UNIT-3 Energy and Resource conservation

1 Need for Energy Conservation:

There are several reasons why energy conservation is important and why we should make efforts to conserve energy:

1. Environmental Impact: Energy production and consumption are major contributors to environmental issues such as air pollution, climate change, and resource depletion. By conserving energy, we can reduce the demand for energy generation, which often involves burning fossil fuels and emitting greenhouse gases. Energy conservation helps to mitigate climate change and minimize the environmental impact associated with energy production.

2. Climate Change Mitigation: The excessive use of energy derived from fossil fuels releases large amounts of carbon dioxide and other greenhouse gases into the atmosphere, contributing to global warming and climate change. By conserving energy, we can reduce greenhouse gas emissions and limit the rate of global temperature rise, helping to mitigate the impacts of climate change.

3. Resource Conservation: Many sources of energy, such as fossil fuels (coal, oil, and natural gas), are finite and non-renewable. Conserving energy helps to extend the lifespan of these resources, ensuring their availability for future generations. Additionally, extracting and processing these resources can have detrimental environmental impacts, so reducing energy consumption can help minimize the need for resource extraction.

4. Energy Security: Dependence on imported energy resources can leave a country vulnerable to supply disruptions and price fluctuations. By conserving energy and diversifying energy sources, countries can enhance their energy security, reduce dependence on foreign energy, and promote domestic energy production from renewable sources.

5. Cost Savings: Energy conservation can lead to significant cost savings for individuals, households, businesses, and governments. By using energy-efficient technologies and practices, we can reduce energy bills and 6.operational costs. Energy conservation also promotes the development and adoption of energy-efficient technologies, which can stimulate economic growth and job creation.

7. Sustainable Development: Energy conservation is a crucial aspect of sustainable development. By using energy more efficiently and responsibly, we can meet our present needs without compromising the ability of future generations to meet their own needs. Energy conservation is aligned with the principles of sustainable development, promoting a balance between economic growth, social well-being, and environmental protection.

Overall, energy conservation plays a vital role in mitigating climate change, preserving natural resources, enhancing energy security, and promoting sustainable development. It is a collective responsibility that requires individual actions, policy support, technological advancements, and a shift towards cleaner and more efficient energy sources.

7 Waste to energy management in residential complexes or gated communities

Waste-to-energy management in residential complexes or gated communities is an approach that aims to convert waste materials into usable energy, such as electricity or heat. It provides an environmentally sustainable solution for waste disposal while generating energy that can be used within the community. Here are some key aspects and considerations for waste-to-energy management in such settings

1. Waste Segregation: Proper waste segregation is crucial for effective waste-to-energy management. Residents should be educated and encouraged to separate their waste into different categories, such as organic waste, recyclables, and non-recyclables. This ensures that the waste can be efficiently processed for energy recovery.

2. Biogas Generation: Organic waste, such as food scraps and garden waste, can be converted into biogas through a process called anaerobic digestion. Biogas can be used for cooking, heating, or generating electricity within the residential complex. Establishing a biogas plant on-site can be a viable option for communities with a substantial amount of organic waste.

3.Composting: Composting is another method for managing organic waste. The compost produced can be used as a nutrient-rich soil amendment for community gardens or landscaping purposes. Encouraging residents to compost their organic waste reduces the overall waste volume and enhances sustainability.

4. Waste-to-Energy Facilities: In larger residential complexes or gated communities, installing waste-to-energy facilities such as incinerators or gasification plants can be considered. These technologies convert non-recyclable waste into heat or electricity. However, such facilities require careful planning, environmental impact assessments, and compliance with local regulations to ensure proper air pollution control and ash disposal.

5. Collaboration and Partnerships: Waste-to-energy initiatives are often more successful when communities collaborate with local municipalities, waste management authorities, or private companies specializing in waste management. These partnerships can provide expertise, funding, and infrastructure support for implementing waste-to-energy projects.

6. Energy Distribution: If a waste-to-energy facility generates excess electricity, the community can explore options for distributing or selling it to the grid, thereby contributing to the local energy supply. Alternatively, the generated energy can be used to power common areas, streetlights, or shared facilities within the residential complex.

7. Monitoring and Evaluation: It is essential to establish a monitoring and evaluation system to assess the effectiveness of the waste-to-energy management approach. Tracking waste reduction, energy generation, and environmental impacts can help identify areas for improvement and optimize the system over time.

