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HIGH-PERFORMANCE BUILDING DESIGN PROFESSIONAL - HBDP EXAM REFRESHER

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ONLINE TRAINING BY KRISHNAJI PAWAR

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

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MODULE
11

Energy Analysis: Initial Assessment

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Energy analysis is a crucial process for optimizing energy usage in a system or process. It involves gathering data on energy consumption and production, identifying key energy sources and sinks, and evaluating energy efficiency opportunities. Data can be obtained through utility bills, equipment specifications, and on-site measurements.

Learning Objectives +

- Energy Analysis: Envelope, Massing, and Orientation Optimization
- **Energy Analysis: Initial Assessment**
- Energy Analysis: Ventilation
- Energy compliance modeling
- Indoor and Site Environment: Thermal Comfort
- Indoor and site environments: air quality
- Indoor and Site Environment: Lighting
- Controls and monitoring: Control Hardware
- Controls and Monitoring: Control Strategies

ENERGY ANALYSIS: INITIAL ASSESSMENT

Data Gathering:

- Gathering data on energy consumption and production.
- Gathering information on energy inputs and outputs.
- Data can be obtained through utility bills, equipment specifications, and on-site measurements.

Identifying Energy Sources and Sinks:

- Identifying key energy sources and sinks within the system.
- Understanding where energy is coming from and going is essential for identifying potential energy efficiency improvements.

ENERGY ANALYSIS: INITIAL ASSESSMENT

Evaluating Energy Efficiency Opportunities:

- Analyzing energy flows within the system and identifying areas of energy waste.
- Common energy efficiency opportunities include upgrading equipment, improving insulation, optimizing processes, and implementing energy management strategies.
- Reducing energy usage can lead to cost savings and environmental benefits.





DETERMINE THE FACILITY PARAMETERS FOR THE INITIAL ASSESSMENT ENERGY ANALYSIS.



- Determining facility parameters is crucial for accurate energy usage assessment and potential energy savings.
- The size of the facility, including square footage and additional structures, directly impacts energy usage.
- The type of building and its use, such as commercial, industrial, or residential, affects energy usage patterns.
- Age and condition of the facility are important to identify areas for energy efficiency improvements.
- Climate, building envelope, HVAC system, lighting, and other energy-consuming systems also play a role in determining energy usage.
- In hot climates, energy efficiency measures can focus on reducing cooling costs.
- In conclusion, a comprehensive understanding of the facility's energy profile can be developed by considering these parameters.

PRELIMINARY BUILDING LOADS CALCULATION IN ENERGY ANALYSIS

- Building loads refer to the amount of heating and cooling energy needed to maintain a comfortable indoor environment.
- Factors influencing these loads include building size, orientation, insulation, windows, and occupancy.
- Manual J calculation is a common method for calculating preliminary building loads, considering the building's envelope, internal heat gains, and ventilation requirements.
- Accurate calculations help determine the appropriate HVAC system size and capacity to minimize energy consumption.
- Other tools and software programs can provide more detailed results, considering factors like occupancy schedules, equipment loads, and climate data.
- Accurate calculations lead to energy savings and improved comfort for occupants.



