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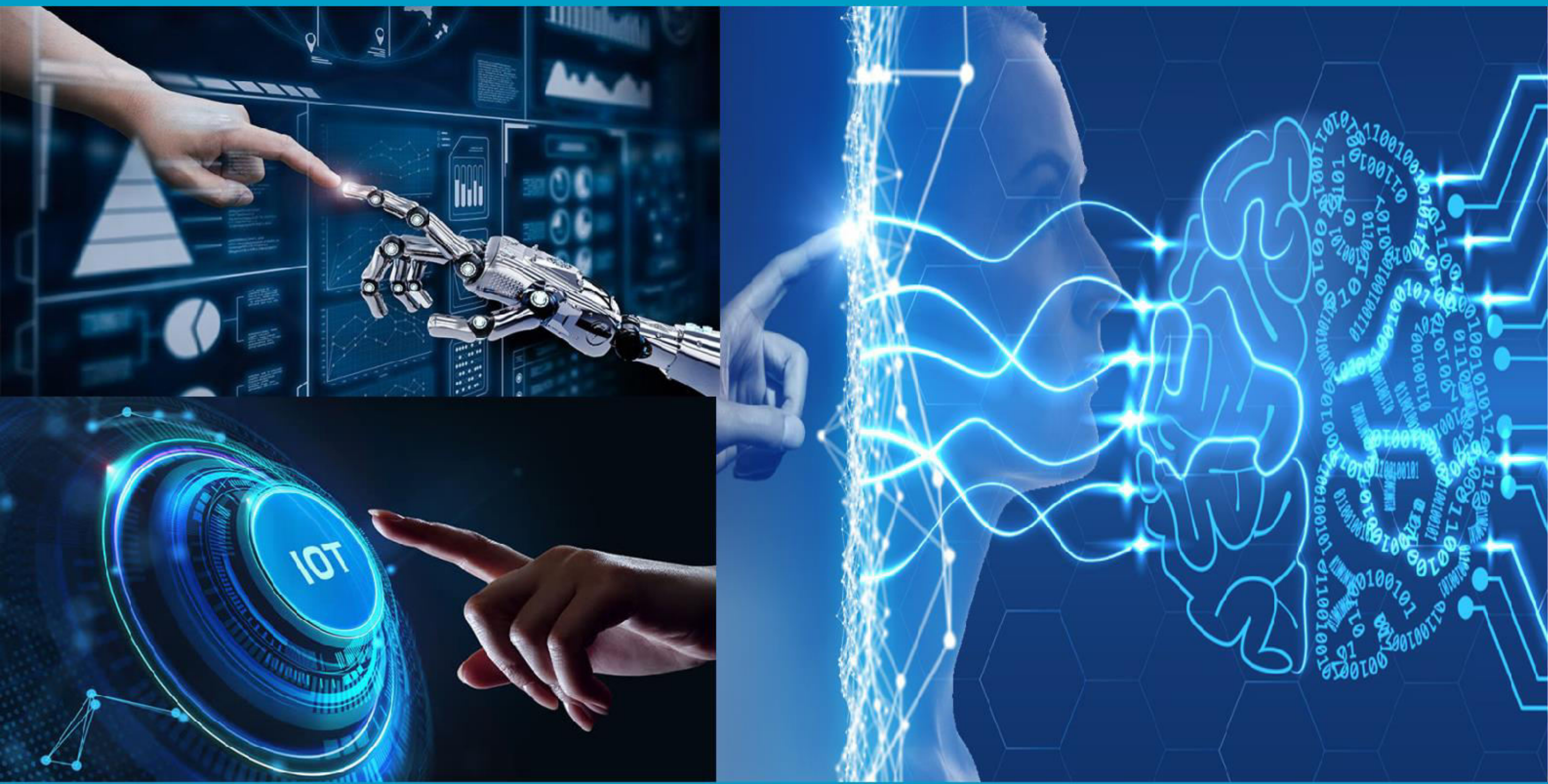