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Case studies of fully solar energy-based buildings in India

The Suzlon One Earth Corporate Headquarters campus spread over ten acres of land in Hadapsar, Pune, India. However, the place conceived with a business and practical need to bring all trade verticals and corporate services under 1 roof. That although connected to each other would be independent sufficiently to be able to act as per their respective needs and requirements.

Case Study :1 of Suzlon One Earth Corporate Headquarters

- Location: Hadapsar, Pune, India.
- Site area: 4,53,930sq. feet
- Client –Suzlon Energy Ltd.
- Principal Architect –Christopher Charles Benninger Architects
- Landscape Architects –Ravi and Varsha Gavandi
- Interior Architects –Tao Architecture and Space Matrix
- Green Building Design and Certification –Environmental Design Solution

Project Typology

The campus is a Corporate Campus. Also, the occupancy profile of the campus twenty-four by seven global shared service providers and the think-tank' for the globe across all places. However, the headquarters changed from a strategic center to a global control headquarter.

Philosophy of Suzlon One Earth Corporate Headquarters

To be a corporation that serves communities with sufferable wind power on a commercial scale with a focus. On continuously growing efficiency and reliability of wind turbines. With a philosophy that emphasizes innovation, to drive every aspect; the company has turned the dream of a greener world into a sustainable and profitable business

About site

This location surrounded by large townships and IT parks. The site rests amidst a fast-growing suburb context. The Corporate Campus developed by M/s Vascon Hadapsar Venture. The Plot Area is approximately 45,392 sq.m. The built-up area shall be approximately 70865.58 sq.m.The Campus shall also accommodate approximately 2500 Suzlon Employees.

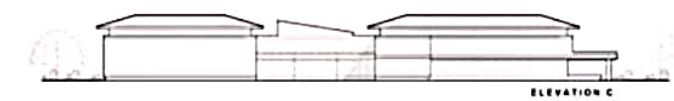
Concept of Suzlon One Earth Corporate Headquarters

- Low rise campus.
- Flexible and Adaptable.
- Functional and durable.
- Integration of inside and outside.
- A green building.
- Based on the regulations of Vaastu and even climatic reaction the building developed in such a manner.
- The southwest side of the structure put with an overload water tank and with minimum openings/windows.
- The center 'Bramhasthal' of the building is open to the sky to get enough light.
- The direction of the building is North-South direction.
- The water feature should be on the east side of the plot
- All sides of the structure have roads for better accessibility.
- The team was conscious of the reality that each of the Suzlon values should reflect and express itself in the campus design, interiors, landscape, and communication.
- The integrity seen in the campus design with connected buildings through some service elements.
- All the possible sides have peripheral routes and entry from them. (indirect access)
- The northeast part of the structure is low in elevation and has the highest openings.
- The entire plot divided into 2 parts with the corporate building placed on the eastern side and the learning center placed on the western side.

Architectural features of Suzlon One Earth Corporate Headquarters

- Suzlon One Earth derives its inspiration from big Indian historical campuses like Fatehpur Sikri and the Meenakshi Temple complex in Madurai.
- Both employ an inter-positioning of open and closed spaces that counteracts one another. Both have strong horizontal features that tie the complexes together and accent qualities that emphasize quadrants and sacred places, like the Gopura at Meenakshi.
- The Panch Mahal at Fatehpur Sikri, a multi-storied construction. That maintains its scale through the employment of modular construction, whose elements expressed, imparting the structure scale and proportions. In these recorded precedents, there are also water bodies and open courtyards, as in Suzlon One Earth.
- It is the need of the hour that architecture should borrow components of critical rationalism, with overhangs, louvers, pergolas, courtyards, water, and natural light permeation
- The design strategy started with the premise of creating a central meeting space, or Brahmasthan, with the sky as its ceiling.
- There is visible access to the big central gardens from everyplace. They act as visible connectors between all the floors.

- The Deepa Stambh, set in the middle of the Suzlon reflecting pool. The waterbody in the lineal basin links the Brahmasthal to a fountain toward the east. These auspicious elements protect the campus from unwanted influences and create a central focus and landmark. They carry very Indian elements within a very global, high-tech ambiance.
- A big water body in the central court helps in enhancing the air quality and evaporative cooling. All the exterior landscape areas brought into the indoors along the perimeter of the structure bringing fresh air, nature, and natural light into the work areas so as to improve the productivity of occupants.



