

ENERGY MANAGEMENT IN BUILDINGS: A BRIEF GLANCE OVER INTELLIGENT BUILDINGS, THE FUTURE OF THE SMART LIVING

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ABSTRACT

In today's time energy management is a precondition for the secure living of the current generation and also for sustainable development. But the changing lifestyle of the citizens has made it difficult for the country to continue itself to be viewed as a power surplus country and also to meet ends with the rising energy demands of citizens. Hence it is highly essential to shift our focus to an environmentally friendly technology and efficient energy management which is the only future of our growing nation. The recent advancement in the architecture of building designs to reduce the harmful carbon impacts on the environment have led to positive energy homes. A vast range of techniques have been proposed to resolve the issue of diminishing energy utilization in buildings. These propositions depend on various yet integral viewpoints, and regularly adopt an interdisciplinary strategy, which makes it difficult to get an extensive perspective of energy management in buildings. The absence of an organized and binding view over the accessible methodologies and procedures promoted to perform the research. An elaborate discussion on "intelligent buildings" and building energy management systems (BEMS) is conducted in the paper. Moreover more focus is led upon how BEMS is developed and successfully accomplished in buildings by various modern techniques such as the lightning controller system. At last the paper also analyzes the use of energy management in building and its advantages and disadvantages.

Keywords: Energy management, sustainable development, intelligent building, Building energy management systems (BEMS)

I. INTRODUCTION

Recent times have increased the demand for wireless building and home automation networks in residential and commercial buildings for particularly energy management [1]. The energy management system of a building is an integrated and computerized system for monitoring and controlling energy-related services, such as heating, ventilation, air conditioning system, etc.

The most important role of conservation of energy in buildings is to provide them thermal insulation properties thereby reducing their heat loss. Energy management is considered as the process of removing and optimizing the consumption of energy thereby conserving its usage in a building. This process includes planning and operation of energy production, distribution, and storage in an inefficient way which is done via a computer-based Building energy management system (BEMS). The main objectives of such a system is conserving resources, protection of the climate, and lowering of the costs.[2] This system provides a centralized platform for managing the usage of energy in the building by detecting and eliminating wastage in all possible manners.

II. INTELLIGENT BUILDINGS

In 1981, United Technology Building Systems used the term intelligent/smart building for the very 1st time. Within the forthcoming years, the City Place Building in the capital of Connecticut, USA, became proverbial to the planet as the first intelligent building that was successfully accomplished. The smart construction of intelligent buildings refers to a kind of construction that has been done keeping in mind reasonable and affordable investment, the one that ensures good green power management of the building wherein minimum energy is consumed and maximum energy output is given thereby creating a positive and handy environment. They're designed keeping in mind an optimized balance amongst the structure, shape, system, and management.

The central and primary connotations to define the term “intelligent building” foremost consider the pivotal role of technology. Different researchers define intelligent buildings as automated buildings that consist of an environment that is flexible, effective, comfortable, and secure and is alert to the users' actual needs.

The most imperative play of an intelligent building is to conserve energy.

