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ENERGY EFFICIENT BUILDINGS

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Abstract: This paper proposes three criteria for an energy efficient building: 1) the building must be equipped with efficient equipment and materials appropriate for the location and conditions; 2) the building must provide amenities and services appropriate to the building's intended use; and 3) The building must be operated in such a manner as to have a low energy use compared to other, similar buildings. Later on in the paper we have discussed about the elements of energy efficiency and its usefulness. The concept of ZEB (Zero Energy Building) has also been introduced and its application in India. The later part of paper specifies the World's Energy Efficient Superpower 2015 is US, which has come up with flying colors in the field of energy efficiency.

Keywords: ZEB (Zero Energy Building),World's Energy Efficient Superpower.

1. INTRODUCTION

An energy efficient building is one which uses less water, optimizes energy efficiency, conserves natural resources, generates less waste and provides healthier spaces for occupants, as compared to a conventional building. There are examples of "energy efficient" buildings in every major country. Curiously, many of these buildings have high energy consumptions when compared to other efficient buildings, or even when compared to similar, "inefficient" buildings in the same city. We have also observed traditionally designed buildings that are claimed to be energy efficient simply by installing a single efficiency device that, at best, can only affect a tiny fraction of the building's total energy use.

Designers of other buildings have claimed that their buildings are efficient simply because they meet the minimum efficiency regulations. In this paper represents the concept of "energy efficiency" and implications that it may have on regulations, economics, energy demand, and the environment. Energy efficiency plays a vital role in achieving sustainability in buildings and organizations. Energy efficiency helps in control of rising energy costs, reduces environmental destruction, and increases the value and competitiveness of buildings, appropriate energy savings solutions, and putting these ideas into practice. Sustainability is all about using the resources of today efficiently, in a manner that meets our own needs, but doesn't compromise the ability of others to meet their own needs in the future.

2. ENERGY EFFICIENCY STANDARDS

- Develop an Efficiency Strategy
- Energy Efficient Products and Technologies
- Demand Response Solutions
- Renewable Energy Services
- Efficient Water Saving Solutions

2.1 Develop an Efficiency Strategy:

An infrastructure improvement that supports triple bottom line by balancing economic, environmental and social there are various ways to improve the efficiency of any outcomes is said to be as an energy efficient building. building some organizations go after the visible first, tackling waste reduction with recycling programs. others, pursue looking for opportunities to save the most money. In some cases, a resource like water is especially scarce, and it commands first attention. Energy efficiency retrofits optimize and modernize facilities by introducing proven improvements that lower energy, operating and capital costs while simultaneously improving your indoor environments and reducing your impact on the outdoor environment.

2.2 Energy Efficient Products and Technologies:

The control systems, HVAC control products and the energy efficient equipments, helps to achieve energy efficiency goals. It also helps to reduce emissions; reduce waste, decrease water use, lower energy use, and lower operational costs without wrecking the budget with performance.

Energy efficiency solutions include:

i) Building management and control system upgrades, save up to 15%.
ii) Carbon dioxide emissions can be reduced by as much as 30% , by the use of variable speed drives and energy efficient motors.
iii) Heat pumps and more efficient air handling units deliver more savings.
iv) Under Floor Air Systems save energy.

2.3 Demand Response Solutions:

Demand response refers to temporary changes in electricity usage in response to signals from a grid operator or utility. Grid Connect technology provides easy access to energy markets, utility demand response programs and real-time energy information, enabling customers to maximize program earnings, control electricity costs and optimize energy efficiency.

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2.4 Renewable Energy Resources:

Renewable energy solutions are designed to increase energy security and independence, while reducing long-term energy costs and environmental footprint. Energy efficiency strategies include environmental friendly solutions that will not only help to reduce organization's energy costs, but also provide with the tools to reduce carbon footprint. The natural environment provides a of renewable energy sources that can be converted into usable energy for buildings or facilities. It can help to maximize energy efficiency through the use of solar, geothermal and wind power.

2.5 Efficient Water Saving Solution:

Buildings are one of the heaviest consumers of energy resources across the globe today, accounting for 40% of all energy, 68% of all electricity and 88% of all potable water consumed throughout the world. For both environmental and economic reasons, water efficiency and water conservation are an area of concern for facility managers. Water solutions can helps to reduce energy consumption up to 50% through water saving measures and operational changes. A wide range of facilities in the hospitality, public housing, healthcare, education and commercial industries can achieve conservation goals and energy efficiency through a series of adjustments. In addition, correctional facilities and other government institutions typically have many opportunities to improve energy and water efficiency.

3. ELEMENTS OF AN EFFICIENT BUILDING

Even if it is impossible to define a single indicator of building energy efficiency, it is believed that an energy-efficient building must contain elements from three categories. The building must contain energy-efficient technologies that will effectively reduce energy use. In another words, it is impossible for an energy-efficient building to be poorly insulated in a cold climate or have a low chiller in a hot climate. Thus, an office must provide around 60 hours/week of suitably conditioned air, lighting, and equipment. The building must be operated in such a manner as to be efficient. The evidence of this operation is low energy use relative to other, similar, buildings. An efficient building may not excel in all three of these aspects, but the building must offset an "average" value in one aspect with "excellent" values in the others. A very clever and attentive operator, for example, might be able to extract low energy use from an only moderately efficient physical plant.