3b *Construction and Operation of various Solar appliances

1. Solar Water Heater

This refers to the solar water heaters used in residential buildings and commercial buildings that have been traditionally powered by electricity being powered by solar power at present. But, it is possible only if does require certain installation processes for you to harness the solar energy to power the heater. It includes setting up thermal panels in the roof, installing a tank to store water and using other accessories such as a circulating pump and thermal regulator. The panels in the roof absorb light from the sun's rays. It is converted into heat energy. This heats up the water in the tank when it is passed into the tank by means of the circulating pump. You may gain additional benefits in the form of reduced electricity bills if the hot water is used for the washing machine and dishwasher.

2. Solar Water Pumps

The solar water pumps are used as water lifting systems that can deliver drinking water. It can also be used to meet the irrigation requirements for agricultural purposes. The process of water lifting is done by the electricity that is generated from the panels placed to harness solar energy. You can use solar pumps to extract water from borewells, rivers, pods and any other source of water. It can also be used to supply water for various purposes that are required. The solar panels that receive sunlight convert it into DC or direct current. If your motor cannot run on DC current, you may use the inverter. this would convert the DC current into AC or alternating current and this can be used to power the water pump. However, once the initial installation is done, it is easy to operate and incurs low maintenance costs too.

3. Solar Air Conditioner

Solar energy technologies have made it possible to power cooling systems effectively. You now have solar thermal hybrid air conditioners the compressors of which is powered by solar energy. Electricity is just used to operate the electric control components and to run the fans. You also have Solar PV hybrid airconditioners that are capable of switching between solar power and battery power as per the need of the hour. The solar AC is considered to be very efficient in terms of cooling as well as bringing down the expenses for electricity. Once the upfront installation costs are met, you can get ready to pay less for electricity generated from the grid. It is an environment-friendly airconditioner that emits very less carbon into the atmosphere.

4. Solar Water RO

Water purification systems are being increasingly sought out to ensure that you get pure drinking water that is free of harmful bacteria and dust particles. These systems, however, use electricity for the purification process. The solar-powered RO systems are a fine combination of best water purification technologies as well as solar technology to power them. The purification systems are powered by solar power rather than the power from the electric grid. This makes it perfect to be installed even in remote places that are off the grid-like army camps, remote villages, etc.

5.Solar phone

You need electric power to charge the batteries that power the cell phones. Samsung introduced a solar-powered cell-phone called GuruE1107 as early as 2009. The in-built solar cell in the backplate of the phone made use of solar energy to generate

electricity that was enough to charge the phone's battery. Though there haven't been any other solar cell phones in the market, you can surely expect more models in a short period of time.

6. Solar Charger

The primary purpose of the charger is to supply electricity to the batteries of products that feature chargeable batteries. A solar charger in contrast to the electricity produced from fossil fuels that are supplied by ordinary chargers supplies electricity produced from the light from the Sun's rays. You have cell phone chargers as well as multi-use solar chargers that can supply electricity for the operation of devices or charge the batteries in them. The products include drones, cameras, DSLR, laptops, tab, etc.

7. Solar Inverter

The inverter is an accessory that is used invariably with solar energy generation installations. It does the job of converting the variable DC current that is produced by means of the activation of electrons in the solar panels into usable alternating current. You might know that the battery of the inverter has to be charged to produce current when the grid current fails in the home or commercial buildings. The power for getting the battery charged is also got from the gridline current in an ordinary inverter or power inverter that you might be using. In a solar-powered inverter, the energy required to charge the battery is also received from solar energy.

8. Solar Cooker

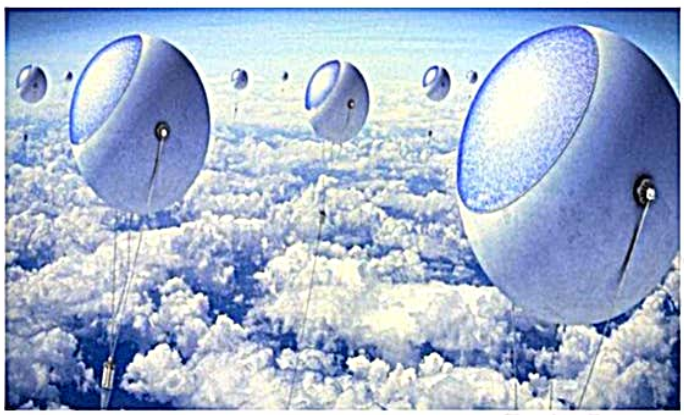
The solar cookers are used to derive heat from the sun and use it to cook food materials and pasteurize drinks. Like the number of appliances that are used for cooking like the stove, oven, etc to suit the type of cooking, you also have solar panel cookers, parabolic solar stoves, and solar ovens to suit the cooking type. But, one of the major drawbacks of using a solar cookers is that the food loses its warmth quickly.

