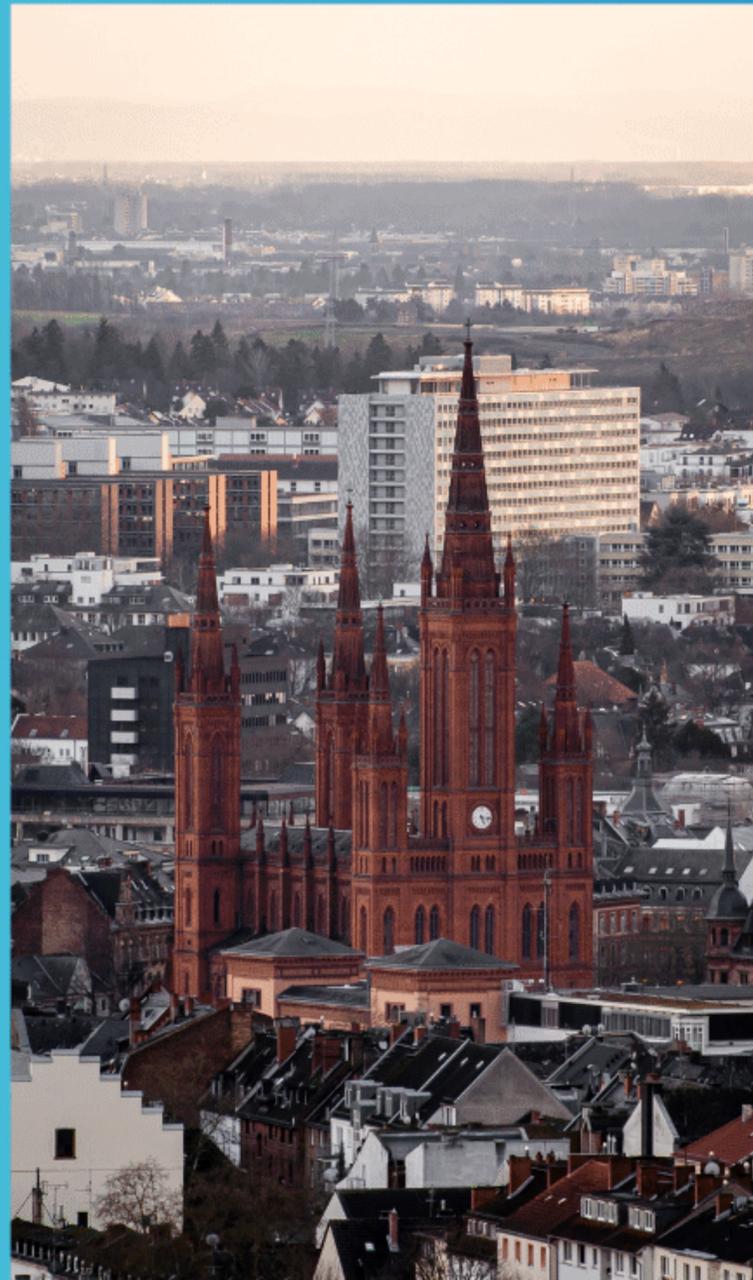
LEVEL OF DETAIL IN DESIGN SIMULATION

- Determining the right level of geometric detail for each analysis is a trickiest aspect of design simulation.
- Parameters such as glazing property, wall covering color, or schedule of people will be in the building are entered as inputs.
- Parametric software allows users to dynamically change inputs that affect the model's geometry or properties.





BOUNDARY CONDITIONS IN DESIGN SIMULATION



- Boundary conditions are assigned to create the outer 'edges' of a simulation, constraining the simulation's geometric scope and run-time.
- Physical daylighting models incorporate light sensors at specific locations, while computer simulations use digital sensor points.
- Many analyses use false colors to graphically convey levels of solar energy, light, heat, or other results.

WHOLE BUILDING ENERGY SIMULATION (WBES)

- WBES considers nearly all energy-related aspects of an entire building, often taking two weeks or more to set up, calibrate, and present results back to the team.
- Despite its benefits, geometric options are costly to study and often run once or twice towards the end of a project as a compliance tool for energy codes and LEED points.





SHOEBOX ANALYSIS OVERVIEW

- Similar to WBES, shoebox analyses use averaged data to account for mechanical systems.
- Boundary conditions limit geometric size and simulation scope.
- Uses imaginary walls through which no energy passes (adiabatic) to focus on façades with most heat transfer.
- Models are usually automated, with hundreds of inputs including reasonable default settings.
- Software allows customization of inputs, allowing architects to model specific aspects.



SHOEBOX ANALYSIS OVERVIEW +

- Example: A shoebox model of a hotel room may have defaults for Lighting Power Density, Occupancy, HVAC system.
- Allows for accurate modeling of specific hotel room's geometry, climate, and orientation.



ARCHITECTS' ROLE IN ENERGY USE

- Dependence on engineers and energy analysts hinders understanding of building design's impact on energy use.
- Integration of design team and software can facilitate design simulation, promoting passive design.
- Simulated design can enhance understanding and design for energy performance.
- Improved communication with engineers and energy analysts facilitates integrated decision-making for low-energy goals.