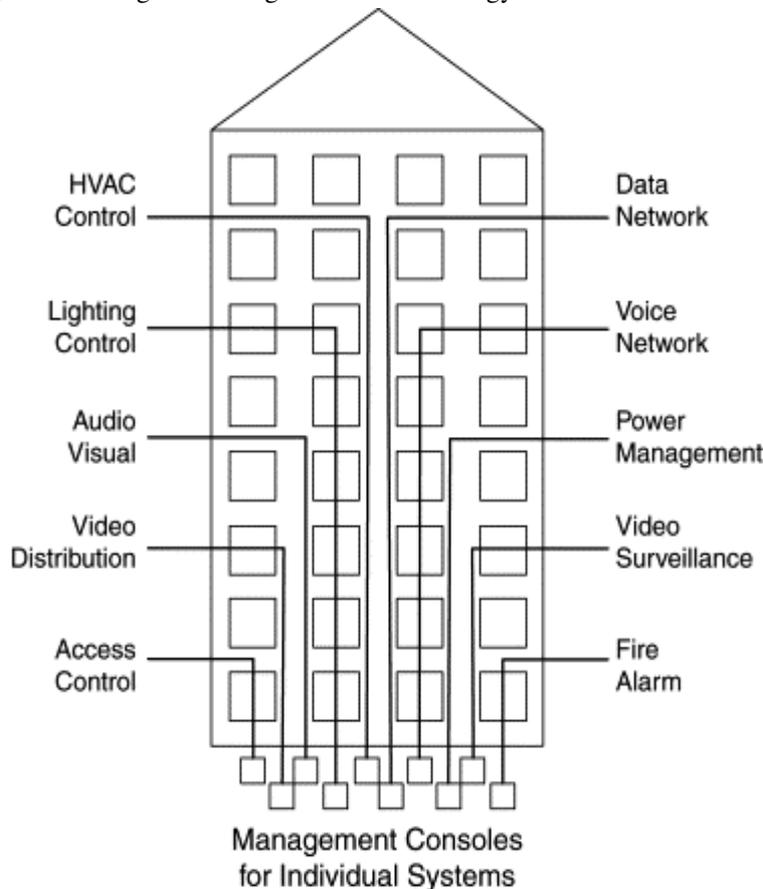


Figure 1: Intelligent building system[10]

III. ENERGY MANAGEMENT IN INTELLIGENT BUILDINGS

The efficiency of smart and intelligent buildings is expected to cover all the possible metrics in order to ensure its energy management. The energy in a smart building should be saved in all the ways possible and in every possible arena. For instance the heating and cooling expenditures of an intelligent building should be entirely controlled and optimized. This can be done by using a thermostat.

The best and the direct solution for the instantaneous action for the reduction of energy consumption for various purposes like businesses and households is application and installation of Building Energy Management System(BMES)

III.1 Building energy management system(BEMS)

A Building energy management system(BEMS) is an arrangement which is used to oversee and more importantly supervise all types of the electrical and mechanical machinery in intelligent buildings. It is a method used for regulating all of the building's energy necessities by overseeing and controlling almost every aspect such as that of lighting, electricity, heating and ventilation systems. The everyday grade by grade increase in mechanical progression and the relentless growth of technology has made building energy management systems an indispensable element for overseeing energy demand, particularly in enormous building projects as to the very astonishment they can proficiently control 84% of the consumption from a building's energy.

