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LEED GREEN ASSOCIATE EXAM
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ONLINE TRAINING BY KRISHNAJI PAWAR
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MODULE 12

Energy and Atmosphere

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LEED GREEN ASSOCIATE EXAM REFRESHER

This chapter discusses strategies and technologies to address energy use and consumption in the Energy and Atmosphere (EA) category of LEED rating systems. Fossil fuels, such as oil, coal, and natural gas, are the primary energy sources globally, with limited renewable resources and harmful environmental impacts.

Learning Objectives +

- Water efficiency
- Energy and Atmosphere
- Materials and Resources
- Indoor Environmental Quality
- Innovation and Regional Priority
- Project Surroundings and Public Outreach
- Summary and Resources
- LEED GA : Practice test

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INTRODUCTION +

- The International Energy Agency identifies oil, coal, and natural gas as the primary energy sources, which are not renewable, limited, and have harmful environmental impacts.
- The burning of coal releases harmful pollutants and greenhouse gases, contributing to global warming and climate change.
- The built environment consumes a significant portion of energy, necessitating the exploration of alternative energy sources.
- LEED rating systems emphasize the EA category to reduce electrical consumption and COg emissions of certified buildings.
- The EA category includes four prerequisites to set minimum performance requirements, requiring projects to reduce demand at a minimum level.

PREREQUISITE

- Fundamental Commissioning and Verification
- Minimum Energy Performance
- Building-Level Energy Metering
- Fundamental Refrigerant Management



COMMISSIONING PROCESS





- New building must be commissioned by a commissioning agent (CA).
- Commissioning verifies and documents that a building and its systems meet the owner's project requirements.
- The OPR, developed early in the design process, includes environmental goals and is issued to the design team.
- The CxA reviews design drawings and specifications to avoid design flaws and ensure environmental goals are included.
- The CxA ensures the installation, calibration, and performance of building system equipment during construction.
- The CxA educates facility management teams on operation and maintenance strategies before occupancy.
- Within a year after occupancy, the CxA returns to the site to ensure system functionality and necessary adjustments.

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LEED RATING SYSTEMS AND ENERGY PERFORMANCE



- LEED rating systems require buildings to meet a minimum energy standard.
- The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 90.1-2010 is used to determine the minimum energy performance requirement for buildings seeking LEED certification.
- The integrative design process is critical in all LEED categories, especially when evaluating energy use.
- Energy performance, demands, and requirements are affected by site conditions, building orientation, water requirements, roof design, and building envelope thermal performance.
- Site conditions like heat island reduction can reduce energy demand.
- Building equipment and fixtures should be sized appropriately and efficiently to reduce energy demand.