With this kind of definition, it may be possible to establish a kind of "score" or rating system for energy efficiency. The score would be based on the scores for the three separate aspects. In principle, this approach would be flexible enough to recognize different strategies to achieve high energy efficiency. The first requirement, that is, the building must contain equipment and materials that permit it to be efficient, could be based on a simulation or design criteria. The second requirement, that is, the building must have appropriate amenities, could be assessed with an on-site audit. The efficient operating requirement could be judged either against other, similar buildings or against simulations of prototypes calibrated to that building's operating schedule, weather, and other factors. The energy associated with the construction and demolition of a building plays an increasingly important role as the operating energy declines. Thus, an energy efficient building may need a fourth element: low energy consumption for construction and demolition. This is already important in Japan because buildings are traditionally replaced after only twenty years

4. ZERO ENERGY BUILDING

An increasing number of buildings use renewable sources of energy (solar, wind, geothermal) at the building site to provide part or all of its energy needs. Then a question arises,"Are these buildings efficient, even when they use large amount of renewable energy?" The answer depends on the objective; they are energy efficient with respect to fossil fuels and CO2 emissions, but they are probably an overall waste of resources (especially money).

Recently, the concept of "zero energy buildings (ZEB)" has been promoted. On the face of it, the ZEB would appear to mean a building that relied entirely upon energy captured on site to provide all the desired amenities. But the United States Department of Energy offered the following definition: "cost-effective buildings that have zero net annual need for nonrenewable energy" This definition allows the building to be connected to the electrical grid.

5. ZERO ENERGY BUILDING IN INDIA:-

Its India's first net zero energy building that has been constructed with adoption of solar passive design and energy-efficient building materials.Speaking about the energy efficiency of the building, The Energy and Resources Institute (TERI), director Mili Majumdar said: "The Indira Paryavaran Bhavan is one of the first buildings in India to have deployed energy efficiency and renewable energy technologies at a large scale. It is one of the exemplary projects to be rated under Green Rating for Integrated Habitat Assessment [GRIHA] and has set standards that can be emulated by upcoming buildings in the region." The building boasts an earthquake-resistant structure with a total plinth area of 31,488 sq. m. It covers only 30 per cent of the total area, while more than 50 per cent area outside the building is a soft area with plantation and grass. The building has a robotic parking system in the basement that can accommodate 330 cars. Thin-client networking system has been provided instead of conventional desktop computers to minimize energy consumption."Buildings have an enormous impact on environment, human health and economy. The energy used to heat and power our buildings leads to consumption of large amounts of energy, mainly from burning of fossil fuels, oil, natural gases and coal, which generate significant amounts of carbon dioxide, the most widespread greenhouse gas. The successful adoption of green building strategies can maximize both the economic and environmental performances of buildings," added Ms. Majumdar.The building has received GRIHA 5-star (provisional) rating for the following features:

The design allows for 75 per cent of natural daylight to be utilized to reduce energy consumption.

The entire building has an access friendly design for differently-able persons.

With an installed capacity of 930 kW peak power, the building has the largest rooftop solar system among multi-storied buildings in India.

The building is fully compliant with requirements of the Energy Conservation Building Code of India (ECBC). Total energy savings of about 40 per cent have been achieved through the adoption of energy efficient chilled beam system of air-conditioning. As per this, air-conditioning is done by convection currents rather than airflow through air handling units, and chilled water is circulated right up to the diffuser points unlike the conventional systems.Green materials like fly ash bricks, regional building materials, materials with high recyclable content, high reflectance terrace tiles and rock wool insulation of outer walls have been used.Use of renewable bamboo jute composite material for doorframes and shutters was done. Its construction includes UPVC windows with hermetically sealed double glass, Calcium Silicate ceiling tiles with high recyclable content and grass paver blocks on pavements and roads. Reduction in water consumption has been achieved by use of low-discharge water fixtures, recycling of waste water through sewage treatment plant, use of plants with low water demand in landscaping, use of geothermal cooling for HVAC system, rainwater harvesting and use of curing compounds during construction.

6. ENERGY EFFICIENT SUPERPOWER (2015 WASHINGTON, D.C.)

1. U.S. electrical energy consumption is down by 6% since its peak in 2007, and every year since has shown a year-over-year reduction in per capita consumption. (Electric Power Annual Data Tables, 2012)
2. For nine straight years, projections of U.S. Building Sector energy consumption -- through the year 2030 -- have declined. (U.S. Energy Information Administration's Annual Energy Outlook 2014)
3. In spite of the progress, when compared to the world's other large economies, the US ranks #13 out of 16 when it comes to Energy Efficiency. (ACEEE 2014 International EE Scorecard)
4. People running buildings are "paying a lot more attention" to energy efficiency, with interest increasing by 116% since 2010. (Energy Efficiency Indicator Survey, 2013)
5. Families and businesses have realized estimated savings of more than $295 billion on utility bills and prevented more than 2.1 billion metric tons of greenhouse gas emissions over the past two decades. (ENERGY STAR, 2014)

7.CONCLUSION

This paper firstly showed how the strategy for creating an efficiency regulation will have an enormous impact on the energy savings. Minimizing the life cycle cost of building or appliance typically results in much greater savings than by eliminating the units with the worst performance, or even exceeding the performance of the best unit presently available. Buildings are more complicated than appliances because their design involves many more energy trade-offs. For buildings, no single indicator of efficiency is likely to give a fair ranking. Indeed, rankings of efficiency are likely to fluctuate depending on the indicator chosen. There is no single correct indicator of efficiency, but it's important to recognize the bias that may result when using just one. Even with these limitations, it is still possible to identify some characteristics of an efficient building. It defined three basic criteria for an energy efficient building: 1) the building must be equipped with efficient equipment and materials appropriate for the location and conditions; 2) the building must provide amenities and services appropriate to the building's intended use; and 3) the building must be operated in such a manner as to have allow energy use compared to other, similar, buildings. In the future, the energy embodied in construction and demolition may also need to be considered in judging efficient buildings. Finally, the special case of defining a zero energy building was discussed. Here, small changes in the definition translate into vastly different technical consequences for the design of the building and its relationship to the utility.

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