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ROLE OF OFFICE OPEN SPACES IN SUSTAINABILITY

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ABSTRACT

Today's world is facing a great and serious crisis of energy. It pertains more in cities than in rural areas and its condition is worst in the metros. Approximately 40% of the worldwide energy consumption is attributed to buildings for lighting, heating, air-conditioning, and so on. The trend of making office building air conditioned increases, which in turn increases requirement of more energy and adverse effect by increasing foul gases in atmosphere increases globalwarming.

The Open Spaces are like lungs (the breathing organs) to the society and helps in creating a healthy environment. Sustainable architecture is an approach of living within the capacity of supporting eco-system. The open spaces directly or indirectly supports in achieving the basic principles of Sustainable Architecture. The buildings are designed to restore & regenerate own resources on site by using various strategies/technologies, so the demands are met in the long run. The arrangements like Rain Water Harvesting, Waste-water recycling. Solar power & Wind power arrangements, Waste management, Roof top agriculture can only be made functional & fruitful by their application in Open Spaces. By proper design of built-form with respect to open spaces & its various attributes further enhancement in the output of open spaces for resource restoration & resource generation can be produced.

SUSTAINABILITY

The World Commission on Environment and Development has put forth a definition of "sustainability" as meeting the needs of the present without compromising the ability of future generations to meet their own needs.

— From Our Common Future (London: Oxford University Press,1987).

At the Earth Summit in Rio de Janeiro, the residents of this planet officially embarked on a new era of conservation practices. The Rio Declaration on Environment and Development declared that "environmental protection shall constitute an integral part of the development process and cannot be considered in isolation.[1]

NEED OF SUATAINABILITY IN OFFICES

Throughout the life cycle of office building, it affects the local and global environments via a series of interconnected human activities and natural processes. As per the present scenario, the trend of making office building air conditioned increases, which in turn increases requirement of more energy and adverse effect by increasing foul gases in atmosphere increases global warming.

India is one of the warmest countries in the world. The spiraling urban growth, the number of buildings, energy consumption and the resultant carbon emission is on a rise in the country. **As per the 17th Electrical Power Survey (EPS)**[2]of the Central Electricity Authority, the electricity demand is likely to increase by 39.7% in 2011-12 as compared to 2006-07, by another 43.7% in 2016-17 as compared to 2011-12 and by yet another 37.5% in 2021-22 as compared to 2016-17. With a near consistent 8% rise in annual energy consumption in the residential and commercial sectors, building energy consumption has seen a increase from 14% in the 1970s to nearly 33% in 2004-05. Electricity use in both residential and commercial sectors is primarily for lighting, space conditioning, refrigeration, appliances and water heating.

As per the report (Environment and energy sustainability: An Approach for India)[3] there is likely increase in energy consumption from 140 TWh in 2005 to 1200 TWh by 2030. This increase in consumption will be due to increase in demand of air-conditioning as affordability and power supply increases. By 2030 over 60% of commercial spaces likely to beair-conditioned.

Considering the fact of high consumption of energy in the present and in the future there is a need to change the approach towards designing and usage of office buildings and open spaces. There are various different possibilities to it, one is by reduction in energy consumption and another is by generation of energy. It can also be demonstrated as Sustainable approach by restoration and regeneration of naturalresources.

SUSTAINABLE ARCHITECTURE

Sustainable architecture is a general term that describes environmentally conscious design techniques in the field of architecture. In the broad context, sustainable architecture seeks to minimize the negative environmental impact of buildings by enhancing efficiency and moderation in the use of materials, energy and developmentspace.

ZERO NET EMISSIONS IN BUILDINGS[4]: Zero net emissions are accounted for Zero-energy buildings. Zero energy buildings are defined as buildings that produce as much energy as they consume over a full year. „Zero energy" states that the energy produced on-site through renewable sources (such as wind, sun) is equal to the energy used by the building when annual accounting is done.