EVALUATING ALTERNATIVE SYSTEM CONCEPTS IN SYSTEM EVALUATION



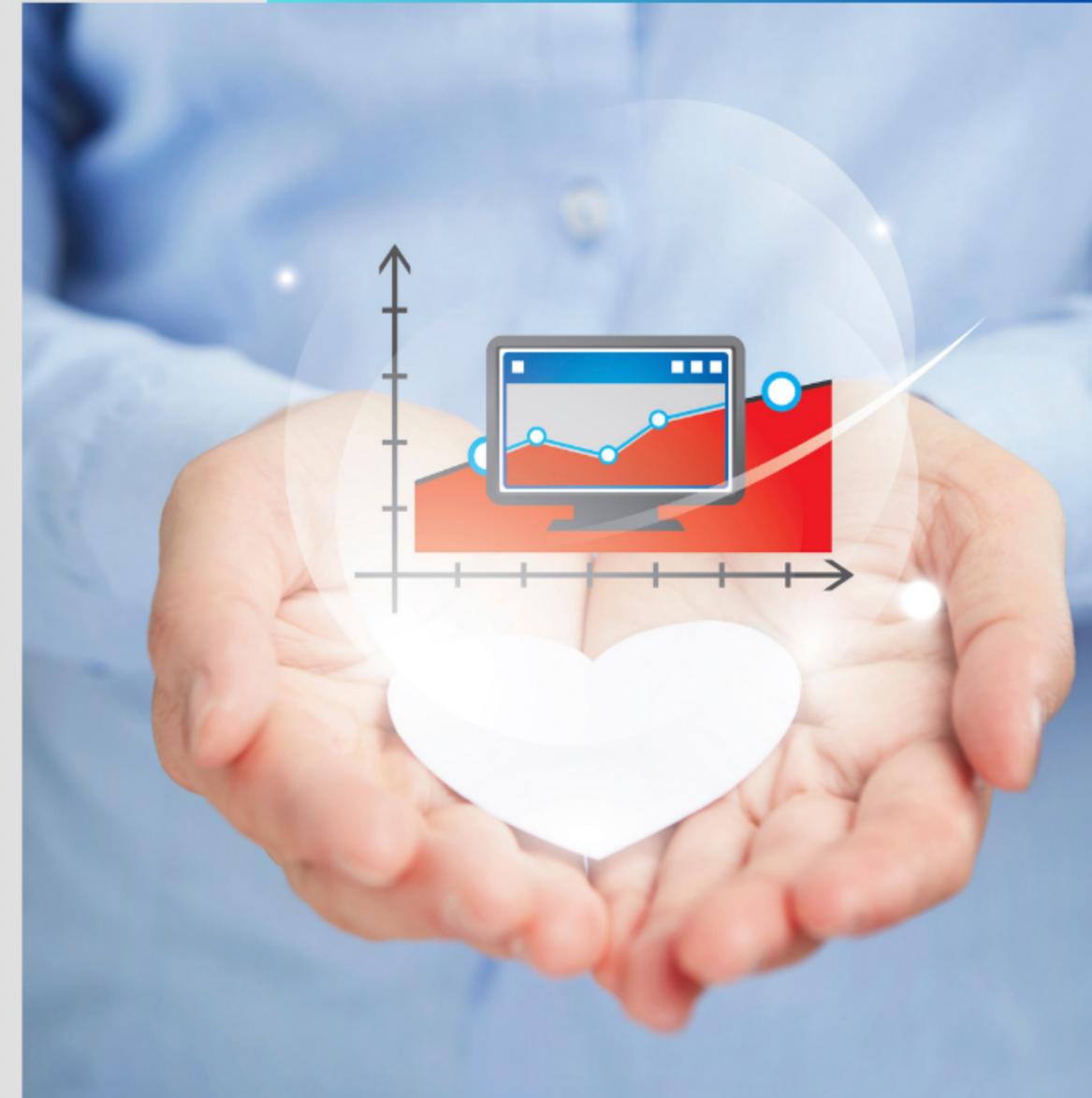
- Evaluating different methods, technologies, and approaches to minimize energy consumption and maximize performance.
- Comparing the process of choosing a mode of transportation with the consideration of energy efficiency, reliability, scalability, and environmental impact.

For example, in designing a heating and cooling system, engineers may consider traditional HVAC, geothermal heat pump, or solar thermal systems.

- Each concept has unique characteristics and benefits, allowing engineers to choose the system that best meets the building's specific needs while minimizing energy consumption and operating costs.

ENERGY ANALYSIS AND SYNERGY ANALYSIS

- Initial energy analysis involves identifying interrelated processes to understand energy consumption relationships.
- Interrelated processes include stages and components contributing to energy consumption.
- Mapping these relationships helps identify areas for energy efficiency improvement.
- Synergy analysis assesses how these processes can work together to maximize energy savings.
- Opportunities for waste reduction and efficiency improvement are identified.
- Incorporating energy-efficient HVAC systems can reduce costs and offset energy consumption.
- This approach can lead to significant energy savings and environmental benefits.
- A systematic approach to energy analysis can uncover innovative solutions to reduce energy costs and minimize environmental impact.



DURING THE INITIAL ENERGY ANALYSIS, ANALYZE ENERGY CONSUMPTION FOR VARIOUS OPTIONS



- Energy modeling is a computational tool used to simulate energy performance of a building based on design parameters.
- It allows designers to predict energy consumption under different scenarios.
- For instance, a designer can simulate energy consumption of two different HVAC systems for a commercial building.
- Energy modeling also allows exploration of the impact of design strategies like incorporating renewable energy sources or improving building envelope insulation.
- It helps optimize the building's energy performance and identify effective strategies to reduce energy consumption.
- Energy modeling provides quantitative data for informed decisions prioritizing energy efficiency and sustainability.

DURING THE INITIAL ENERGY ANALYSIS, COMPARE ALTERNATIVE SYSTEMS

- Essential to compare alternative systems to determine the most efficient and cost-effective option.
- Conducting a life cycle cost analysis considers both the initial cost of installing and long-term operating and maintenance costs.
- For example, a traditional gas furnace may be lower initially but may be more cost-effective over time due to higher operating costs and potential price fluctuations.
- Energy efficiency is another crucial factor to consider. Systems with higher efficiency consume less energy and produce fewer greenhouse gas emissions.
- For example, LED lighting is more energy-efficient and can result in significant energy savings over time.
- In conclusion, comparing alternative energy systems is crucial for making informed decisions that meet both energy needs and sustainability goals.