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.



STANDARDS ORGANIZATIONS AND CODE ORGANIZATIONS

American Society of Heating and Air-
Conditioning Engineers (ASHRAE)

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>



AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR- CONDITIONING ENGINEERS (ASHRAE)

Guidelines

- ASHRAE Guideline 14-2014 - Measurement of Energy and Demand Savings
- ASHRAE Guideline 36-2021 - High-Performance Sequences of Operation for HVAC System

Resources from Other Organizations

- Heat and Mass Transfer in Building Services Design
- IESNA Lighting Handbook
- Mechanical and Electrical Equipment for Buildings
- Solar Radiation and Daylight Models



WHAT IS A GREEN BUILDING RATING SYSTEM?

A Quantitative System to evaluate and measure the environmental impact of a building on the environment.

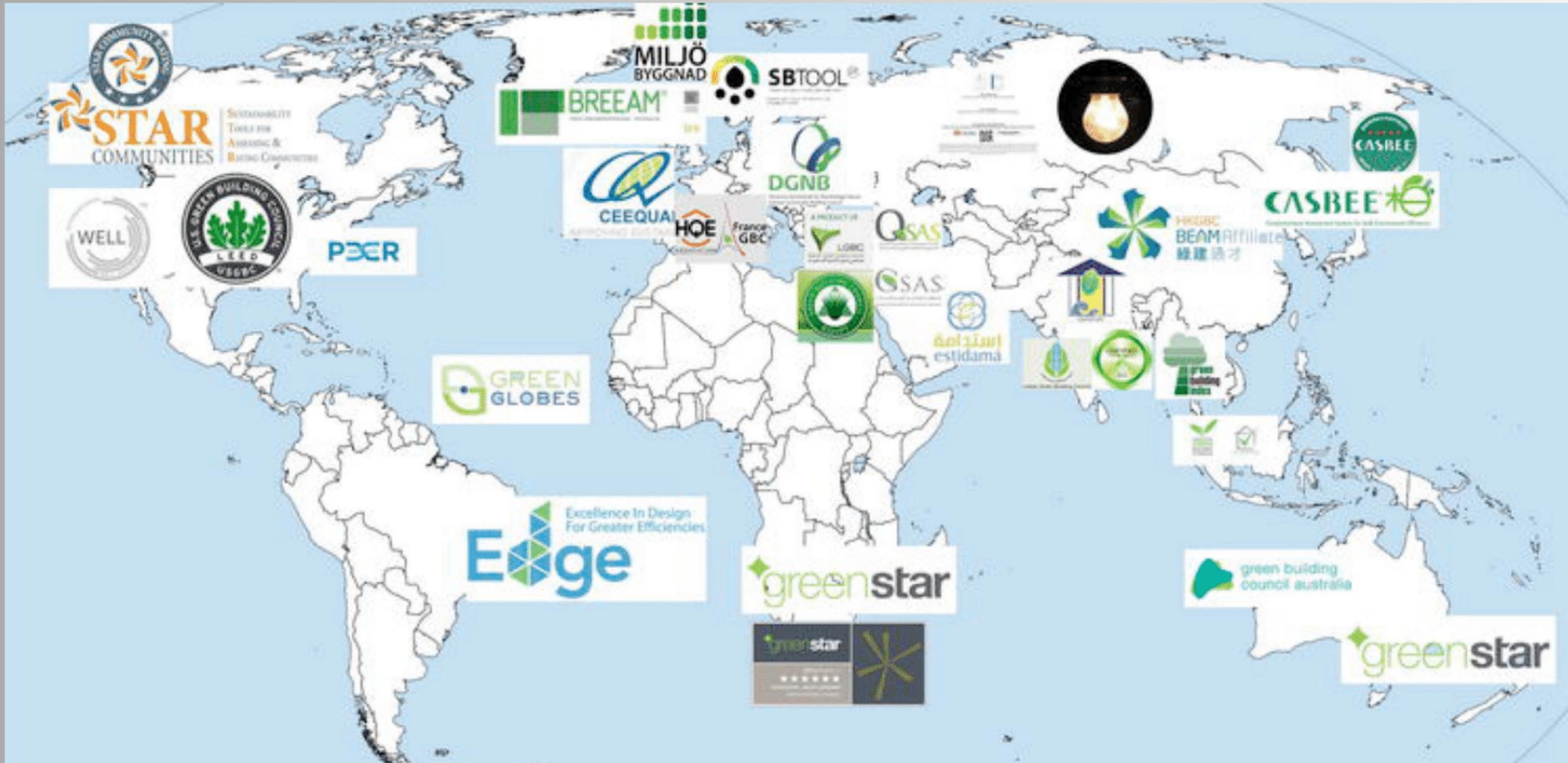
- Site
- Water
- Materials
- Energy
- Indoor Environment

It evaluates the “whole building”

The Most Widely Used Rating System is LEED



GREEN BUILDING RATING SYSTEM



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THANK YOU