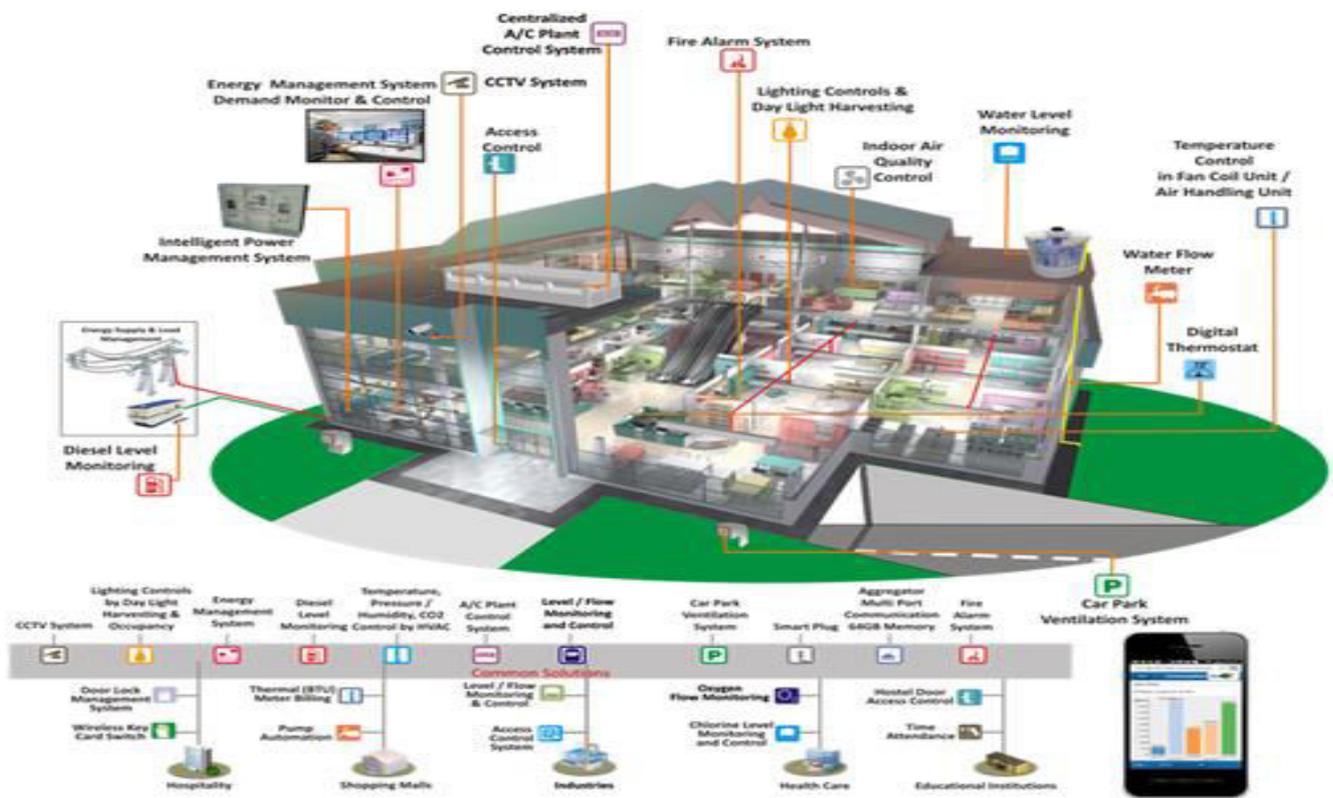


Figure 2: Building Energy Management System(BEMS) internal mechanism[11]

As indicated by the US Department of Energy, commercial architectures consume and devour nearly 20% of the energy produced in the United States and also upon looking at the shocking and appalling statistics of commercial and residential buildings and homes it is found that they nearly produce around 38% of the ozone depleting discharge gases[12]. This is merely wasting the planet's resources which can furthermore be utilized for a much greater cause. To address this, BEMS is one of the numerous apparatuses that is being utilized to operate and run buildings all the way more productively and with the maximum energy management and utilization.

III.1.1 Working Of BEMS

BEMS works by using a computer based system/software that checks, controls and supervises the building functioning, and oftenly alerts and alarms the building administrators thus enabling them to reoptimize the aggregate building functioning in the on and off situations. BEMS are indispensable segments which closely scrutinize and reduce energy consumption without

compromising the users' energy demands. BEMS is an electric control system. It works using sensors and controllers using digital and analogue signals.

III.1.1.1 Controllers

A controller is an extremely vital segment of the working machinery of building automation systems/BEMS. It is essentially a small computerized system in which its input facility reads temperature, humidity, current and air flow and some essential parameters and the output facility sends command and control signals to the site equipment. One of the elementary benefits of the controller is that they enable and empower the user to have the advantage of the building's administration. Controllers arrive in various sizes to control gadgets and equipment that are frequently found in buildings, which is the main reason to properly comprehend and analyze its many uses. Their principal objective is to monitor the efficiency of the facilities of the buildings such as mechanical, electrical, plumbing, lighting, security and surveillance systems.

For instance information like the values of temperature, humidity and pressure on which the building currently is running at are sent in the forms of digital and analog input signals to the BEMS. Then the analog and digital outputs, from the central supervising PC send signals to the appropriate site equipment which there command its settings or even turn that particular gadget on and off. BEMS can be utilized to control practically anything and even controls lighting and controls critical frameworks.

III.1.2 Lighting Control System

One of the examples of the numerous technologies implemented under BMES is the Lighting control systems.

A BMES empowers building operators to screen and monitor all the lighting framework and control its utilization thus minimizing its wastage. Light energy makes life conceivable in the world by its wide range of uses be it vision, food production, growth, development, etc and hence it needs to be conserved with relentless efforts. In BMES, lighting control systems are installed within the building which switches the lights on, off, or even dims its brightness using occupancy sensors and timers which automatically turns the lights on when it's dark or by sensing a human's motion under it and automatically turns them off where there is no human activity detected. It senses the time of day and regulates lights in external workplaces of the building and also in the parking garage.

