Strategy to Make JSPM'S ICOER A – Building Carbon Neutral

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Abstract – Climate change is the most serious challenges the world is facing. Addressing this challenge is a shared responsibility of all governments, universities, businesses and other wider community.

All across the world, colleges and universities are trying to become Carbon Neutral. To become Carbon Neutral, universities are working to reduce their Greenhouse gases emissions, cut their use of energy, use more renewable energy and emphasize the importance of sustainable energy sources.

Following are the tasks which need to be accomplished to become Carbon Neutral:

- ***Creating an inventory of Green House Gas (GHG) emissions.***
- ***Coming up with detailed solutions to achieve Carbon Neutrality.***
- ***Working out a practical schedule to implement those solutions.***
- ***Developing a realistic plan to finance the process of achieving Carbon Neutrality.***

This paper discusses the ways to minimize the Carbon emission at JSPM'S ICOER Campus A-Building located at Wagholi. For the existing pattern, suitable suggestion will be given based on techno-economic feasibility.

Keywords: Carbon emission; Greenhouse gas; Sustainable energy; Carbon neutrality.

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INTRODUCTION

Climate change is the most serious challenge the world is facing. Climate change has many different aspects to it. Climate change can be associated with rise in sea water levels, change in atmospheric temperature, changing ecosystems, melting polar ice, and so on. It may be due to either natural or human influences. Scientists from all over the world have been working to find out the cause and impacts of climate change, for more than a century but there are still gaps in our knowledge. However, most of the experts feel that human activities are having an adverse effect on our planet. Anthropogenic activities related to consumption of fossil fuels are mainly responsible for the GHG emissions. These emissions in the atmosphere are attributed to create a greenhouse effect subsequently leading to global warming.

NEED OF CARBON NEUTRALITY

Carbon neutrality is defined as action of various organizations, universities and individuals taking action to achieve zero carbon footprints an remove as much as carbon dioxide from the atmosphere.

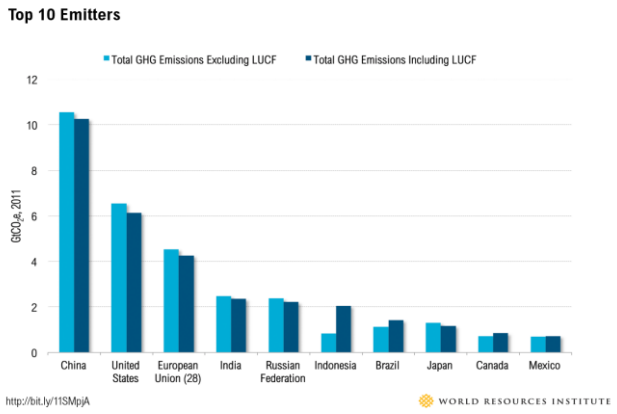
It can be achieved by various methods and techniques like installation of solar panel, setting up of wind turbines and using more renewable energy sources.

Climate change is one of the most serious challenges the world is facing. Various problems or difficulties arise such as increase in temperature , increase in water level in ocean, health problems in humans, etc.

Hence, to solve problems related to climate change, carbon neutrality should be achieved.

However, it is impossible to get zero carbon emission but we try going Carbon Neutral.

We can become Carbon Neutral by purchasing carbon offsets which is practical, affordable and easily available to neutralize the emissions.



Carbon auditing

- To determine the carbon foot prints of various elements present in the campus.
- Measure emission of various gases in terms of their carbon dioxide equivalent.
- To review the use of energy, e.g. Air-conditioner, fans and lighting, and various electrical appliances etc.
- To find an alternate source of energy this can reduce carbon emission.

LITERATURE REVIEW

Warners and Heun (2007) has worked on the carbon neutrality project on Calvin college Michigan they have created an inventory of Green House Gas (GHG) emissions and sequestration potential. They came up with detailed solution to achieve carbon neutrality. As an approach to project they have divided students in five groups and investigated the following areas:-

- Energy Use and Purchasing
- Land Use and Waste Water Management
- Recycling and Solid Waste Management
- Construction and Renovation
- Transportation

They have identified that the carbon foot print due to energy use on campus is a significant part of the overall carbon emitted by Calvin. Carbon emission are incurred by Calvin College due to energy use through two ways, natural gas combustion used for heating campus and production methods used to create the electricity Calvin uses.

