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GREEN AND INTELLIGENT TECHNOLOGIES FOR SUSTAINABLE BUILDINGS

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ABSTRACT:

Building sustainability means using the best available technology and methods to reduce contamination and to ensure proper resource use throughout the entire lifecycle of a building, while at the same time promoting good health and a sound environment for the people who will use it. Planning for the entire lifecycle of a building means taking a number of considerations into account, which span across the design and construction phase, over building operation and maintenance to considerations regarding how to demolish the building and reuse its materials once the building has served its purpose. This paper analyzes the scope and application of Green and Intelligent technologies that could be used to construct Sustainable buildings. Life Cycle Assessment Analysis on Sustainable Buildings provides Significant Return on Investment with respect to energy savings, Reduction of Green House Gas emission, Operation &Maintenance.

Key words: Energy efficiency, Green Technology, Intelligent Technology, Sustainable buildings.

1.INTRODUCTION:

A sustainable building is the one that is both intelligent and green. A sustainable building is the result of application of Green and Intelligent technology. It uses both technology and process to create a facility that is safe , healthy and comfortable and enables productivity and well being for its occupants.Conventional buildings suffer from an inability to communicate and intelligently manage the large amount of data that they possess or generate. With the advent of computers, rapid efforts are taken to achieve remote monitoring, diagnostics and centralized operation.

Through the application of Intelligent and Green technologies, Sustainable Buildings provide timely integrated system information for its owners so that they may make intelligent decisions regarding its O7M and also ensures continued and improved intelligent operation, maintenance and optimization.

A sustainable building is characterized by fully networked systems, due to integration of independent systems and work collectively and thus optimizes building performance and creates an environment that is conducive to the occupant's goals.

With device net working technology, it is possible to bring together all building sub systems into an efficient net work by having net worked electronic devices. Connecting electronic devices of the various sub systems in a building through an IP back bone is the core of Intelligent Technologies.

2. GREEN TECHNOLOGIES:

The term "Green" is widely used to describe buildings designed and constructed with minimum negative impact to the environment, with an emphasis on conservation of resources, energy efficiency, and healthier interior spaces.

A green structure is designed, constructed and operated with minimum impact on the environment and with an emphasis on conserving resources, using energy efficiently, and creating healthy occupied environment. Green buildings must meet the needs of the present without compromising the needs of future generations.

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Green structures can be constructed in a number of ways including using natural and non toxic materials, improving air quality, reducing waste of energy and water, employing renewable energy sources and reusing materials whenever possible. Conservation of energy is the biggest concern related to green structures. Efficient use of power, making use of solar design, efficient heating and cooling systems and high grade insulation are a few options that make structures more energy efficient.

Implementation of Green building concepts and practices results in higher energy savings, higher productivity and lower waste. Green technology has the following attributes:

- Provide a healthy and comfortable environment
- Improve long-term economic advantages.
- Incorporate efficient energy, water, and air technologies.
- Involve less wasteful construction and demolition processes
- Improve adaptability for rapid and easy changes through the capacity for on-going collaborative design.
- Provide long-term value and quality of construction or use

BUILT ENVIRONMENT	CONSUMPTION	ENVIRONMENTAL EFFECTS	ULTIMATE EFFECTS
1.String Design 2.Constructin 3.operation 4.Maintenane 5.Renovation 6.Deconstruction	1.Energy 2.Water 3.Materials 4.Natural Resources	1.Waste 2.Air pollution 3.Water Pollution 4.Indoor Pollution 5.Light Pollution 6.Heat islands 7.Noise 8.Loss of natural environment	1.Harm to human health 2.Environment Degradation 3.loss of Resources

Figure 2- Impacts of the built environment

Green buildings have been gaining attention because of their potential to reduce building energy costs, mitigate greenhouse gas emissions, consume less water (thus relieving the burdens of municipal water and wastewater providers), and Green buildings can add value to buildings given the savings and the positive effects on occupant comfort and satisfaction, in comparison to conventional buildings.

