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# SPECIAL ISSUE FOR
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# GREEN YOUR CAMPUS

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**Abstract:** *This conceptual paper examines the theory of the Green Campus design & investigate the implications for its proposed project- Development of Existing Campus as Green Campus at College of Engg. & Tech. Babhulgaon, Akola. Maharashtra state, India. R. Buckminster Fuller (1895 – 1983) an American Architect & inventor has said that, "The best way to predict the future is to design it." Green Your Campus – COETA !!, is such an initiative, has been designed with a vision of making existing COETA Campus more Sustainable & Green. It is also to promote the idea & necessity of Green Campus among the COETA community. The Green Your Campus – COETA !! is the continuation of our efforts in direction of sustainability with participation of the college going youth of this college. The paper further elaborate on the initiatives may be taken up by the College Community. As a methodology, inventory of existing campus is necessary & for energy efficiency setting targets, sub targets, concepts, measures are suggested. The separate estimation & analysis of the Life Cycle Costing of building, Retrofitting cost, Payback period would lead to execution of retrofits.*

**Keywords:** *zero impact, green roof, cool roof, bldg. envelop, retrofitting, fenestrations.*

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## INTRODUCTION

Architects, Engineers & Urban Planner all over the world are making efforts to equip large, densely-packed multi-storied urban buildings & surrounding with sophisticated technologies. The aim is to produce an inherently sustainable form of development with zero negative impacts. The major concerns today are Energy & Resources, Light & Ventilation, Greenery inside & outside, Water & Waste, Construction & Use of materials & Urbanism.

In this paper, the term Green Campus, is an attempt in the direction of campus sustainability & human environment around, that are functional & environmentally benign. Gregory Bateson (1904 -1980) English anthropologist, social scientist, has said that, "*The major problems in the world are the result of the differences between the way nature works & the way people think.*" Architecture & building offer the greatest potential for sustainable shaping of the environment. We will have to strengthen our efforts to increase materials & energy efficiency in construction & the use of buildings. Clever design & planning decisions could help us to use resources more sparingly, improve the durability of buildings & reduce environmental damage. In this way we can create & maintain lasting value & contribute to the campus sustainability of our college campus.

### Building Envelope

Humans first created shelters to provide thermal comfort & protection from natural elements, & this still remains a primary objective of buildings. The building envelope is the physical separator between the interior & exterior of a building. A building envelope generally refers to the building components that enclose conditioned spaces & through which heat energy is transferred to or from the outdoor environment.

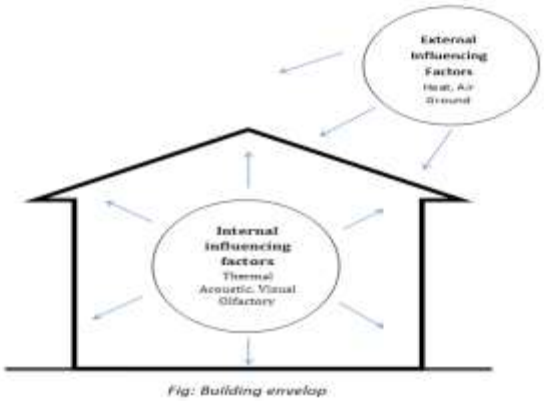


*Fig: Building envelop*

More energy is needed to keep a constant temperature in the building because the heat energy is being transferred through the various components of the building envelope. Most of this energy ( 50% ) is transferred through the windows, 21% of the energy is transferred through infiltration, or air leakage in the building envelope. The remaining heat energy is transferred through the roof (16%); walls (10%); & floor or foundation (3%). Components of the envelope are typically: walls, floors, roofs, fenestrations & doors. Fenestrations are any opening in the structure: windows, skylights, clerestories, etc.

Roofs tend to be large "heat islands," where they absorb a large amount of radiant energy from the sun, causing the temperature of the roof, as well as the surrounding air, to rise. Much of the energy being transferred through the roof might be minimized if the temperature on the surface of the roof could be significantly lowered, perhaps by using a "cool roof" product. The main purpose of a cool roof is to reflect the sun's radiant energy before it penetrates the interior of the building, thus reducing the amount of air conditioning needed to cool a building.

Green roofs are simply vegetated roof covers constructed atop & across a roof deck. Like cool roofs, green roofs can reduce the surface temperature of the roof as well as the surrounding ambient air temperature, thus combating the urban heat island effect.

There are two types of green roofs, extensive and intensive. Extensive green roofs typically have lower growing plants than intensive green roofs, and also have less variety or species. Intensive green roofs are usually designed for human recreation (as in a rooftop garden), while extensive are typically non-accessible. Extensive green roofs are also less expensive to install and maintain than intensive green roofs. However, both types of green roofs are built in the same fashion. The vegetation is planted in a type of growth medium with a drainage layer beneath it. Beneath the drainage layer is a root barrier and waterproof membrane, all constructed atop the insulated roof deck.