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LEED RATING SYSTEMS AND ENERGY PERFORMANCE +

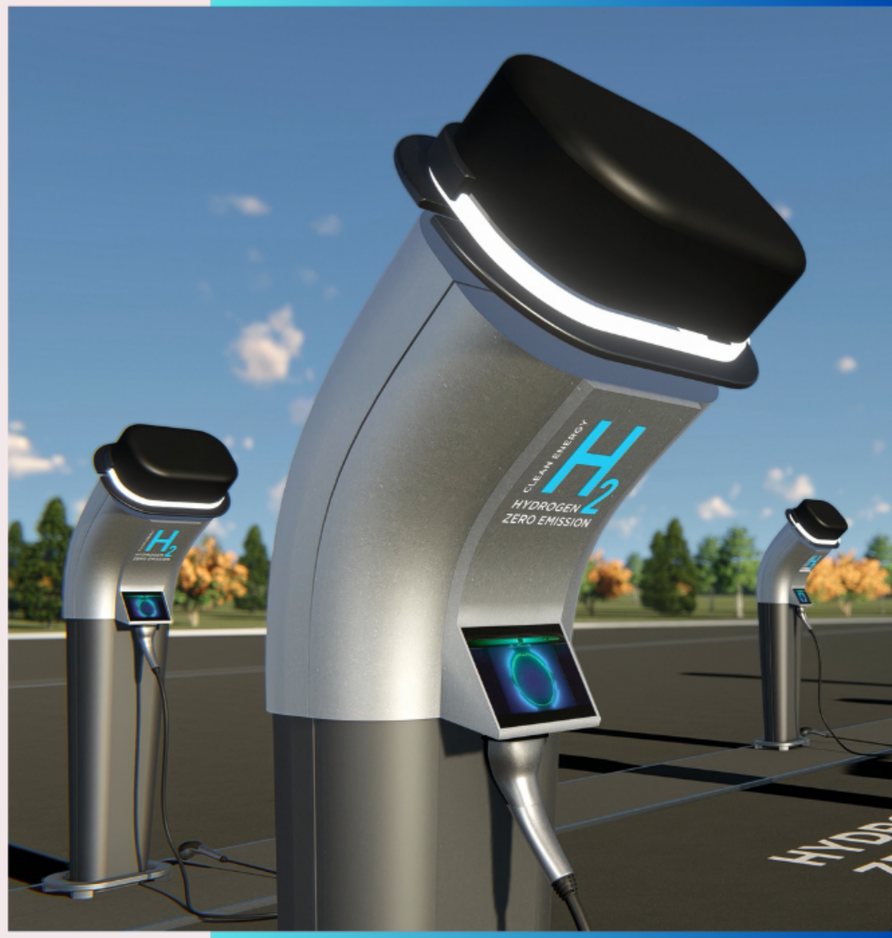


- Optimizing lighting power density through different fixture types and lamps/bulbs.
- Generating onsite renewable energy to reduce energy consumption from municipal grid.
- Commissioning buildings to ensure consistent and minimal energy demands.
- Educating occupants and operations on building performance, environmental goals, and performance monitoring tools.

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MINIMUM ENERGY PERFORMANCE

- Aims to reduce environmental and economic harms from excessive energy use and greenhouse gas emissions.
- Requires compliance with ANSI/ASHRAE/IESNA Standard 90.1–2016, with errata or a USGBC-approved equivalent standard.
- Compliance pathways include mandatory provisions, prescriptive provisions of Sections 5 through 10, and the Normative Appendix G Performance Rating Method.
- Exceptions to mandatory measures include modeling the Proposed Building Performance in lieu of compliance with mandatory provisions.
- Exceptional calculations modeled in accordance with Section G2.5 can be used to document minimum prerequisite compliance.
- Only on-site or on-campus renewable energy that meets ASHRAE Standard 90.1-2016 Section G 2.4.1 requirements can meet performance requirements.





ENERGY MODELING IN BUILDING DESIGN



- Energy modeling is a computer-based tool used to review building design strategies.
- It predicts energy savings of a proposed building against a baseline building.
- It's a valuable tool in the Integrated Design Process (IDP) as it simulates energy use of a building throughout a year.
- It evaluates the energy performance of different materials, construction types, and mechanical and electrical system options.
- The process involves creating an energy model early in the design phase, developing a baseline building, creating and analyzing Energy Conservation Measures (ECMs), and determining the energy performance of the proposed design option against the baseline.

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ENERGY SIMULATION MODELS: PROCESS VS REGULATED ENERGY

- Project teams should differentiate between regulated and process energy.
- LEED minimum energy performance criteria only cover regulated energy.
- Regulated energy uses: lighting, HVAC, and service water.
- Includes computers, office equipment, kitchen appliances, washing and drying machines, elevators, and escalators.
- Includes miscellaneous items like waterfall pumps and lighting exempt from lighting power allowance calculations.
- Essential for understanding calculations for minimum and optimized energy performance requirements in LEED Green Associate exam.





LEED REFRIGERANT MANAGEMENT



- Refrigerants are crucial in air-conditioning and refrigeration equipment, enabling thermal energy transfer.
- Despite cost-effectiveness, refrigerants contribute to ozone depletion and global warming.
- Project teams must consider the ozone-depleting potential (ODP) and global warming potential (GWP) of each refrigerant.
- The Montreal Protocol is used to determine refrigerant usage, banning chlorofluorocarbons (CFCs) and requiring the phase-out of hydrofluorocarbons (HFCs).
- Alternative refrigerants are less harmful but contribute more to greenhouse gas production.
- Alternative options are less efficient and use more energy per unit of cooling output.