9. Solar Street Light

As the name implies, it refers to street lights that are powered by solar energy. The solar panels are generally mounted on the lighting structures or poles erected for the lights itself. The lights can be custom made and you can have different types of street lights.

10.Solar Balloon:

The solar balloon is one of the recent developments in Solar energy technologies used for harvesting solar power. The balloons are meant to address the two problems that are usually considered in connection with solar energy like the necessity to use a battery to store energy for the night and not being able to harvest enough power when it is cloudy. The solar radiation creates heat that warms up the air inside the balloon. Since warm air would be less dense than cool air, the balloon floats higher and higher. These balloons act as solar panels deployed above the clouds and scientists estimate that the yield of energy from the ballons could be at least 3 times more than that you can produce with panels in the buildings, without having to worry about clouds too.



8b

India, with an **installed solar capacity of over 63.3 GW**, ranks as the **5th largest solar country in the world**. This achievement underscores the country's significant solar potential, as many Indian states receive **sunshine for more than 300 days a year**. Recognizing this opportunity, the Indian government has been actively introducing policies and initiatives to promote the adoption of solar energy across the nation.

Solar Potential and Government Initiatives

India's vast solar potential makes it a key player in the global renewable energy landscape. The country's favorable climate, with abundant sunlight throughout most of the year, provides an excellent foundation for expanding solar power capacity. To maximize this potential, the government is continuously launching policies that encourage individuals, businesses, and industries to switch to solar energy.

One of the key focuses of the government is to reduce reliance on imported solar equipment and build **domestic manufacturing capabilities**. By fostering a robust domestic solar industry, India aims to secure its energy future while reducing vulnerabilities in global supply chains.

Performance Linked Incentive (PLI) Scheme for Solar PV Panels

In **September 2022**, the Indian government approved the **Performance Linked Incentive (PLI) scheme** for **High-Efficiency Solar PV panels**. This scheme is a crucial part of the country's efforts to accelerate the adoption of solar energy while promoting local manufacturing. The PLI scheme is designed to incentivize enterprises that produce solar equipment domestically, encouraging them to innovate and scale up production.

By rewarding companies for sales of indigenously manufactured solar panels, this initiative directly supports the **Atmanirbhar Bharat (Self-Reliant India)** campaign. The PLI scheme not only helps strengthen the domestic solar manufacturing sector but also aims to make India a global hub for high-efficiency solar PV panels, reducing dependence on imports and bolstering energy security.

5a **Modular Waste Treatment Systems:**

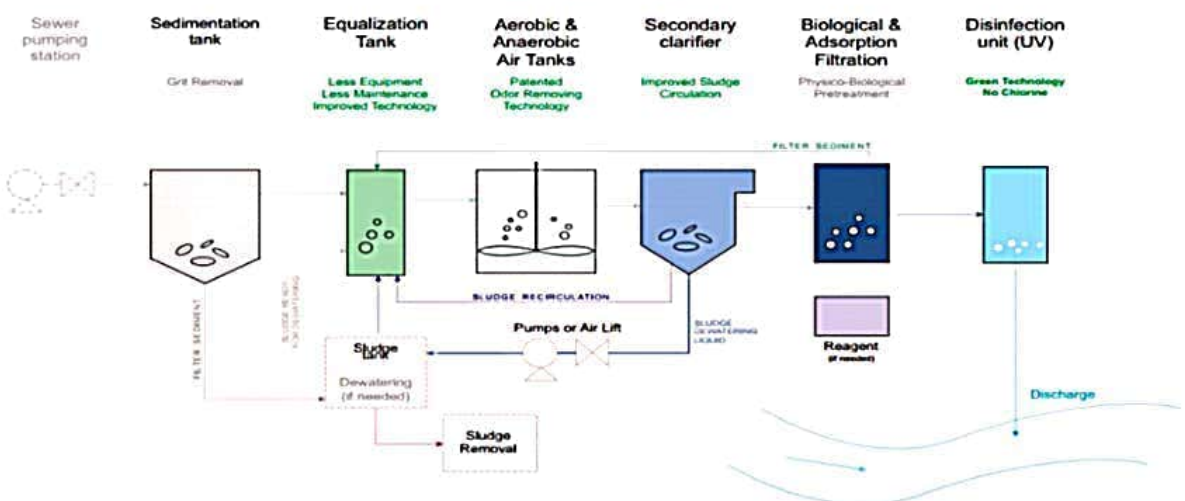
10b What is modular wastewater treatment plant?