**Fenestration (Windows/Doors):**
Fenestration refers to the design and position of windows, doors, and other structural openings in a building. A window is actually a system of several components.

**Building envelopes with photovoltaic panel:** Photovoltaic modules are mainly available in the form of laminated glass or plastic elements & should therefore be employed like glazing components. Numerous special module are available for special applications e.g. solar roof tiles, solar membranes etc. the energy efficiency planning of the building envelop means

guaranteeing that the interior climate conditions necessary can be maintained over the hole year with low energy requirements & whenever possible, essentially without any costly energy supply technologies. Such planning presumes an accurate analysis of the climatic boundary conditions & the usage profile in conjunction with all the aspects.

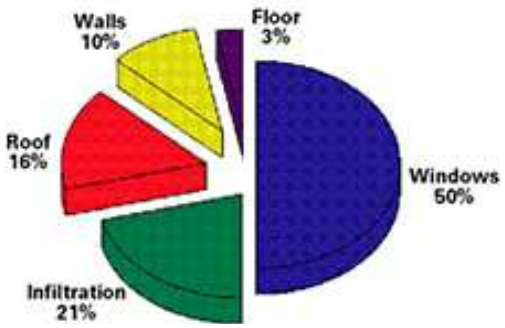


**Figure: Building envelope energy losses of facilities 15 years or older**

**Decentralized ventilation:**

Good quality air in building calls for a regular exchange of air that depends on the type of use & the no. of persons. Modern forms of construction render possible a high air tightness, an uncontrolled exchange of air via joints & crack is to a very large extent prevented. This demands careful planning of ventilation systems, which can be realized via the building envelope or by building services.

From the sustainability view point a maximum amount of natural ventilation should be the aim. This means that the air change rate for habitable rooms is achieved by way of thermal currents or differing pressures due to the wind. Electrical ventilation leads to a considerable increase in the energy consumption. Owing to the long operating hours of ventilation systems, there is a substantial potential for savings in energy consumption & operation costs if mechanical ventilation can be avoided. In addition, the horizontal & vertical ducts of many ventilation systems occupy considerable valuable floor space.

**Energy efficient window**-

Today we have high performance window with improved frame materials, multi panels, gas filled & insulation which are capable of drastically decreasing energy consumption & thereby

the heating & cooling costs of a building. Such windows also provide acoustic insulation. Some of the technologies for the construction of window are as:

1) Single clear glazing 2) Low energy single glazing 3) double clear glazing 4) Low energy double glazing 5) Vacuum-glazed super glass 6) Aero gel.

**Landscaping:**

Carefully positioned trees around a building can save up to 25% of that buildings energy consumption for heating and cooling. Landscaping does this by reducing the surface temperature on the various building envelope components, therefore minimizing the temperature difference between the interior and exterior environments and minimizing the conductive heat transfer through the building envelope during the summer months.

The key issue in energy efficient building is the attempt to use constructional measures to accomplish a convenient, comfortable use of the building with the minimum use of energy. This is achieved in the first place through designing the building & choosing the material to suit the climate.

- **Recycled Materials**

Materials using recycled content not only require less virgin resources, they also use less energy and chemicals to process.

- **Using Recycled Materials**

To use recycled content in your building, call suppliers to source recycled materials. Be sure to verify the physical properties (strength, stiffness, etc.) of the material with recycled content. If they are lower-performance, you may need to alter your design to use slightly more material. This is usually still a net benefit environmentally.

- **Making Recyclable Constructions**

Materials are only recycled when the monetary value of the materials is greater than the cost to separate them out from other materials. To make your building (or parts of your building) recyclable, design for disassembly. That is, make it easy to separate different kinds of materials from each other. Some strategies for this include using as few different kinds of materials as possible, using undoable fasteners (e.g. screws rather than nails or epoxies), and using larger assemblies that have greater value than small pieces.

**Reused Materials**

Reused materials are even more beneficial than recycled materials, because in addition to saving natural resources, they also require far less manufacturing. However, it may not be zero manufacturing. Reclaimed wood, for instance, is often planed or otherwise cleaned up for reuse.


**Local Materials**

Local materials are any kind of material grown or manufactured within a certain radius of the building site. They are also called "regional" materials.

**Other lifecycle considerations**

Sustainable construction must focus on three main area of actuation during the lifecycle process of design, construction, utilization & demolition. The term “life cycle” of a building describe the time span between constructing & demolishing a building. In the life cycle costing ( LCC ) that goes with the life cycle, the costs for planning, constructing, running, maintaining, maintaining the value, demolishing & disposing of a building are compiled in the total costs calculations. The LCC stands therefore for a holistic approach to cost optimized building planning. High structural performance, being strong but lightweight High durability, giving the building a long life. High acoustical performance, absorbing or blocking sound for better occupant comfort. (This helps lengthen building lifetime and increases use.)