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Green Retrofitting for Old Buildings: An Overview

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ABSTRACT: The Green building movement has gained tremendous momentum during the past 3-4 years. This work inspects inventive styles, practices and objectives of old building retrofits while demonstrating green design methods and execution strategies. The present building stock is substantively huge and denotes one of the largest chances to decrease energy waste and control air contamination and worldwide warming. In relations of tall buildings, numerous will advantage from retrofits. There are lengthy lists of unproductive all-glass curtain walls, primarily endorsed by the modernist crusade, that are outstanding to retrofit. The all-glass curtain wall buildings depend on synthetic freshening, refrigeration and heating system, and suffer from poor insulation, which together create them energy hogs. Latest practices specify that green retrofit has facilitated older buildings to growth energy efficiency, enhance building performance, growth tenants' pleasure and boost economic return while decreasing greenhouse gas emission. This paper proposed focus to design and analysis of green retrofitting of old building using different parameters. For this research we have consider some parameters like Energy consumption, Water consumption, indoor environmental quality, Innovation etc. Once implement Green Retrofitting in Educational Complex as per IGBC Rating System, then to determine Green Rating of Green Retrofitted Building as per IGBC Rating System. The proposed system all parameters has verified with payback period. The experimental analysis shows how the proposed research is applicable for old building with tangible as well intangible advantages to end user.

KEYWORDS: sustainable design; green retrofit; energy efficiency; building's performance; holistic approach.

I. INTRODUCTION

The global ecology is being irreversibly damaged due to the rapid expansion of human economic and industrial activity, which will have negative consequences for future generations. According to a recent report by the United Nations Environment Programme (UNEP), the usage of fossil fuels throughout a building's operating life accounts for as much as a third of all GHG emissions today. Around 40% of all energy is used in the construction industry every year [2], and the industry is responsible for around 30% of all greenhouse gas emissions. Carbon dioxide emissions are a major source of the problem; they may be responsible for as much as 40 percent of all emissions worldwide, and India is ranked 144th in this regard. The industry must create sustainable construction technologies in response to the rapid growth of intermediate economies in emerging nations, the worldwide shortage of available building materials, and the inefficient utilisation of existing structures. Greenhouse gas emissions from buildings are expected to more than double in the next two decades if no concrete efforts are taken immediately. Therefore, if goals to reduce GHG emissions are to be realised, policymakers must engage with as a must the emissions from the construction industry. Every country's plan to combat climate change should include a measurable goal of reducing greenhouse gas emissions from buildings.

Global greenhouse gas (GHG) emissions must be reduced by at least 50% during the next 40 years if we are to avoid the worst-case scenario of climate change. In the next eleven years, countries throughout the globe want to reduce their emissions by at least 25%. Time is of the essence, therefore countries are eager to go to work as soon as possible to prevent doing any permanent harm. Sustainability has emerged as a central theme in 21st-century building design. Green construction refers to the practise of making buildings more eco-friendly, sustainable, and resource-efficient

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from the ground up or over their entire lifespans.

This integrates many elements, such as efficient use of water, an ecologically friendly atmosphere, the employment of renewable energy and reprocessed/recyclable materials, the productive utilisation of landscapes, the efficient utilisation of controllers and building management systems, and improved indoor quality for the benefit of residents' health and convenience. In addition to helping people live longer and healthier lives, the notion of green buildings also protects the planet from the destructive and toxic impacts of human activity, thereby delivering on the promise of ecological growth.

II.LITERATURE REVIEW

Previous research on the monetary effects of "green" certification has mostly concentrated on new construction in the United States, with usually positive findings designating a correlation between environmental certification and economic outcomes in the market. Miller and Buys (2008) conducted research in Australia to determine the returns of retrofits from the perspective of tenants in a big office building. The renters they surveyed were overwhelmingly positive about the green retrofits and were confident that the trend would continue. We are unaware of any research that has analysed the economics of a statistically significant population. After ecological certification, Eichholtz, Kok, and Quigley (2010) find substantial and favourable impacts on market rentals and selling prices for office buildings. Rents for LEED or Energy Star designated office buildings are roughly 2% more per square foot, effective rents are about 6% higher, and dividends to selling prices per square foot may be as high as 16% higher than for a control sample of conventional office buildings.