Containerized MBR systems are designed with simplicity, flexibility and durability in mind. These containerized wastewater treatments plants provide high quality, portable treatment solutions ideal for remote and tight locations
modular wastewater treatment plants are economical, require minimal maintenance and staff, and modular construction is decreases environmental impact and budget friendly.

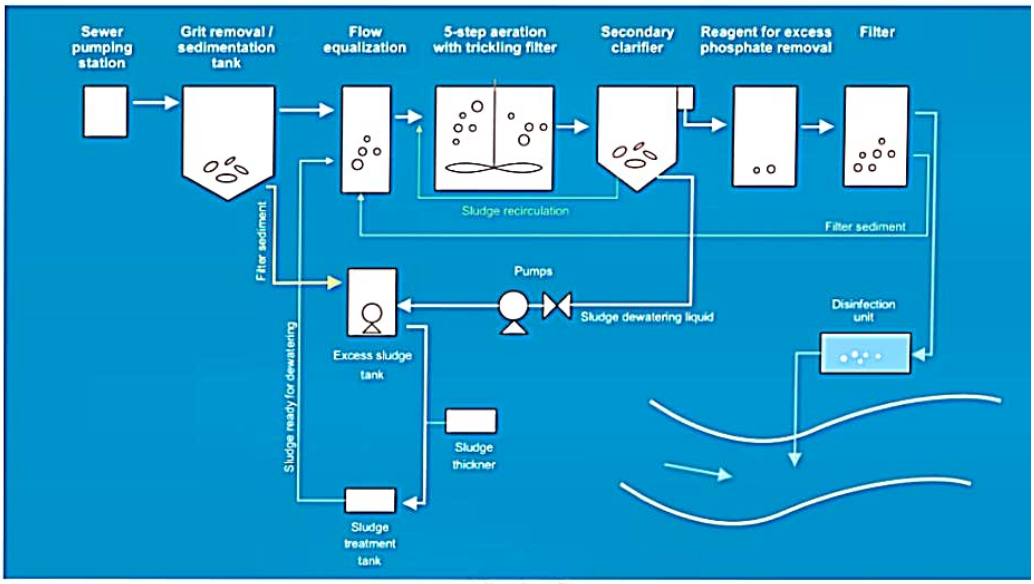
Modular waste treatment plants are quite, leak and smell proof with the capacity to expand seamlessly with the growing construction. The fairly compact nature of our wastewater treatment system gives you the ability to save on valuable real estate and comparatively low cost of maintenance and installation allows you to have room in your budget to concentrate on things you really want to spend money

- Packaged wastewater Treatment system
- Residential wastewater Treatment System
- Compact wastewater Treatment System

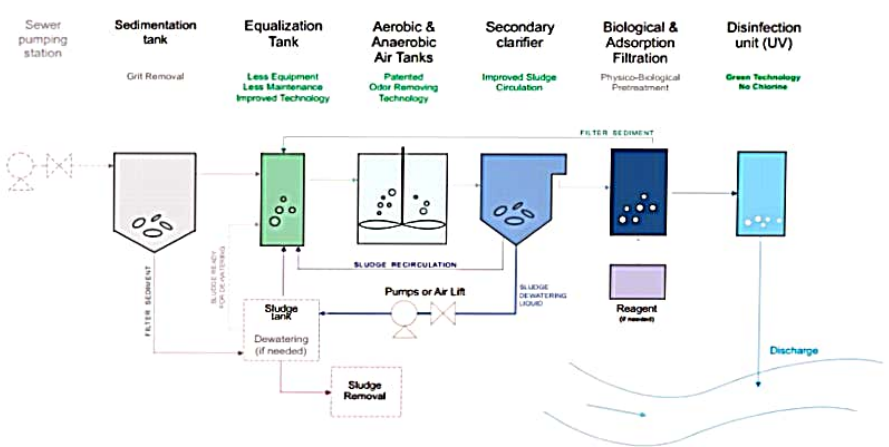
- Packaged wastewater Treatment system



- Residential wastewater Treatment System



Compact wastewater Treatment System



Green Building Rating Systems 5b

Green building rating systems are frameworks that evaluate and certify the sustainability, energy efficiency, and environmental performance of buildings. These systems guide architects, developers, and stakeholders in designing and operating buildings that have minimal environmental impact. Here's a discussion of some of the most prominent green building rating systems:

1. LEED (Leadership in Energy and Environmental Design)

- **Developed by**: U.S. Green Building Council (USGBC).
- **Global Impact**: LEED is one of the most widely used and recognized green building certification systems worldwide.
- **Key Criteria**: LEED evaluates energy efficiency, water conservation, indoor air quality, materials used, and building location. It offers certification levels ranging from **Certified** to **Platinum** based on performance.
- **Focus**: Sustainable site development, energy and water efficiency, materials selection, indoor environmental quality, and innovation.

2. BREEAM (Building Research Establishment Environmental Assessment Method)

- **Developed by**: Building Research Establishment (BRE), UK.
- **Key Criteria**: BREEAM assesses the environmental performance of buildings across categories such as energy use, health and well-being, innovation, land use, pollution, materials, transport, and waste.
- **Focus**: Primarily used in Europe, BREEAM emphasizes sustainability at both the design and operational stages of a building's life cycle.
- **Certification Levels**: Pass, Good, Very Good, Excellent, Outstanding.

3. IGBC (Indian Green Building Council)

- **Developed by**: Confederation of Indian Industry (CII).
- **Key Criteria**: The IGBC system is designed for Indian conditions and evaluates energy efficiency, water management, use of sustainable materials, indoor air quality, and site management.
- **Certification Levels**: Certified, Silver, Gold, and Platinum.
- **Focus**: Promoting sustainable practices in the Indian construction sector while considering local climate and resources.

4. GRIHA (Green Rating for Integrated Habitat Assessment)

- **Developed by**: The Energy and Resources Institute (TERI), India.
- **Key Criteria**: GRIHA evaluates buildings on energy and water efficiency, waste management, air quality, building design, and environmental impact.
- **Focus**: Primarily for Indian buildings, GRIHA emphasizes minimizing resource consumption, reducing emissions, and promoting renewable energy use.
- **Certification Levels**: Vary based on the number of points earned in areas such as sustainable site planning, energy, and material efficiency.

5. WELL Building Standard

- **Developed by**: International WELL Building Institute (IWBI), USA.
- **Key Criteria**: WELL focuses on the health and well-being of building occupants. It measures aspects like air quality, water quality, nourishment, fitness, comfort, and mental well-being.
- **Focus**: Enhancing human health and well-being through building design and operations, WELL complements traditional green building standards by prioritizing human health outcomes.

6. Green Star

- **Developed by**: Green Building Council of Australia (GBCA).
- **Key Criteria**: Green Star rates buildings across categories such as management, indoor environmental quality, energy, transport, water, materials, and land use.
- **Focus**: It is widely used in Australia and New Zealand and aims to reduce the environmental impact of buildings and enhance community well-being.
- **Certification Levels**: Four, five, or six stars based on performance.

10a

LEED Criteria (Leadership in Energy and Environmental Design)

LEED (Leadership in Energy and Environmental Design) certification evaluates buildings based on various sustainability and environmental performance criteria. Here's a concise breakdown of key LEED criteria:

1. **Sustainable Sites (SS)**:
   - Encourages responsible site selection, reducing environmental impact through efficient land use.
   - Promotes stormwater management, heat island reduction, and public transportation access to minimize carbon footprints.
2. **Water Efficiency (WE)**:
   - Focuses on reducing water usage indoors and outdoors.
   - Encourages water-efficient fixtures, drought-resistant landscaping, and systems to monitor water consumption.
3. **Energy and Atmosphere (EA)**:
   - Aims to minimize energy consumption by improving energy efficiency and utilizing renewable energy sources.
   - Points are awarded for optimizing energy performance, using eco-friendly refrigerants, and promoting renewable energy generation.
4. **Materials and Resources (MR)**:
   - Promotes the use of sustainable, recycled, and locally sourced materials.
   - Encourages construction waste management, and using sustainable products to reduce environmental impact.
5. **Indoor Environmental Quality (IEQ)**:
   - Focuses on enhancing indoor air quality, lighting, and occupant comfort.
   - Encourages proper ventilation, use of low-emitting materials, and natural lighting to improve the indoor environment for occupants.
6. **Location and Transportation (LT)**:
   - Assesses the location's connectivity to public transport and walkability.
   - Encourages bike facilities and easy access to basic services to reduce transportation emissions.