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SUSTAINABILITY ASPECTS ON ECOLOGY CENTERED GREEN BUILDINGS

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ABSTRACT

Earth faces many issues putting at risk the human way of life. This situation is caused by various factors related to population growth, industrialization, urbanization and comsuption rate. In order to overcome these problems, only solution may depend on a sustainable living. Converting settlements into an eco friendly habitat based on natural implementation could provide humanity a safer future.

The study focuses on qualities and regulations on sustainability for the design, construction and merging of green building into the natural environment. Green buildings provide a collective life to the inhabitants as well as providing support in closing gap with the nature. Design and construction tips presented in the study are eloborated with global and local implementation examples in order to provide a deeper undertanding of a global issue. The study also mentions the aesthetic, financial and social awareness related values of green buildings.

Keywords: Green Buildings, Ecology, Sustainability, Global Warming, Architecture

INTRODUCTION

As mentioned by Kavut (2020), accommodation is a shifting dynamic changing and arranging the relationship among people. As a result of goals on urbanization various styles of habitation types emerge depending on the society.High rises decorated with vegetation provide an ecological life style enhancing visual perception of the city panorama as well as a unique experience for the tennants. Plant implementation on horizontal and vertical axis support the structure to blend in with the vegetational surrounding. In a world weary with global warming, planting implemantations provide a welcome support in aiding the planet.

Hypothesis of the study is 'ecology centered high rises aids in the battle againts global warming and adds an aesthetical value to the perception of the city'. The study presents and provides information about the reasons, results and solutionsregarding the term of global warming. Then the notion of a 'Green Movement' is explained in order to justify the change that is taking place for Earth made possible by sustainability implementations. The study provides descriptions and examples about 'Green Buildings' in order to layout the observations and resolutions regarding the hypothesis.

The study aims to present the construction requirements related to design and ecology by providing literature content and examples in order to lay out the ecology centered sustainability properties of green buildings.

1. GLOBAL WARMING

Climate has been a global concern in the last decade. In 2008, in order to decrease the amount of greenhouse gases, The Kyoto Protocol initiated by the UN as a great undertaking for the planet. Even though the protocol carries an immense importance for the world, many countries such as US and Turkey have not participated in this global ordeal.



Problems such as industrialization, comsumption rate, fossil fuel, CO2 osciliation and enviromental problems led to disasters such as seasonal shifts, global warming, arctic meltdown, rise of sea levels, forest fires, erosion, reduction of coral reefs, etc.

1.1 Green Movement

The study encompasses the subject of green buildings to be able to provide a foundation for the claims and observations presented. In order to provide a better future for generations to come, green movement came to life implying to a greener society. Conceptual ideas and public inititives like green villages based on an ecological life style on micro scales paved the way for energy saving green buildings on a macro scale. Goals of the green movement can be listed as show below:

1) Providing a healthier and a more productive environment for the tennants.
2) Decreasing negative effects of the population from the environment.
3) Administering green roofs, walls and interiors.
4) Economically cutting administrative costs and energy saving for the building.
5) Providing an ecology based experience.
6) Aesthetically enhancing the environment.

1.2 Sustainability

The term sustainability refers to the contuinity of productivity and diversity with the promise of permanence. Productwise sustainability is the longevity regarding the life cycle of a product implying to the transforming functionality of the asset. The introcution of the term dates back to the report published by the World Environment and Development Commission for the UN in 1987.

Sustainability culturally has various definitions and roles and can be applied to many areas. The study approachesthe term through the lens of environmental and design oriented perspective. The goal of sustainability is the sustanance of human life through homeostasis which refers to the balance between mankind and ecology. All aspect of a homeostatic life

implies the relationship amongst social development, environmental conservation and economic growth in order to achieve goals on sustainability.



The consequence of decisions to settle is a heavy price for all humanity. Without taking the necessary measure environmental conservation is not applicable leading to poor economic growth. Results of this situation may be as catastrophic as global warming, pollution, specie loss and settlementsof no identity all point out to the beginning of the end. Results of poorly planned urbanization weighing heavy for all mankind need an urgent transformation into an ecological life style. Unnecessary energy consumption leading to the depletion of resources indicates the range of an energy dependent society. Greenhouse gases effecting the breathable air placed all lives and at risk as well as the future.