These results have also been confirmed by other research (Miller, Spivey, and Florance 2008; Fuerst and McAllister 2011). The financial crisis seems to have had no influence on these findings, as a system document for a recent dataset of 3,000 green buildings shows that the energy efficiency and "greenness" of buildings are included into rental and selling pricing. The current downturn in the real estate market has not completely destroyed this result. There is evidence from other research that shows financial advantages, such as faster occupancy, higher occupancy rates, cheaper operating expenditures, better residual values, and more productive occupants. Green renovations have not been the subject of any theoretical research on their impact on the housing market. The retrofitting of single buildings is well documented in the owner-occupant market but less so in the private rental market.

Tenants may be shifting towards "green" real estate because of reputational gains, social responsibility mandates for businesses, and increased output from workers. Such a change in preferences among inhabitants shows that businesses are repurposing their old spaces to better communicate their goals to stakeholders and staff.

This connection between CSR performance, positive PR, and company allure is something that has been explored in the CSR literature. Pivo and Fisher (2010), authors of a recent comprehensive analysis, advocated for CSR's increased rents and profits. Tenant productivity is often cited as a reason to choose green office space over conventional buildings. A study by Miller et al. (2009) shows that a majority of businesses with offices in green-certified structures report increased productivity among their staff. However, these findings are difficult to interpret because of the uncontrollable variables of management approach and staff background. Tenant polls in London, however, show that businesses are shifting their priorities.

Five-eighths of renters consider energy efficiency "important," according to a study conducted in 2008, and half of tenants say the same about "green" features. One of the immediate economic advantages cited by real estate investment businesses when thinking about energy productivity and sustainability in their portfolios is improved building energy competency.

According to Jones LaSalle's (2010) findings, the average realised savings for 2007 and 2008 at the 115 office buildings in its portfolio where energy efficiency was enhanced in 2006 was $2.24 million and $3 million, respectively. According to British Land's (2010) report, the company has reduced its energy use throughout its portfolio by 12 percent, saving an estimated $1.12 million per year and 11.1 million kWh in 2009.

In many markets, including Boston, San Francisco, and Washington, D.C., we are seeing increased government pressure from both the regulatory side and direct government office demand from the government services offices (federal GSA or California GSA), which require Energy Star-labeled space for most new leases.

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III.METHODOLOGY

The client needs a pathway to energy management, provided by an independent (non-product) based team. Furthermore, it has been proven time and again that this is a process, requiring continuous analysis and feedback to management. Energy management is not satisfied by a one-off fix-it-all approach and requires client participation and commitment. We need to first define scope of work with below points.

1: Insulation, primarily roof secondary walls as well as floor also.

2: Retrofitting heating equipment's in older houses, results in household savings of 30–80% due to cut in energy-use and a reduction of CO2-outlets by 30–100%.

3: Thermostats in all rooms

4: New windows.

5: Plugging air leaks.

6: Tuning up heat and cooling (HVAC) systems.

7: Switching to compact into light bulbs and/or LED light bulbs

8:choose different appliances which can use minimum energy. In the different countries, this is certified by the Energy Star.

9:Minimizedusage of water by installing aerators and low-flow heads of shower.

10: Convert to green power, including solar energy and updatablesuch as heating-pellets and biogas

11: Using low-VOC products to recover indoor air quality

12: Planting native plants and other appropriate landscaping measures.

A. Energy Management Process & Performance Improvement

To differentiate their energy management strategy from others who define a retrofitting procedure, the American Society of Heating, Refrigerating, and Air-Conditioning Engineers recommends a feedback loop. Importantly, unlike retrofitting, energy management requires a feedback or cycle process where the applied plan is constantly reviewed.