Kevin .P. Crosby (2010) has done an environmental sustainable assessment report on Taylor college campus, Indiana. The assessment is divided into main sections of operations, administration, people, and finance. Most of the emphasis is on an operation which includes main category carbon emissions, energy, The goals of this project are to provide data for benchmarking and to reduce the carbon footprints and sustainable development.

Sumeet V. Khirade (2016). Has analyzed carbon emission occurring from electricity and vehicles of SCOE Campus,Pune. He has implemented the use of Solar panels as an alternative for electricity and to reduce the carbon emissions from the SCOE Campus.

METHODOLOGY

To achieve Carbon Neutrality, the following steps need to be implemented:

- Counting and Analyzing
- Action
- Reduction
- Evaluation

Counting and Analyzing

The analysis of various activities and emission coming from it is calculated. The activities which can be reduced are first identified without affecting the existing system.

Carbon calculators are easily available online which vary significantly in their uses and parameters they measure.

Action

To reduce Carbon Neutrality, various administrations and universities take proper action such as cutting their energy resources, using more renewable resources.

Reduction

This is the important to reduce Carbon Neutrality. In this, various alternative methods and techniques such as installation of solar panel or wind turbines

which limit the use of energy and reduce the emissions.

Evaluation

This step includes collection of all above data and it is evaluated for improvement to achieve Carbon Neutrality.

After evaluation is completed, the cycle is started again and experiences of previous lessons are learnt.

From this, technology is improved, demand in standard of living increases and overall improvement of building is carried out

EMISSION FROM ELECTRICITY

Estimation of carbon emission from electricity is done on the basis of the consumption of electricity per kilowatt.

Emission Factor of electricity is 0.82. *(www.epagov.in)*

Total CO2 emission from A-Building is calculated from the equation

Emission for 1 day = Use of electricity (KW)

x Emission Factor

CALCULATION OF EMISSION FROM ELECTRICITY

The power required for Tube lights is **40W**.

Total energy consumption from Tube lights is 6.4KW.

CO2 emission from Tube lights from A–Building of ICOER Campus.

= Total consumption x Emission factor

= 6.4 x 0.82 = 5.248 Kg CO2 e/ day.

The power required for Fans is **60W**.

Total energy consumption from Fans is 4.92KW.

CO2 emission from Fans from A-Building of ICOER Campus.

= Total consumption x Emission factor

= 4.92 x 0.82 = 4.034 Kg CO2 e/ day.

Total CO2 emission from Tube lights and Fans from A-Building of ICOER Campus.

= 5.248 + 4.034 = 9.282 Kg CO2 e/ day.

COST ECONOMICS

If 4 KW of solar panel will be installed.

The price of 1 KW of solar panel is Rs.40,000.

Therefore, for 4 KW of solar panel,

Price = 40,000 x 4 = Rs1,60,000.

Power Generated

For 9hrs, Power = 9 x 4 = 36 KW

So, for 1 month, Power = 36 x 30 = 1080 KW

Therefore, emission reduction for 1month by solar panel = 1080 x 0.82 = 885.6 Kg CO2 e/day.

Payback Period

Price of 4 KW Solar Panel = Rs1,60,000.

The price of 1 unit is Rs.5 (1 unit = 1 KW)

Therefore, Reduction in Electric bill for one year = 1080 x 5 x 12 = Rs64,800

Hence, Payback Period = $\frac{1,60,000}{64,800}$ = 2.5 years

In 2.5 years, the Solar Panel will be in Payback. It will start giving profit in electricity bill as well as reduction in indirect CO2 emission.

REDUCTION TECHNIQUES OF EMISSION FROM ELECTRICITY

- Use of alternate energy sources such as Wind, Solar Power and LED lighting.
- Awareness among consumers towards energy conservation.
- Energy efficiency techniques.

CONCLUSION

- There is need to recognize the sources that are directly and indirectly emitting carbon dioxide and equivalent gases.
- Use of alternatives like solar panels and wind turbines.
- There is need to focus on reducing emission by increasing the energy efficiency of the main sources of greenhouse gases such as electricity
- Solar panel will be in payback in 2.5years, hence it will start giving profit in electricity bill as well as reduction in indirect CO2 emission.