1.3 Environmental Sustainability

Earth with depleting resources has to find a way to make up for what is lost. The situation putting all life forms in danger, with the desire to find a solution came up with the constantly spreading incentive of environmental sustainability. Unfortunately efforts are mostly in vain applicable still only to few, is still under the risk of a collapse. Environmental sustainability refers to the transfer all assets and resources to future generations. Only then earth can replenish and provide a safe future for all.



Policies and treaties signed various countries based on environmental sustainability is the proof of the effort and desire to make earth fertile once again. Even though global economic interests and expectations tend to slow down the process of change, if humankind has the desire to live long, it can be suggested that every country provides their share of effort. In 'The Limits to Growth' report prepared in 1972 published by Club Roma, the relationship between growth and usage of natural resources has been presented focusing on sustainability.

In 1972 organized by the UN, 'Human Environment Conference' took place in Stockholm, focusing on renewable energy resources and preventions for environmental protection. Up until now, many initiations have begun working hard to make the world habitable for the future generations. As individuals having the chance to live in a preferred manner, the choice to live in an ecological structure offers many possibilities regarding the quality of life. Green buildings provide the possibility to protect the environments as well as adding a unique aesthetical value to the surroundings.

2. ECO STRUCTURES

Ecological buildings require a specific design approach for the integration of vegetation horizontally or vertically. Apart from having a longevity value, vegetation also provides energy saving and protection against the elements. From an design point of the view, unique structures add an aesthetical value to the perception of the environment. Eco building implementations can be realized in various ways such as green roofs, green walls, Biofilter and indoor vegetation.

The growth of high buildings is the result of various factors leading to a understanding in architecture and urban planning. These reasons can be listed as populatin growth, technological advancement, prestige, request of the society and urbanization. There are additional cultural and economic reasons that have had an effect on the emergence of skyscrapers. The merging of term *green* mentionedin the 90's and the term of sustainability initially used by the UN in 1987, led to the green buildings of today. Each country has their own regulations on sustainability depending on the height of buildings constructed. In the US 12 storey buildings are classified as high rises meanwhile Germany has set a 22m limit.

In a contemporary approach, high rises can be defined as transformational symbols of development as mentioned by(Tapan,1984).High buildings can be classied as green, smart buildings and high rises. High rises consist of buildings higher than 15 storeys meanwhile green buildings and smart buildings do not have a height limit. Smart buildings usually perform cutting and technological features and green buildings support ecological recycling as well as vertical and horizontal gardening implementations. Aytıs (1996) mentions the necessity to regulate the height, planning and design of structures in order to achieve a better outcome for urban planning decisions.

2.1 Ecological Landscape Adaptability

Sun, wind and soil provide an energy loss of 4% that need to be compensated by proxy resources. Waterproofing wall, panels, walls, roof isolation and scaffolding create a protection for isolation and heat conservation as well as engineered window frames and structural positioning.Landscape adaptability also plays an important part in obtaining an ecological quality of life. Factors that contribute to an ecological life style can be listed as shown below.

1) Adaptable choice of plants to environment.
2) Conservation of the natural site surrounding the structure.
3) Selection of plants that do not require constant watering and care.
4) Using a natural fertilizer.
5) Covering the roots of trees with leaves and fallen pieces of bark.
6) Integrating territorial landmarks to the general scenery design.
7) Curing and protecting the top layer of earth.
8) Separating the botanic soil from the rest.

In order to produce a sustainable structure abovementioned factors need to be taken into account during design, construction and adaptation stages. Environment centers implementations secure the adaptability of the structure to nature as well as providing a greener quality of life. As it is not always possible to transform any structure in terms of sustainability, green buildings provide the required solution to reach the goals on ecology.

3. GREEN BUILDINGS

Green buildings that are decorated with green vegetational implementations provide protection against the elements as well as preserving heat. They have the ability to increase heat performance by 50%, as indoor plants can cool the room by 10 degrees and biofilter indoor air up to 50%. Vegetation integrated to green buildings effect the micro and macro environment allowing climatization to provide a financial profit.