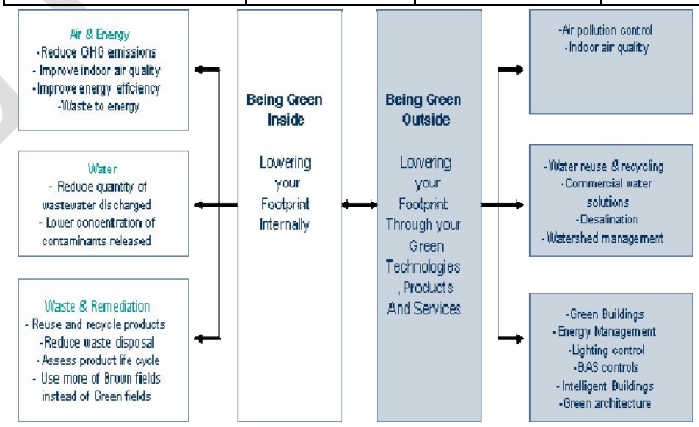

Chart 2-A Being Green "Inside-Outside"

Sustainability is measured in three interdependent dimensions: environmental stewardship, economic prosperity, and social responsibility, referred to as the triple bottom line. Social responsibility includes providing healthy communities and creating a safe work culture. As such, a Green building must meet the needs of the present without compromising the needs of future generations.

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3. INTELLIGENT TECHNOLOGIES:

Building Automation Systems (BAS) typically include a net work of sensors and other electronic devices connected to controllers on each floor, a front end Web server for monitoring building systems and a back end data base for storing historical data. But as intelligence continue to move into Activators, Chillers ,Security cameras, sensors and other elements of building systems, these devices will increasingly communicates as peers via web services, allowing BAS to be more flexible and integrate better with other systems.

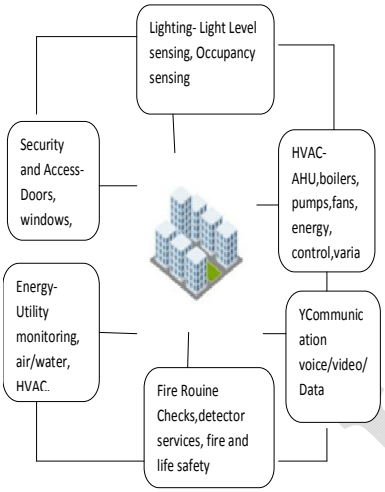

Figure 3 A Typical Building Energy Management Systems

BAS and BUILDING Energy Management Systems (BEMS) are designed to provide over sight and remote control of HVAC systems, lighting and other building systems. In simple terms, BAS is a programmed, computerized net work of electronic devices that are employed for control and monitoring of building systems. It primarily aims at optimizing the performance, start ups and maintenance of systems and greatly reduces the inter action of mechanical sub systems in the buildings.

BEMS basically performs the same function as a BAS but varies more in capacity. BAS and BEMS greatly increases the inter action of mechanical sub systems in the building. This leads to improved occupants comfort, optimum energy consumption and cost effective building operation. All these can be done remotely or from a centralized system with a minimum human involvement factor.

Several areas that form the sub systems are addressed in order to achieve 'total integration' as in intelligent buildings.

BAS and BEMS are used to improve energy efficiency by monitoring the temperature inside and out side the buildings and controlling the boilers and coolers. Essentially they aim at optimizing energy consumption by employing a control strategy by integrating various energy consuming units.

Energy Management Systems are helping building owners and operators reduce energy costs, while maintain occupancy comforts.

A typical BAS/BEMS carries out the following functions

- Optimum start/stop of systems.
- Scheduling maintenance.
- Predictive fault detection.
- Generate alarms and preventive actions minimizing damage in the case of emergency.
- Constantly monitor systems to detect abnormal operating conditions; take corrective decisions and bring the system back to normalcy.

Behind the success of BAS and BEMS lie different types of control strategies.

4. OPTIMISATION OF O&M:

Currently buildings need to exhibit operational efficiency at lower cost with respect to factors such as energy consumption and operational costs, life cycle benefits and management of resources.