Most investigations that analyse the before and after impacts of an energy retrofit don't seem to use this idea. More recently, various bodies accrediting energy retrofitting and environmental procedures for buildings have become aware of this continuous loop process. The method is outlined, but the steps aren't broken out in any great length. Some of the old retrofitting and energy management techniques may be used together. Overall, the following seems to have widespread support: A consensus on the project's goals and an appreciation for the business case are necessary first steps. The performance may be compared to other initiatives with a similar focus on early analysis and auditing to establish a baseline. Methods for recognising risks and selecting strategies, reaping savings via energy retrofitting, and developing an action plan. Starting with an action plan, then checking in to see how it's going. Intentionality revival via iterative goal-settins.

B. Retrofitting assessment

In this paper, we propose a pre-retrofitting methodology that is divided into four stages (Figure 4), one of which is a "building integrity audit," which will be discussed in greater depth below.

One, the creation and implementation of a management strategy for improving building performance through retrofitting.

Building services, energy systems, building fabric, mechanical and occupant schedule, control, and identifying energy waste are all covered in a "Building Integrity Audit."

Pre-retrofit energy management involves learning about, then implementing, a system of sub-metering to track and record energy consumption and consumption patterns.

And finally, we'll be putting into action a ranked and prioritised plan to retrofit the building's services, systems, and fabric in stages. In the diagram below, you can see the various steps involved in the Energy Retrofitting models that have been suggested.

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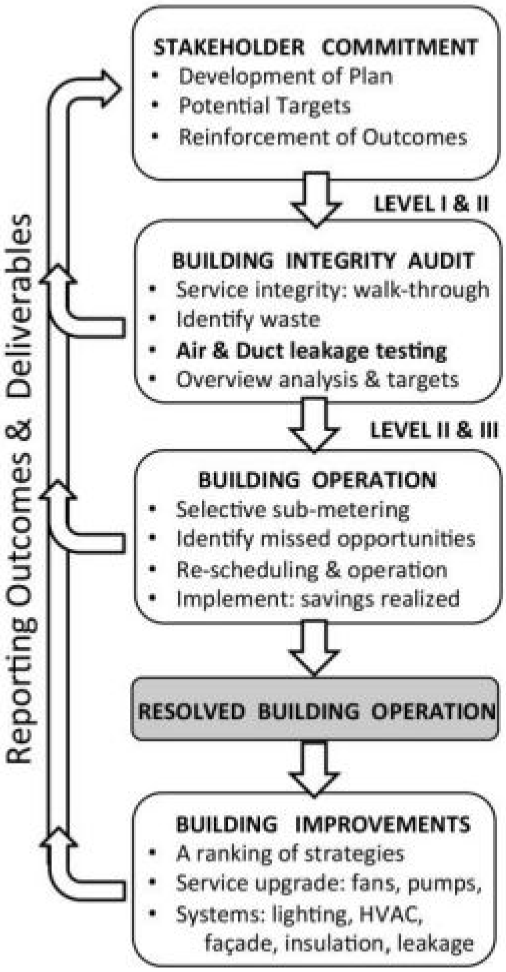

Figure 1: Energy retrofitting of proposed model

The results of this survey highlight the value of incorporating "decision processes for energy-efficient retrofits" into the renovation planning and implementation stages. In this first step, the client is involved in developing a strategy for the ongoing management and retrofitting of the building's energy systems. The success of the proposed project hinges on the client's dedication and agreement to a suitable staged process and procedure. The next steps require the creation of a timeline, which must be approved, as well as an orientation and permission to enter the building. Furthermore, the building administration and the energy management group would like to work together. As a corollary, it is important to educate everyone involved on the processes, methodologies, and business case. This may seem like a trivial part of the energy management and retrofitting process, but it actually plays a crucial role. To establish a programme that is not a one-and-done project, it is crucial that all members of management be involved in the decision-making process.