REFERENCES

Aroonsrimorakot and Yuwaree, "Carbon Footprint of Faculty of Environment and Resource Studies", *Mahidol University, Salaya Campus, Thailand*.

Kevin P. Crosby, "An environmental sustainability assessment of taylor university", *Taylor University Department of Earth and Environmental Science Upland, Indiana.*

Leonardo and Iriarte, "Evaluation of greenhouse gas emissions and proposals for their reduction at a University campus in Chile" *School of Industrial Civil Engineering, Faculty of Engineering, Universidad de Talca, Casilla 747, Talca, Chile*

Nader Chalfoun, "Greening University Campus Buildings to Reduce Consumption and Emission While Fostering Hands-on Inquiry-Based Education" *University of Arizona, CAPLA, 1040 N Olive St. Tucson, Arizona 85721, USA*

Sayam and Chumporn, "Carbon Footprint of Faculty of Environment and Resource Studies, Mahidol University, Salaya Campus, Thailand*, Faculty of Environment and Resource Studies, Mahidol University, Salaya campus, Nakhonpathom 73170 Thailand.*

Sumeet V. Khirade, Rajendra B. Waghmode, Dr.S.S. Shastri, "Evaluation and Reduction of Carbon Emission to make SCOE Campus Carbon Neutral."

Warners and Heun, "Carbon Neutrality Project", *Calvin College Michigan.*

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Study of Mechanical Properties of Polymer Concrete by Manufactured Sand and Orthophthalic Polyester Resins

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Abstract – Recently, a number of researches have involved improving the concrete technology requirements through advanced research. These studies involved high strength concrete HSC, were highly dependent on the quality of ingredient– materials. HSC production potentially involves several trial mixes and uses high quantities of fine materials thus making it very costly and time consuming. The objectives of this study were to reduce the production cost, time required and to improve HSC properties by providing control mixes and using Orthophthalic polyester resin. This was done by experimentally investigating the HSC production using 100% replacement of cement and water by Orthophthalic polyester resin and selecting the optimum replacement content. All concrete mixes were homogeneous in fresh concrete state, did not show any sign of segregation. Orthophthalic polyester resin additions further improved the workability. At the age 7 days, all concrete mixes achieved the cube compressive strength between 60 to 70MPa. Tensile and flexural strength were increased using Orthophthalic polyester resin using Orthophthalic polyester resin. Higher strength concrete showed low ductility because the ultimate strain was found less than 0.35%, there was In General 10% Orthophthalic polyester resin content was found the optimum.

Keyword: Orthophthalic polyester resin, optimum, compressive strength and flexural strength, Split tensile strength.

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I. INTRODUCTION

This paper presents the effect of different polymers on structural and mechanical properties of concrete. The aim of this study is to investigate the mechanical and Flexural properties of polymer modified concrete. Thermosetting polymers are used at different dosages to modify the concrete matrix. Besides, a series of tests without modification was also carried out. By means of four point loading method, the flexural strength and flexural properties of polymer modified concrete are measured. The influence of different polymers and its optimum dosage in respect of flow and strength characteristics are found. A comparative study has been carried out to highlight the effect of two different polymers on fresh and hardened properties of polymer modified concrete. Based on these results, recommendations are made in respect of its dosage, chemical characteristics and suitability.

For the past few decades, active research has taken place in polymer modified concrete, polymer concrete and polymer impregnated concrete. Currently the same is used as popular construction materials because of comparative high performance, multi functionality and sustainability compared to conventional cement concrete. Concrete polymer composites are environment conscious and confirm to concerns of saving of natural resources, the longevity of infrastructures and the environmental protection. Adding aqueous polymer emulsions or dispersible polymer powders in the fresh concrete mix makes polymer modification of concrete. The polymer emulsion is stabilized by surfactants, and each polymer has its own film forming properties within the applicable temperature range and the physico-chemical conditions during hardening and curing. The surfactants and the low film forming ability of most Emulsions are generally hindering the building of highly performing and durable microstructures in PCC.