IV. ADVANTAGES OF ENERGY MANAGEMENT IN BUILDINGS

The management of building energy benefits the residents as it increases their comfort without impacting the standards of living. Energy expenditure of residential and commercial buildings is reduced by cutting down electricity bills. It reduces the risk of energy scarcity and precisely reduces building's greenhouse emissions.

V. CONCLUSION

The energy sector in India requires much more innovative and efficient ideas to meet the ever-increasing demand of energy. Smart building methods appear as an effective tool in such scenarios to manage energy and make society a better place to live. Energy professionals are responsible for power auditing, environmental impact assessment, power resource management, assessing the viability of other energy resources, and laying down costs. Our country accounts for 6% of the world's primary energy consumption. Rapid urbanization in our country has led to increased carbon emissions and energy consumptions. Also, cities face a complex set of challenges in different sectors, for example, building environment, mobility, waste management, etc. All these problems can be managed by integrating smart energy management principles in buildings. Small buildings may have independent controls for energy systems, but for larger or complex buildings, this can achieve significant savings. A fully automated home, integrated with innovative technologies, can provide a complete scene of safety and security to the people who continue to spend more time indoors, and their homes have become the center of their world.

By applying technologies in commercial buildings and industrial facilities, it contributes to social development by making the workplace safer and healthier. This may become more composite and costly as starting opportunities are realized, but to reach the climate goals and businesses will be under huge pressure. While it is savvy, to consider that all the energy resources are inadequate and insufficient, it is very important to devise other substitutes of the energy resources with the same efficiency, and having an energy management system in the buildings in the present day seems to hold an impressive future ahead.

VI. REFERENCES

- [1] Abiodun Iwayemi, Wanggen Wan and Chi Zhou (August 1st 2011). Energy Management for Intelligent Buildings, Energy Management Systems, P. Giridhar Kini, IntechOpen, DOI: 10.5772/18589. Available from: <https://www.intechopen.com/chapters/17055>
- [2] UGAC, ISO 50001:2018, Energy Management Systems <https://ugac.us/iso-500012018/>
- [3]energy saver solutions, safecity security <https://www.dubaicctv.net/blog/archives/02-2015>
- [4] David stevens, "Energy Storage - A "Game-Changer" for Electricity Utilities?", <https://www.airdberlis.com/insights/blogs/energyinsider/post/ei-item/energy-storage-a-game-changer-for-electricity-utilities>
- [5] Lu Wenhai1*, Caroline Cusack2, Maria Baker3, Wang Tao1, Chen Mingbao4, Kelli Paige5, Zhang Xiaofan6, Lisa Levin7, Elva Escobar8, Diva Amon9, Yin Yue1, Anja Reitz10*, Antonio Augusto Sepp Neves11, Eleanor O'Rourke2, Gianandrea Mannarini12, Jay Pearlman13, Jonathan Tinker14, Kevin J. Horsburgh15, Patrick Lehodey16, Sylvie Pouliquen17, Trine Dale18, Zhao Peng1 and Yang Yufeng19, "Successful Blue Economy Examples With an Emphasis on International Perspectives", Published on 07 JUNE 2019, <https://doi.org/10.3389/fmars.2019.00261>
- [6] North America Smart Shade Devices Market Industry Report <https://www.inkwoodresearch.com/reports/north-america-smart-shade-devices-market/>
- [7] MBA in Energy Management - Is It a Good Career Choice <https://leverageedu.com/blog/mba-in-energy-management/>
- [8] ISO 50001: the pros and cons of an energy management <https://www.energylivenews.com/2020/11/24/iso-50001-the-pros-and-cons-of-an-energy-management-system/>
- [9] Kaile Zhou, Shanlin Yang," Energy management", <https://www.sciencedirect.com/topics/engineering/intelligent-building>
- [10] Figure 1: <https://ars.els-cdn.com/content/image/3-s2.0-B9781856176538000016-gr1.gif>
- [11]Figure 2: <https://3.imimg.com/data3/QV/AC/MY-8929153/building-energy-management-system-500x500.png>
- [12]<https://www.arcweb.com/market-studies/building-energy-management-systems>