C. Pre-retrofitting Energy Management

Here, we can see how to go about choosing the sub-metering equipment to use. From a financial point of view, it is unreasonable to track every variable. The data from the metres is then separated out into functional schedules for the structure. Energy waste and peak loads (in kilowatts) are also determined. In order to shed light on energy consumption oddities, this data is often fed into statistical and analytical algorithms with specific modifications. Inconsistencies in operation, which could result in broken machinery, missed appointments, and a general lack of command are the objects of study. Prior to investing in retrofitting building infrastructure, it is crucial to identify sources of operational energy waste and implement solutions. The installation of energy metres serves a dual purpose in helping people take control of their energy use and costs while also enhancing the efficiency and dependability of their tools. In order for property owners to make the most of demand management possibilities and to make informed predictions based on past use patterns, intelligent metering systems are needed.

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D. Case Study

(1) Roof and roof constructions
1. In connection with change of the roof a decision will be taken on the possibilities for a possible mounting of sun cells or photovoltaic (PV) modules as well as solar thermal collectors?
2. In any case preparations are made for a possible later mounting of PV modules or solar thermal collectors, including labeling / piping to inverters or storage tanks in loft room or cellar?

(2) Windows and entrance doors
1. The dwelling is optimizes regarding utilization of passive solar heat, with an account of how possible overheating problems, if any, have been solved?

(3) Materials in general
1. Only building components and installations totally free of PVC are applied. Where possible only materials with ecological certification are applied Where applicable only materials with environmental documentation are applied (documented)
(4) Building constructions– indoor

1. Floor slab, ceiling and floor As flooring materials are only applied wood, natural stone or ceramic?
The building project will be connected with the local district heating?
2. The municipality has received documentation to the effect that the heating system in the house ensures maximum cooling of district heated?

(5) Water and plumbing
1. Water saving toilets with differentiated flush are installed?
2. Rain water collection for garden irrigation is installed?
3. Water saving taps are installed?
4. A main water metering device is installed in each block, for use in green accounting for all blocks?
5. “Grey”waste water is utilized?

(6) Electric installations
1. Use of electric installations without PVC?
2. Installation of individual consumption display for electricity consumption?
3. All white goods must be certified as “low energy” or be prepared for that. (White household electrical appliance goods are freezers, refrigerators, stoves, washing machine, tumble dryers and dishwashing machines)?
4. Low basic lighting is installed outdoor. Supplemented with user activated stronger specific lighting?

(7) Indoor air climate and ventilation
1. Air tightness measurement 3) of the building in order to document a natural air change via constructions?
2. Installation of user controlled balanced mechanical ventilation with heat recovery, on demand, where exhaust air is used for heating of inlet air?
3. Inspection possibilities available for all pipe joints?

(8) Waste
1. Space for composting container is included in the garden plot?
2. Appropriate containers for fractionated waste disposal are built in kitchens and in the outdoor disposal places?
3. Life cycle assessment of building materials?

IV.DISCUSSIONS

While some projects are able to deliver savings of 40% or more, reviews of actual savings in real buildings show a wide discrepancy in delivered savings, with many projects bringing savings of well under 10% of pre-existing energy costs, far short of forecast savings, and barely discernible within the noise of utility bills. Common issues include a lack of commitment to improvement, leading to a narrower development focus and higher costs in the long run, as well as a failure to take into account the newest retrofit plans. In this article, we discuss the state of the art in commercial building retrofitting and how it might be used to the refurbishment of a number of structures in Australia. But it's feasible that this strategy might be used in other places than Australia. The goal is to provide facility managers with

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cost-effective, scalable, and practically applicable retrofit solutions that will allow them to constantly enhance the performance of their building stock over time.

V.CONCLUSIONS

Currently, eco-friendly structures are the norm. Green building design is receiving increasing attention from owners and policymakers around the world. Some truly impressive Green Buildings have been constructed in India over the past few years, but the concept of green buildings for the general populace is still in its infancy. The current effort is a step toward educating the public at large about the importance of green buildings to long-term environmental sustainability and effective environmental management. We also explore how the proposed methodology can be used to conduct a comprehensive survey of older buildings.