These kinds of implementations encapsule variouse indoor and outdoor plant convenient to climatization. Vegetation that has been lost due to urbanization and constructions may be replaced witg green implementations 360 degrees. Ken Yeang (1995) has designed many strategies that encompass energy, water, lighting ideas transforming into concepts focusing on ecology. In order to optimise the use of resources, green buildings are the contribution of architecture to ecology. For humanity to fully integrate with nature, conserve the health of inhabitants, optimise usage of resources and create a minimum impact on the environment, green buildings offers a great deal.

Height of buildings is a subject related to growth the of cities (Aytıs, 1996). Ever since the industrial revolution, progress being made with migration taking place led to a point where over growth began threatening the lives of city dwellers. The solution to this problem presented itself as multi storey building located around a green area such as a park.Concept of green buildings can be defined as structures that are implemented with features that are compatible with the rules of sustainability. Some buildings relate to this definition with vegetation implementation indoor and outdoor on appropriate structures.

3.1 Properties of Green Buildings

Green building construction adaptability regulations and goals depend on many factors. These factors close the gap in constructing or converting a structure into a green building regardless of housing concerns. Housing concerns can be integrated into design choices as well as in to the urbanization goals. In order to achieve goals on ecology the transformation should involve the factors as listed below.

1) Usage of renewable energy resources.
2) Production of own energy from the sun, wind, soil and water energy.
3) Sewage and drain water recovery.
4) Daylight utilization.
5) Heat isolation activity.
6) Environmental landscape adaptability.
7) Usage of local materials.
8) Vegetational soil conservation.
9) Prevention of heat island forming.
10) Solid waste management.

Factors mentioned all contribute to the preservation of nature as well as balancing the effects done by humankind on ecology. In order to extend the lifespan of nature, with necessary precautions global warming has to slow down to an extent where it can no longer threaten the

existence of all species. Green building external resources depend on choices made by the design and administrative parties. Internal elements such as energy saving strategies depend on implementations made during design and construction stages. Energy saving systems can be classified as shown in the next section in order to provide a wider explanation of the alternatives.

3.2 Energy Saving Systems

Heating, cooling, lighting and electronical equipment rely on fossil fuel energy as coal, fuel and natural gas. Apart from renewable hydroelectricity energy source, in traditional buildings 85% of energy consumption is recovered by fossil fuel resources. Green building energy saving systems function depending on various technologies and the essential infrastructure.

Energy systems consist of cogeneration units, sun batteries, wind turbines, solar heat collectors and heat pumps. Environmental systems can be classified as rainwater recovery systems, gray water reuse systems, sunlight chimneys, lawn irrigation systems, low consumption toilet systems.Systems installed for employee and environmental health can be listed as ventilation systems providing high clean air and ambient air quality detection systems.

3.2.1 Waste water recycle methods

Waste water can be recycled in various ways. Recycled water can be reused for structural requirements distirbuted to the building and the site. Rain water collection, waste water collection, treatment of collected water, use of treated water in areas such as garden irrigation, low capacity reservoirs and economic fixtures provide an essential use of collected elements.

3.2.2 How to benefit from daylight

In order to benefit from daylight as much as possible, certain architectural and landscape design decisions may provide anoptimal outcome. As a design centered decision, considering the dominant sun direction may be a smarter choice while positioning the structure. Using large window openings on the south facade may aid in recollecting sunlight inside the structure. Deciduous trees in the south, coniferous trees in the north create a energy isolated landscape. In a setting composed of multiple buildings, correct positioning of structures relative to each other is required. The purpose of storing solar energy is to store and use solar energy during the day and to use the heat stored at night to heat the structure.

3.3 Advantages of Green Buildings

Green buildings have many advantages reflecting on the environment as well as enhancing the quality of life for everyone. Solutions provided encapsule increasing the quality of the soil, improving water surface quality, reducing the load on the sewage system, providing an opportunity to renew the underground resources, purification of storm waters, air filtration, contributing to oxygen production, urban heat balancing, contributing to plant fauna, contribution to landscape, contribution to health and visual enjoyment (Yeang**,** 2000). All these factors mentioned pave the way in living in harmony with the ecosystem increasing the chance of preserving and protecting the nature.

3.4 Global Green Building Examples

Green building design is a field oftenly preferred by renowned architechtural studios and construction firms. The primary reason for this preference is the social responsability nature of these iconic structures.