SUSTAINABLE DESIGN

"Sustainable design is the design is a design philosophy that seeks to maximize the quality of the built environment, while minimizing or eliminating negative impact to the natural environment." (McLennan 2004)

Sustainable design (also called environmental design, environmentally sustainable design, environmentally conscious design, etc.) is the philosophy of designing physical objects, the built environment, and services to comply with the principles of economic, social, and

ecologicalsustainability. The goal of sustainable design is to find architectural solutions that guarantee the well-being and coexistence of these three constituent groups. In this type of design approach both segments of a site Built form and the open spaces are designed keeping in mind the basic principles of Sustainablearchitecture.

Three principles of sustainability in architecture:[4]

- **Economy of Resources** is concerned with the reduction, reuse and recycling of the natural resources that are input to abuilding.
- **Life Cycle Design** provides a methodology for analyzing the building process and its impact on theenvironment.
- **Humane Design** focuses on the interactions between humans and the natural world.

These principles can provide a broad awareness of the environmental impact, both local and global, of architectural consumption.

OPEN SPACES IN OFFICES FOR SUSTAINABILITY

TERI, defines: "*A Green building is designed, constructed and operated to minimize the total environmental impacts while enhancing user comfort and productivity*" (GRIHA, 2008).

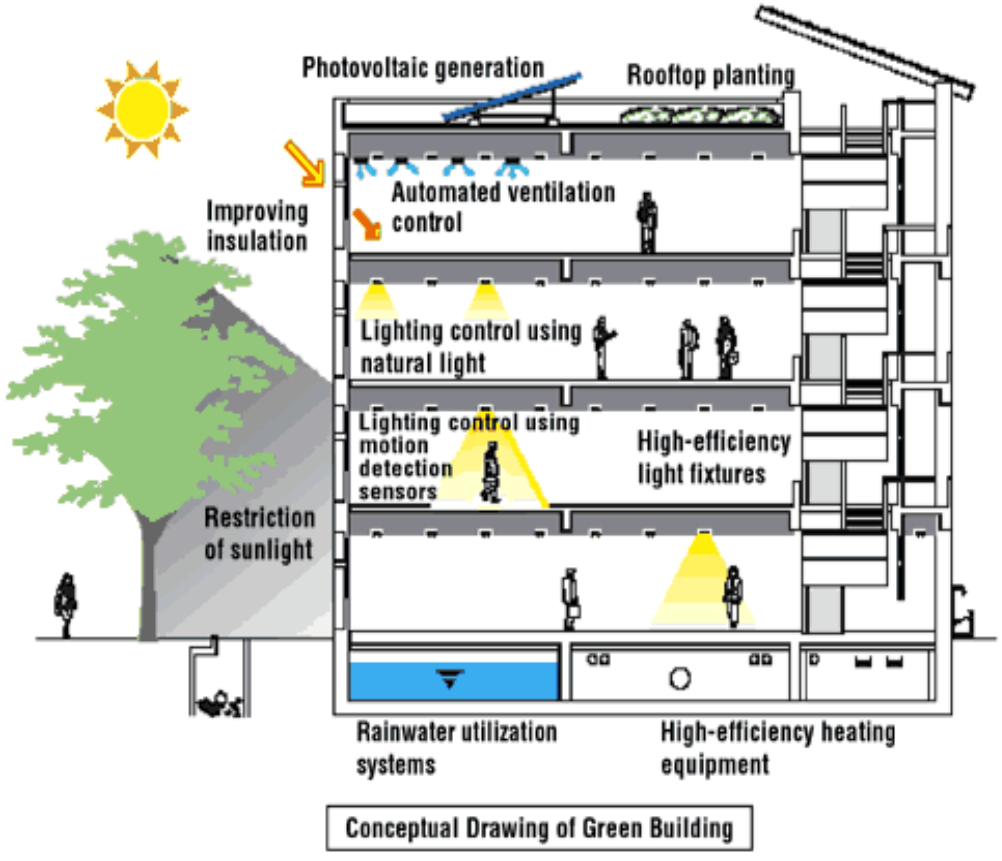

Fig.1: Conceptual Green Building

While considering any site there are two things only, One is Built form and the other is Open Space surrounding the building and/or within the building. Although these are of equal importance but the built form in general enjoy a little preference over the open spaces. But these are the open spaces which actually promote & help in healthy habitation in the buildings. It may be considered because of its functioning the built forms are primarily energy consumers and on the other hand the Open spaces are energy producers (as it is said Energy saving is energy producing). Provision of open spaces like streets, pathways, court yards, terraces of suitable sizes and at proper locations not only provide good and healthy living conditions to the inmates in buildings but also help in achieving energy efficiency through light & ventilation. With growth of population, more buildings would be required to be constructed to meet the increasing demand of shelter, trade & commerce, industries, institutions etc. and level of energy consumption are likely to rise accordingly.

Making sustainable buildings have distinct advantages in terms of not only saving money on energy costs but also reduction of adverse impact on the environment through the reduced consumption of resources, use of fossil fuels, increased comfort levels achieved through effective use of natural light andventilation.

Sustainability in office buildings can be achieved by: There are different ways to achieve sustainability in office buildings by using the open spaces in and around the building.