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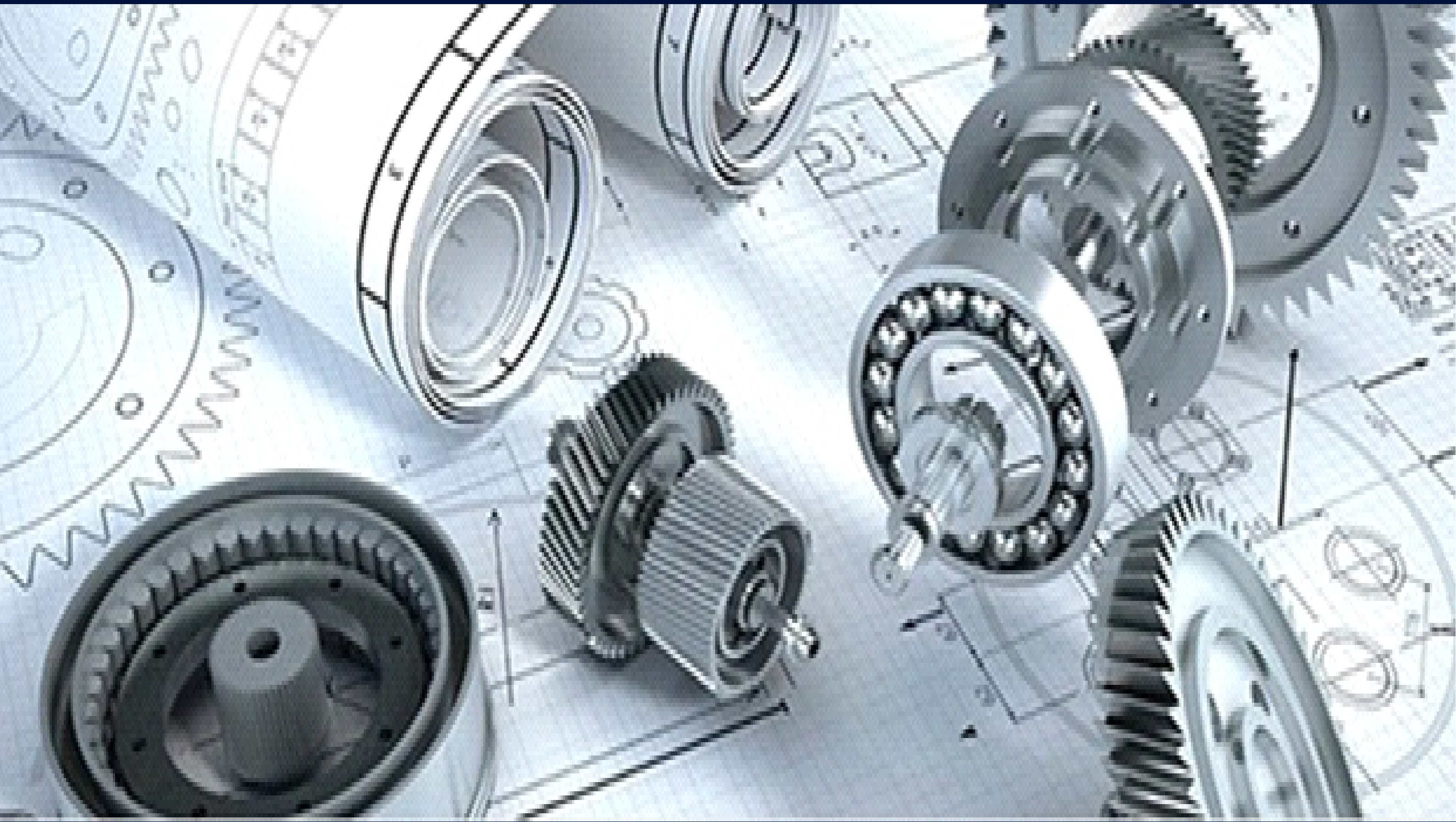

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