The process allows building up of composite polymer cement microstructures on a nano- scale, which can

avoid the negative influences of the polymer admixtures cement interactions on the shape and distribution of the cement hydrate crystals, and on the transition zones between cementitious binder matrix and aggregates. This modified cement concrete contains two types of binder: the system based on hydraulic cement and the polymer system. An interpenetrating network of polymer and cement hydrates is generated in which the aggregates are embedded. Polymer modification is a frequently used technique to overcome some of the shortcomings of conventional concretes such as poor tensile and impact strength limited resistance to corrosion, poor behavior under severe conditions and poor adhesion of fresh mortar or concrete to old concrete. Some polymers are soluble in water and their low solubility causes difficulties in respect to the application concrete modifier. For water soluble polymers, one of the major advantages is the absence of surfactants to keep the polymers in solution. The polymer molecules are supplied on a molecular scale, improving the approach of the relative large cement grains (up till 80 μm) by the polymers. In the absence of surface active agents, the film formation on the hydrate crystals may proceed more easily and uniformly and the material properties can be better tuned and modeled.

There are various classes of water-soluble polymers that can be used for the modification of cement mortars and concrete. The first class consists of non-ionic polymers with an oxygen or nitrogen in the backbone of the polymer. Examples are polyethylene oxide (PEO) and polyethylene imine (PEI). These polymers can be synthesized with molecular weights up to the millions. Secondly, there are water soluble non-ionic polymers containing an acrylic group, e.g. polyacrylic acid (PAA) and polyacrylamide (PAAm). The water-soluble polymer polyvinyl alcohol (PVA), frequently used for the modification of concrete, belongs to the class of the water-soluble non-ionic polymers containing a vinyl group. The workability of the fresh mixture is markedly improved over that of ordinary concrete, because of plasticizing and air-entraining effects of the polymers. The modified systems show higher water retention than the ordinary systems. This may contribute to an improvement in the workability and the prevention of dry-out, and it also leads to superior adhesion to porous substrates such as ceramic tiles, mortars and concrete. In such cases, this type of polymers hardly contributes to an improvement in the strength of the modified system.

As a part of this study, a detailed literature survey is conducted and it reveals that, byvarying the nature and concentration of polymer materials, concrete property can be varied across a wide range that makes polymer modified concrete versatile in its applications. Then the results of the primary tests conducted in the laboratory reported that the use of PMC is rich in Specific applications. However, with the increasing demand being made on concrete technology to serve the needs of society, experts are responding positively by proposing new formulations using other materials.

Hence it is understood that, incorporating polymer materials into the concrete has, to some extent, contributed to this demand.

In this paper presents a comparative performance of two different polymers on conventional concrete. The selected polymers are from two different groups. The modification is brought by adding different dosages of polymers (by cement) to the conventional concrete. The behavior of concrete is studied with respect to its mechanical and structural properties by varying the two polymer dosages. The optimum dosage of the individual polymer is found from the experimental details. Finally recommendations are made based on the experimental investigations.

II. LITERATURE REVIEW

Polymers with different kinds of fillers are used as construction materials. They have good binding properties and good adhesion with aggregates. They have long-chain structure, which helps in developing long-range network structure of bonding. In contrast, cement materials provide short-range structure of bonding. As a result, polymer materials usually provide superior compressive, tensile and flexural strength to the concrete compared to Portland cement. Some polymer materials may provide good adhesion to other materials as well as resistance to physical damage (abrasion, erosion, and impact) and chemical attack. The choice of polymer mainly depends on the application.

Conventional concrete materials combined with polymers could yield composites with excellent mechanical and physical properties. Polymer materials with wide variations in properties could provide complex properties to polymer-modified concretes, and thus, present an opportunity to design structural materials with tailored properties.

Mandel and Said (Mandel, 1990)[1], conducted research on the effect of an acrylic polymer on the mechanical properties of mortar and found that the mechanical properties of mortar and the adhesion between mortar and a steel fiber improved with the addition of an acrylic polymer into the system.

Kim et al. (Kim, 1995)[2], studied the properties of polyvinyl alcohol (PVA) modified mortar and concrete with up to 2% polymer by weight based on cement and compared the structure and properties of polymer-modified concrete with those without polyvinyl alcohol. The interfacial transition zone and fractured surface were examined with both polarizing optical microscopy and scanning electron