- **Catering to its water demand from Rain water harvesting and Waste water recycling:** Rainwater harvesting is a technology used to collect, convey and store rain for later use from relatively clean surfaces such as a roof, land surface or rock catchment [5]. A major portion of rainwater that falls on the earth's surface, runs-off from streams to rivers and finally to the sea. An average of 8% of the total rainfall recharges the ground water aquifers. Therefore, most of the rainfall goes waste in the form of surface run-off. The water harvesting system employed in open spaces of offices effects in two ways, first by recharging the underground water table of the region. Second by using the ground stored water to fulfill the needs of ground activities like vegetationsetc.

  How much water can be harvested?

  Chenni water metro department employed successfully the rain water harvesting system and formulated a general consideration for quantity of rain water can be harvested. By considering a building with a flat terrace area of 100 sq.m. The average annual rainfall in Chennai is approximately 1300mm. In simple terms, this means that if all the rain that falls on the terrace is retained, then in one year there will be rain water on the terrace floor to a height of 1300mm.

Area of Terrace	100 sq.m.
Height of rainfall	1.30m (1300 mm)
Volume of rainfall over the Terrace	Area x Height of Rainfall 100 sq.m. x 1.30 m : 130 cu.m. (1,30,000 litres)

Source:http://www.chennaimetrowater.com/departments/rwh/whatwhy.html*

Fig.2: Water harvesting data from Chenni metro water department

Fig.3: Different Resource generation & restoration systems in open space

- **Catering to its energy demand from renewable energy resources suchas**

Solar power: In office buildings the day to day needs of energy can be approached by using solar powers. Sunlight can be converted directly into electricity using photovoltaic (PV), or indirectly with concentrated solar power (CSP), which normally focuses the sun's energy to boil water which is then used to provide power.

Photovoltaic roof tiles - These are special tiles that are used on the roof of a house to take full advantage of sunlight.

Solar panels - These are panels placed on the roof of a building to collect the heat from the sun, which can be used for making electricity.

Street Light solar panels – Solar panels mounted with lamp post used for Street lighting.

Wind power: The concept of wind power is not very much used in India due to non availability of high speed winds throughout the year. The wind generator is designed to provide utility grade power for domestic purposesThe wind generator utilizes the power of the wind to produce electricity. With increasing wind speeds the power output of the generator increases.

- **Maintaining micro climate & provision of roof top agriculture:** The open spaces in offices also help in controlling micro climate of the region. The provision of landscaping in open spaces on the ground level in the form of lawns and on the top terrace in the form of terrace agriculture. The heat gain and heat lose can widely be controlled through sensible spacedesignbytheprovisionofvariousgreyandgreenspaces,water-bodiesandlandscape elements.