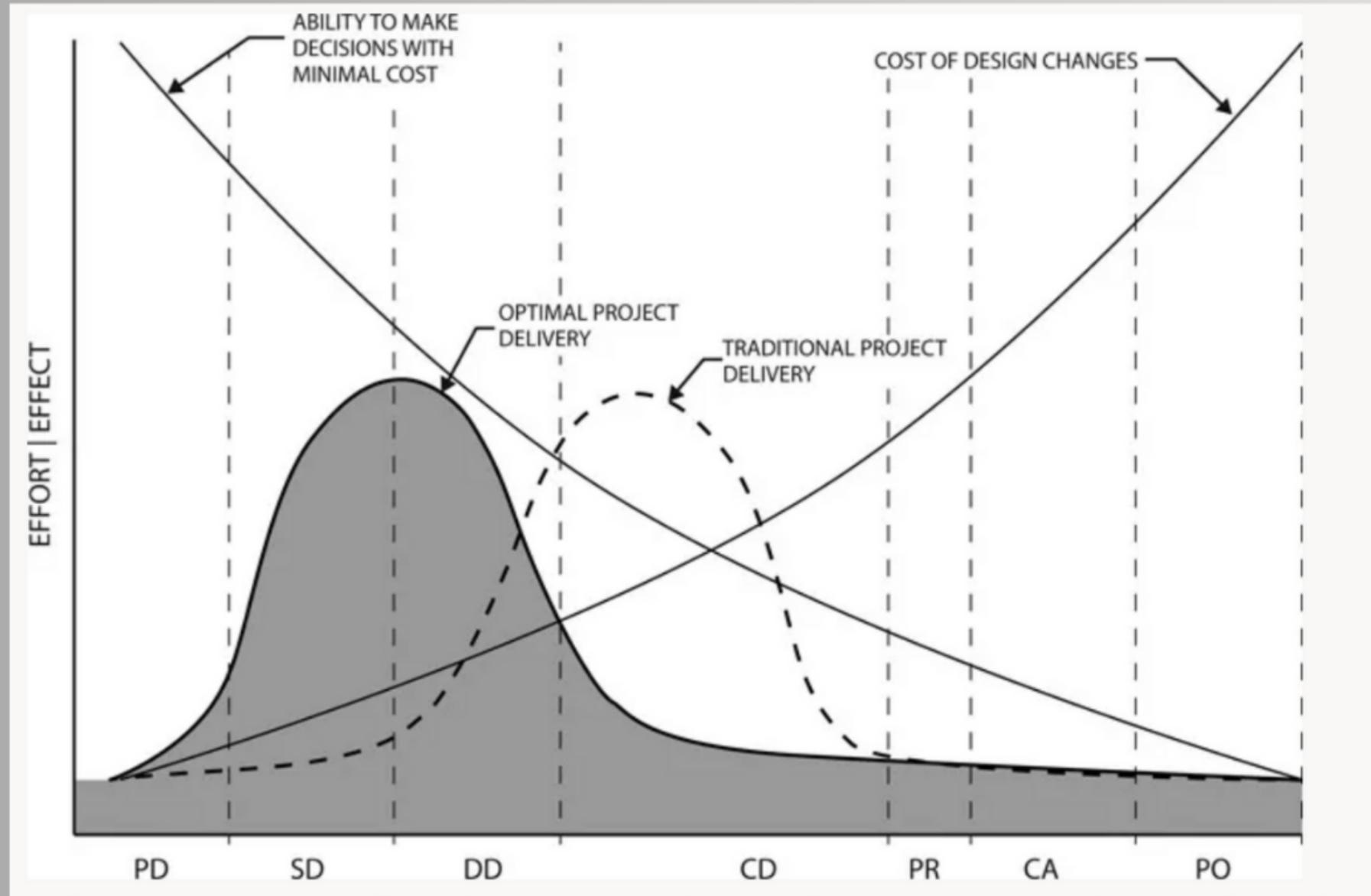


BEM DESIGN PROCESS

- Climate and building geometry are crucial in early architectural evaluation.
- BEM is used in four key phases: pre-design (PD), schematic design (SD), design development (DD), and construction documentation (CD).
- The AIA's 2012 design process uses BEM in each phase.
- Grinberg and Rendek outline 12 information categories for energy modeling throughout the building design process.
- The AIA's activities and phases align with the design process defined in its Handbook for Professional Practice.
- BEM can evaluate siting, orientation, envelope construction, passive strategies, and others in the PD phase, enabling architects to confidently select key alternatives during SD.



BEM DESIGN PROCESS OVERVIEW



MacLeamy's optimal project delivery curve.

Design phase

Concept (pre-design)

AIA recommendations

Siting

Orientation

Envelope construction

Daylighting

Passive strategies

Reduce loads

Schematic design

Rough baseline

Test energy-efficiency measures

Set up thermal zones

HVAC options

Design development

System alternatives

Refine models

Baseline vs. alternatives

Specific products

Control strategies

Quality control

Construction documents

Final design model

Quality control check

Final results

Submit for code compliance





BEM IN ARCHITECTURAL DESIGN

- BEM settings may not need modification before simulation.
- Software defaults are used, determined by some BEM tools using code defaults or common practices.
- Running simulations using defaults can provide a starting point for design efforts.
- Moving from default settings is crucial for diagnosing and analyzing energy use.
- BEM tools should be able to evaluate designs with minimal information and allow finer inputs later.
- There are no perfect BEM tools, but some programs and workflows have proven effective.
- Understanding BEM design decisions requires careful attention to the starting point.
- Two common BEM developments are a baseline and a goal-setting model.



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THANK YOU