The Shangai Bank project by Norman Fosterhas a unique approach on sustainability and on ecology. The iconic structures is easily visible has a reputation of being a landmark object for the city.



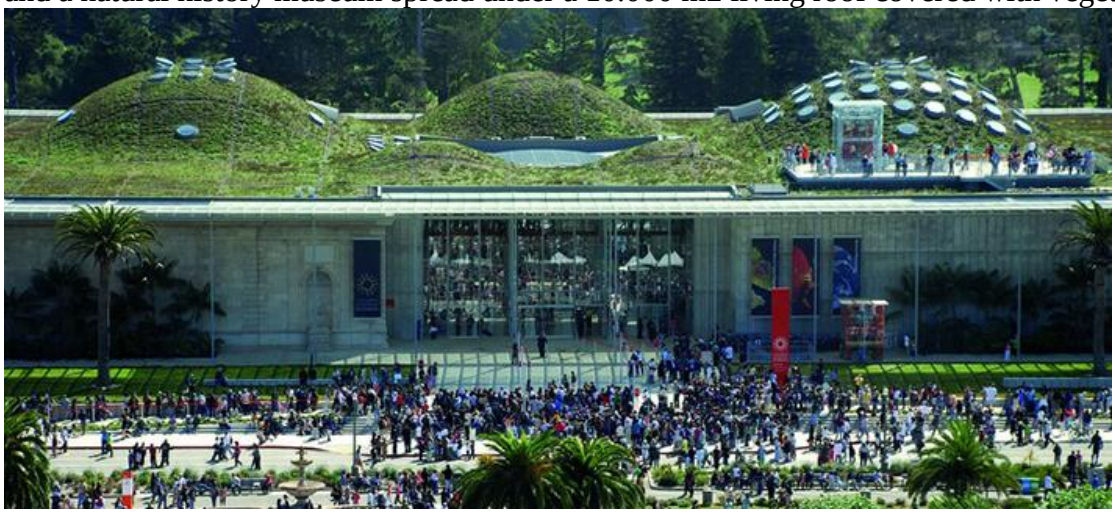
The project is an iconic implementation based on the cooling water collected from the sea permitting the irrigation system to be pumped into the toiletsthat allows low consumption of clean water.

Beijing Airport by Foster & Partners withholds the claim of having the most sustainable strategy concept with its environmental policies.



Seasonal change in Beijing has led to decisions regarding the positioning of the structure with southeast roof lighting slits to save heat and environment control systems decreasing energy consumption while keeping carbon emission on minimum levels.

Science Museum California by Renzo Pieno is currently the greenest museum on the planet. Located in San Francisco Golden Gate Park, the museum consists of a planetorium, aquarium and a natural history museum spread under a 10.000 m2 living roof covered with vegetation.



Often green buildings resemble normal construction even though they rely heavily on sustainable materials, energy saving lighting and low preassure irrigation systems. Only a handful of projects can actually compare to Renzo Piano's project with its unique approach and concern about the planet. The sharpness of the structure, its strong expression, aesthetical approach and sustainability features present an important opportunity of a further dialogue regarding ecology and environmental issues.

3.5 Local Green Building Examples

Environmental awareness is a subject undertaken by various schools and architectural studios for quiet a long time. Research, competition and project based implementations have taken place in Turkey for the last 30 years. National milestone projects on sustainability are presented below in order to provide an insight on the historical development of the topic.

RMI Turkey, first green building

RMI designed by Efekta Architectural Studio, with its ability of generating renewable energy and energy preservation features is a unique structure. Located in an indoor area of 2217 m², the structure has been constructed in 2006.The structure consists of 210 tons of construction steel intergrated with reinforced concrete and steel carcass costing around 3 million €.



Energy Conservation: In order to decrease the heating and cooling energy consumption, carbon reinforced thermal insulation boards with double thickness is used.

Sustainable Energy Consumption: Ground Source Heat Pump System installed provides the heating and cooling energy requirements of the structure.

Natural Illumination Benefits: 190m² roof opening provides almost 90% of courtyard illumination requirements.

Natural Ventilation: Natural flow of air into the structure takes place through the embedded air-to-airsystem. This unit provides energy transfer between the polluted aircoming out of the building and the fresh air introduced into the building, thereby reducing heating and cooling costs.