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Fig.4: Terraces Garden

LANDSCAPING

There is a strong public interest in creating pleasant open spaces, and in this sense, thermal comfort is as important as acoustic or visual comfort.[6]Gullone (2000) states that certain landscape features that we find aesthetically pleasing today may have an affinity with those that enhanced the survival of the species – for example, bodies of water, plants and animals, higher areas, trees with low trunks, trees with high canopies (Kahn, 1997; Wilson, 1984). Natural open spaces and well-designed green spaces provide a locus for recreation, social interaction and community action, are a source of employment and natural resources, and are highlighted as having a particularly positive influence on health and well-being (MacArthur, 2002; Gruber, 1986; Steptoe and Butler, 1996; Gordon and Grant, 1997; Calfas and Taylor, 1994; Ulrich and Parsons,1992)[7].

Effective use of landscaping as part of building design can help considerably in lowering energy consumption in the buildings. Gardens can act as significant climate moderators. Use of deciduous trees/vines can help in providing required shade during summers and permitting winter sun to filter through when the leaves are dropped, as a simple option to manage the ill/good effects of sun. Plantation of trees can also be used to shield the buildings from adverse impact of some trees. Shrubs or creepers grown an open pergola on the southern face of a building can provide windows with required level of shading in the summers. Use of evergreen creepers and trees along Western walls can help in considerable reduction of heat intake in the summer. Use of shaded paving on the south and Western sides should be avoided to minimize the intake of heat reflected intothe windows during the summer. Wherever provided they need to the properly designed andshaded.

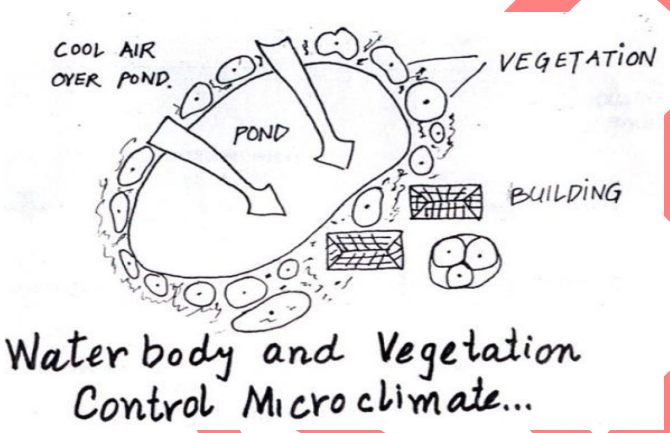

Fig.5: Water body helps in controlling micro climate

CONCLUSION

Office buildings consume large amounts of electrical energy for air-conditioning and lighting.[8]Further increasing urbanization imposes immense pressure on the energy resources. Except the Solar energy other energy source like fossil fuels, quality water etc. are limited & diminishes considerably, if we don"t plan, design and develop buildings by using appropriate strategies and incorporating concepts of energy efficiency and sustainability we may create hell for the future generations.

Appropriate knowledge and technologies are available for creating Sustainable buildings. These technologies are beautiful blend of Natural as well as Artificial energy saving measures. Use of proper Open spaces of proper size & orient these not only creates healthy living habitation but also efficiently improve buildings energy performance and helps in achieving the desired results of sustainability.

Various technologies like Rain water harvesting; Waste management, Solar & Wind energy etc. can effectively be used/employed in the open spaces. It is easy & clear to understand that Roof tops/ terraces can be used to collect the rain water for rain water harvesting, Roof tops & big streets with appropriate width & orientation can be used to employ Solar and wind charging installation units.

To achieve the goal of sustainable society in buildings full co-ordination of various components of community like design community(architects and professionals engaged in the field of architecture and construction), financial community, Policy makers, building industry offering product and services for supporting energy efficiency, building owners and end users.

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