5. INTEGRATION AGENT OF INDEPENDENT SUB SYSTEMS:

Ideally, a building is termed intelligent when its sub systems provide the occupants with productive and comfortable conditions by responding to their requirements and enhances work place environment. Thus the sub systems of a building greatly influence the perception

and measure of an intelligent building. The main sub systems of a functional building must address Lighting, HVAC, security, fire and life safety, elevators, water management and AV technologies.

5.1 LIGHTING:

Lighting serve as one of the basic and most challenging areas to be addressed by an intelligent building. Lighting is one of the top most areas for saving energy in buildings. Lighting control devices such as occupancy and photo sensors provide a cost effective and simple route to achieving energy savings.

An intelligent Lighting system serves effectively and productively and serves numerous functions

An intelligent lighting system could serve effectively and productively to provide numerous functions, such as:

- Modification of light levels depending on specific tasks, individual preferences, through phone or computer.
- Addressable control of each light fixture controlled through front end software.
- Automatic switches on or off capabilities through an array of sensors or based on time schedule
- Optimize energy consumption by self-monitoring room occupancy and adjusting light to suit occupancy status.
- Load shedding to reduce demand charges or overall building consumption in response to energy price spikes.

Individually embedded and hard ware architecture enable lighting controls to control each fixture in a building by assigning it with a unique IP address. Lighting control system, thus, can provide valuable information to easily integrate with BAS and further enhance the functionality of BAS systems.

Lighting also adds to the heat load in buildings, necessitating a higher demand on HVAC system of a building. So efficient lighting systems also adds to energy savings by the HVAC systems.

5.2 HVAC:

HVAC control system provides optimum comforts to building occupants and is an inherent part of the BAS .It is also a major area of energy consumption, so efficient handling of the resources will lead to optimum operation. According to USDOE, the energy consumption from HVAC systems accounts for approximately 40% of the total energy used in buildings. HVAC is an inherent part of the BAS and together can provide the following benefits.

- Adjustable work temperature based on individual preferences
- Distributed control of the indoor comfort conditions at the zone/room level of the building
- Monitors temperature, air quality, air flow speed, and humidity to provide optimum operation facility
- Pre-engineered system optimization strategies to reliably reduce energy consumption

5.3 SECURITY:

Effective security is one of the obvious solutions expected of intelligent buildings. This can be achieved by identifying the different types and levels of security to be provided such as access control, surveillance or intrusion. Again, inter dependence, as well as cooperation is the key to integrating a small, intelligent and proactive security system into an intelligent buildings.

Bio metrics and access control are some of the most important security applications in the building automation space. A well integrated building can operate more efficiently, save energy and guide evacuation in case of emergency situations.

5.4 FIRE AND LIFE SAETY SYSTEMS:

Intelligent buildings can cope well with the increasing no of stringent codes and norms associated with fire and life safety systems .In

the past fire alarming systems, public address systems were used to notify Emergencies such as fires, chemical spills ,natural disasters and evacuation orders. However with the advent of telephony and IP technology, mass notification system have evolved into a more robust solution.

5.5 ELEVATORS:

Elevators are yet another building systems that needs to closely tie up with the other systems. Elevator operations can be controlled by electronics access method such as proximity cards or bio metric access control. In the event of an emergency such as fire or natural calamity such as earthquake, the centralized system will shut down its services to avoid the use of elevators.

5.6 WATER MANAGEMENT:

Water management disciplines include water management, waste water management and storm water management in building systems. Waste water management systems help building owners increase the overall water efficiency of the building by allowing them to manage, monitor and control water usage. Use of water conserving fixtures will mitigate energy costs. Proper storm water management tool will assist in the avoidance of capital cost for a water treatment facility. Use of efficient and reclamation technologies inside and outside of a green building can save water, pre treatment fees and energy costs as well as potential building damage due to irrigation over watering.

6. CONCLUSION

This paper focus on the buildings by employing green and intelligent work together and has identified the exciting developments taking place on the technology front and analyses their implications for sustainable buildings ie buildings employing Green and Intelligent technologies.

Sustainable buildings are the choice of changing needs and life styles of occupants. The need of the hour is to educate and influence the end users of these technologies ie owners, builders, architects, contractors about these technologies which results in sustainable buildings.

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