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ENERGY PERFORMANCE IN EXISTING BUILDINGS

- New construction and renovation projects use ASHRAE 90.1-2016 as baseline.
- Existing buildings seeking LEED certification use EPA's ENERGY STAR Portfolio Manager.
- Portfolio Manager is a free online tool for evaluating energy use against similar buildings.





STRATEGIES TO SATISFY EA PREREQUISITES AND CREDITS



To satisfy the objectives and purposes of the EA category and contribute to the reduction of greenhouse gas emissions, project teams are recommended to concentrate on the following four elements:

1. Energy Demand
2. Energy Efficiency
3. Renewable Energy
4. Ongoing Energy Performance

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GREEN BUILDING ENERGY DEMAND STRATEGIES

- Establish design and energy goals using standards like ASHRAE 90.1 and California's Title 24, building codes like IGCC, and benchmarks like EPA's ENERGY STAR Portfolio Manager.
- Size the building appropriately to meet owner and occupant needs, avoiding unnecessary vertical or horizontal square footage.
- Use free energy by exploring natural resources early in the design process.
- Insulate with high-performance building envelopes to reduce HVAC system size, reducing energy consumption.





DEMAND RESPONSE STRATEGIES IN ELECTRICITY



- Encourages customers to reduce usage during peak demand times.
- Optimizes supply-side energy generation and delivery systems.
- Offers tiered electricity pricing and rewards commercial accounts for changing usage patterns.
- Helps avoid additional power generation facilities, transmission lines, and distribution stations.
- Reduces environmental effects of energy infrastructure and consumption.

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ENERGY EFFICIENCY IN BUILDING OPERATIONS

- Addressing energy demands is the first step in reducing energy for building operations.
- Energy efficiency aims to optimize energy use intensity, maximizing the use of a unit of energy.
- Energy use intensity is measured in British thermal units per square foot per year (kBtus/sf/yr) or kilowatt hours per square foot per year (kWh/sf/yr).
- LEED rating systems encourage addressing energy efficiency for both space heating and lighting.



ENERGY EFFICIENCY IN BUILDING OPERATIONS +

- Lighting strategies should consider fixture type and count, coordinating lamp or bulb type, and interior color schemes.
- Compact fluorescent lamps (CFLs) last longer and use less energy than conventional incandescent lamps, delivering appropriate light levels.
- Interior design decisions can stretch the efficiencies of light, potentially reducing the amount of required fixtures or lamps.





ENERGY EFFICIENCY STRATEGIES



- Address the envelope with high-performance glazing, proper insulation, and weatherization.
- Install high-performance mechanical systems and appliances, balancing up-front costs with operating costs.
- Use high-efficient infrastructure and traffic signals for long-term use, reducing energy consumption.
- Capture efficiencies of scale, like large universities or corporate campuses using district systems for thermal conditioning.
- Use energy simulation to optimize synergies and monitor performance.
- Implement building automation systems and retro-commissioning for ensuring energy efficiency.

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RENEWABLE ENERGY IN GREEN BUILDINGS

- Implementing renewable energy technologies reduces energy consumption from coal, nuclear power, oil, and natural gases.
- Reduces pollutants and emissions, improves air quality.
- Eligible renewable energy sources for LEED include solar, wind, wave, biomass, geothermal power, and low-impact hydropower.
- Green Building and LEED Core Concepts Guide outlines strategies to reduce fossil fuel use.





RENEWABLE ENERGY GENERATION AND PURCHASE



- On-site renewable energy generation: photovoltaic panels, wind turbines, geothermal, biomass, low-impact hydropower.
- Purchase of green power or renewable energy credits (REC): offsite, not associated with project site, for LEED certification.

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GREEN BUILDING ENERGY DEMAND STRATEGIES

- Commissioning new buildings and retro-commissioning existing ones allows monitoring of system demands.
- Four strategies to ensure optimal performance:

- Adhere to the OPR early in the commissioning process.
- Provide staff training on energy usage and facility operation.
- Conduct preventative maintenance to keep the building and systems efficient.
- Create incentives for occupants and tenants to achieve and exceed project goals.



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