**Water Resources in Buildings**

There are several ways to get the most out of every drop: water-efficient fixtures and equipment, water-efficient irrigation and landscaping, recycling water so it can be used more than once, and capturing rainwater. You can also purify the water on-site with living machines or advanced septic systems. Good system design and good specification of products can easily reduce water use by 50% or more.

- **Water-Efficient Fixtures and Equipment**

Water-efficient fixtures and equipment are perhaps the easiest way to reduce potable water use. You can calculate the predicted water savings using simple formulas.

- **Wastewater Recycling**

Many water uses (such as irrigation, toilet flushing, decorative fountains) do not require potable water. Wastewater recycling is the reuse of water after it is no longer potable.

- **Water-Efficient Irrigation and Landscaping**

Water-Efficient irrigation and landscaping save water by choosing different irrigation equipment, different plants, and sitting plants differently. They can also be combined with water reuse.

- **Rainwater Harvesting**

Rainwater harvesting is generally used for irrigation and toilet flushing or other grey water uses, though it can also be used for drinking water if it is adequately treated.

**Retrofitting for Energy Saving**

There are numbers of various new building envelope technologies available to retrofit an existing building envelope, including roof, doors & window & wall technologies.

**Considerations for Retrofitting Existing Buildings:**

There are many considerations to take into account when retrofitting an existing building. The first is Indoor Air Quality (IAQ). Highly insulated buildings can accumulate noxious gases if they are not ventilated well.

The second consideration is the cost of the retrofit. Life cycle cost payback is calculated taking the cost of the retrofit and dividing that by the potential annual energy savings. The lower the

payback, the better the value of the retrofit. If the payback period is greater than 10 years the project is not considered.

The last consideration when retrofitting a building envelope is the safety benefit of the retrofit. All of these considerations will be taken into account when the different building envelope technologies are evaluated.

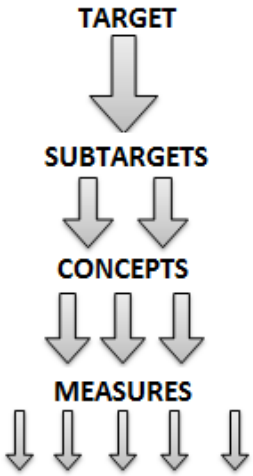


*Fig: Strategies for energy efficiency optimization*

If COETA Campus is to become "*The campus the Earth needs"* one thing it needs to demonstrate is, that it cares for it environment. Also that its activities are ecologically sustainable rather than exploitative. The initiatives may be taken up by the College Community –

1) Optimization of building envelop – using the daylight, decentralized ventilation, avoid overheating, generating electricity etc.
2) Water conservation & Recycling waste water.
3) Renewable Energy – solar, wind, energy from biomass, oil seeds, solar desalination.
4) Landscape – forestation, green belt( indigenous trees, shrubs, creepers) biological corridor (area around water body, nallah bank ) irrigated landscape (botanical garden, nursery ) commercial planting etc.
5) Eco-friendly as a way of life in campus –

1) Transportation: use of public transit system, car-sharing programme, shuttle buses, bio fuels efficiency, bicycle initiative. 2) Food: organic food, local food, food procurement& production, minimizing bottle water use. 3) Environmental Procurement : recycle paper, reusable water bottles, biodegradable dishware, computer (old) reuse, use reusable dishes &utensils, take notes electronically, short shower while bath, buy ecofriendly products, stop using disposable

items, buy second hand, buy local & re-sell, embrace a minimalist life style. 4) Small scale energy efficiency: computer energy saving programme, bold stickers reminders turn off lights & taps.

**CONCLUSIONS & RECOMMENDATIONS**

1. Majority of heat transfer takes place in building through walls, roof, floor, ceiling & glazing i.e. the envelop. It is predicted that the next decade will be the decade of retrofitting & existing building that have a remaining service life of 25 or more years.
2. With changing times, easy retrofits can make these old buildings as energy efficiency as most modern buildings. These retrofits are technically feasible & reduce energy consumption & costs, but can have relatively long payback periods.
3. Use of Value Focused Thinking would be an appropriate methodology for selecting Energy Efficient Building Envelope technologies to retrofit into existing building.
4. Delivering economic development through sustainable energy sector- Our institute may act as facilitator for providing goods & services relating to technology transfer.
5. Our college as both providers of education & research in this field.
6. NGO's & students associations- this voluntary sector include professional institute/bodies such as NASA, PISA , student pressure groups.
7. The green campus approach represent an opportunity to initiate a cultural paradigm shift, where by university & college become leader in sustainability.

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