Award: RMI has won various awards of which demonstrate the importance of the project locally and globally. Med-Enec competition held by The European Union Energy Commission,the project won first place in National Project category and second in the general

classification. The project has also been awarded by The European Commission, Joint Research Center with its status given as the first green building in Turkey.

METU Solar House

First local sustainable building project initiated in 1990. 30 years ago first project 'Metu Solar House' on sustainability has been designed by Mete Turan and his students during a summer internship project.Still in use as an office structure by the Metu academic staff, the structure carries a national historical importance regarding an ecologic approach on architecture.



Primary goal of the project is to obtain hydrogen and saving solar energy for heat and electricity sustanance of a residence. Solar batteries store energy during daytime and distribute stored energy during the night. Panels situated on the roof automatically rotate towards the sun during different seasons allowing the maximization of stored energy. The system also enables the production of hydrogen that is stored as a back up for cloudy days.

5. INTERNATIONAL SPECIFICATIONS

As projected by the EU Industry Committee around the year 2000, by the end of 2018, every building will produce its own energy with the installation of solar panels and heat pumps. In order to achieve this goal, there are certain certifications to evaluate the sufficiency of an implimentation on ecology.

5.1 Green Building Certifications

Green building evaluation certificates aim to assess the competence of a structure. The appointed council is composed of various delegates selected from different areas of the construction industry. The goal of the initiative is setting a standard for the validation of green building applicable to most constructions. Introducing the green concept to the industry, reinforce and incourage green competence and conversion of the current industry to a greener one. 4 categories of international and national certificates can be listed as LEED, Breeam, Dgnb and Çedbik. The study elaborates information on Leed and Breeam due to their international recognition.

5.1.1 LEED

Leed certificate depends on evaluating the structure based on four criteria. These criteria are sustainable terrain, water usage solutions, energy-atmosphere, materials -resources, interior air quality and innovation-design.

5.1.2 BREEAM

Breeam certificate evaluates buildingsbased on 10 categories. These categories can be listed as building management, health-wellness, energy, water, terrain usage-ecology, transportation, materials, waste, pollution and innovation.

5.2 Beckhoff Automation Technology

The installed system provides maximum energy conservation for new and transformed buildings. Centrally run automated library meets all energy saving process as suggested by European Standard EN 15232and requirements on function control.Central heating system, climate system, room automation, lighting, climatization and all other functions are provided for service to the tennants.

6. CONCLUSIONS

The study explains, comments and provides milestone examples regarding the title and goals set in support of the hypothesis. Even though the intention of designing, constructing or converting a building in a green concept, certain mandatory, enviromental and urbanization regulation have to be respected. This implies to the fact that a green strategy has to be followed in a systematic way beginning from the macro scale to a micro scale. Green buildings have a great impact on the individual and collective quality of life, society and the environment.

It is possible to mention the importance of design and positioning qualities of a building emphasizing the prominence of isolation, landscape, construction and ecology centered factors. Presented literature demonstarates the necessicities that need to be respected in designing and constructing a green building. As green buildings support collective life based on sustainability regulations, having awareness about the planet may help solve problems such as global warming that effect humaninity.

Designing and constructing a building with essential regulations is not sufficient to claim that the structure is eco-friendly. Without a valid certification, it is not possible to state that a building is green just because of its color. In order to prove the adaptability regarding a sustainable infra structure, required certification evaluation criteria prove the validity of the structure. As mentioned by Yeang (2016), ecoarchitecture is an approach embracing the nature in order to design living constructed ecosystems.

Examples presented provide different approaches, design and construction implementation methods. It is possible to state that the vegetation surrounding the structure has an important role regarding climatization and protection against the elements. Design plays a crucial role for purposes related to collective living, blending with the city, financial values and aesthetical values as seen from the examples.

Result of the study conducted show that green roof, wall and building implementations manipulate perception in such a way that the building seems as an organic entity. Green practices cover the building with a second skin regardless of the physicality of the structure.For future studies, green roofs, green walls and smart building design may be subjects of value investigating in order to further the discourse. Sustainable living has given humanity a second chance for living in harmony with the planet that requires a special care with the population growth.

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