

A SURVEY ON NEED TOWARDS CONSTRUCTION OF LOW CARBON BUILDING

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ABSTRACT - Climatic change brought about by man-made emissions of greenhouse gases have been identified as the greatest challenge facing human society at the beginning of the twenty-first century. Change in temperature not only increases levels of mercury in thermometer but also increases suffering level of human kind. To avoid effects of change in temperature we need to focus on reduction in carbon emission from building sector as lots of CO₂ emission takes place through construction activities. Low carbon building is one of best solution to overcome the problem of environmental threats due to climate change. Low carbon building reduces carbon dioxide emissions by changing the ways in which buildings are designed, constructed, managed and used. So it is necessary to give proper attention towards low carbon building construction today for better future.

Index Terms – Climatic change, Low Carbon building, Carbon emission.

I. INTRODUCTION

Economic growth of India has been dramatic in last two decades where Urbanization, industrialization has given boost to construction industry which results in construction of many sky- scrapers. Shopping mall, roads and many infrastructure projects are built with innovative features. But in many cases environmental aspects are ignored which result in threats to environment.

Climate change brought about by man-made emissions of greenhouse gases that have been identified as the greatest challenge facing human society at the beginning of the twenty-first century. Concentration of greenhouse gases play major role in raising the earth's temperature. Global warming not only cause in increase in mercury of thermometer but also increasing suffers in human life. Tackling climate change requires concerted and focused action. This will include reducing carbon dioxide emissions by changing the ways in which buildings are designed, Constructed, managed and used. It's important to remember the wider context for action to address climate change. Even though building holds low carbon, they should also be sustainably designed, that is, they should be created with consideration of the wider, long-term environmental, social and economic aspects of sustainability.

The construction industry is one of the major sources of pollution in which construction-related activities emits large amount of CO₂. Hence, contribution of the building industry to global warming can no longer be ignored. To overcome problem of emission of carbon due to construction, "Low Carbon Homes" concept come in flash. Low carbon building is nothing but the building which produces less carbon thorough its life. Generally carbon emission takes place from building in five phases. The first phase corresponds to the manufacturing of building materials and components, which is termed as embodied Carbon. The second and third phases correspond to the carbon emission during transport materials from production plants to the building site and the carbon emission during the actual construction of the building, fourthly, carbon emission takes place at the operational phase, which corresponds to the running of the building when it is occupied. Finally, carbon released in the demolition process of buildings as well as in the recycling of their parts, when this is promoted. Therefore, there is need to work on designing buildings with low carbon emission by using low carbon emission material and natural sources.

II. RELATED WORK

A. *Reducing CO₂ Emissions Through Refurbishment of Non-Domestic UK Buildings Ref. [1]* -

The authors suggested that a 70% reduction in CO₂ emissions will be required by 2030 to mitigate the worst impacts of global climate change. In the UK, approximately 11% of CO₂ emissions are attributable to non-domestic buildings. Of the UK nondomestic stock that will be present in 2030, approximately 75% will have been constructed before 2005. Consequently, refurbishment of existing buildings is likely to strongly influence whether these emissions reduction targets are met. This paper catalogues interim research outcomes from a search project (TARBASE) whose aim is to identify technological pathways for delivering a 50% reduction in CO₂ emissions of existing UK buildings by 2030.

This investigation describes the approach as applied to the non-domestic sector. The approach taken was to describe a series of non-domestic building variants, chosen due to their prominence in the stock as a whole and also by their ability when taken together to describe the range of construction methods found in UK buildings. Technological interventions, grouped by building fabric, ventilation, appliances and on-site generation (of both heat and power) as applied to the building variants were investigated. Their applicability was determined with respect to energy and CO₂ emission savings.

B. Building Confidence Energy saving Trusts Ref. [2]-

The author sets out the Energy Saving Trust's vision for the energy performance of new build housing. In this vision, the cumulative "business as usual" increase in emissions from the new build sector can be reduced, and indeed, turned around, by 2030. To make this a reality, the vision needs to be adopted by all stakeholders, particularly Government and industry; the low-carbon homes that already exist today need to be mainstreamed through comprehensive training and supply chain capacity development; net zero-carbon heating homes need to be made a universal requirement by 2015; and the policy framework needs to be adapted to allow the development and recognition of zero-carbon homes by 2030. This is the Energy Saving Trust's vision and proposed pathway to zero-carbon new build homes.

This paper has been written for policy makers, construction industry decision makers, and energy experts. It sets out in broad terms the emission reductions required from new build housing if we are to reach our long-term climate change goals; and offers a framework for policy and support mechanisms that would assist the achievement of these. This report pulls together evidence from a number of recent research projects undertaken by the Energy Saving Trust and also others. It begins by showing the importance of new build housing to long-term carbon emissions, within the context of the Government's goal of a 60 per cent reduction in carbon emissions from the UK as a whole by 2050. This includes an exploration of various scenarios for reduction, using a combination of energy efficiency and micro generation measures.

They also describes the markets for new build housing today, current performance standards, the technical solutions already available, and the barriers to main streaming higher performance. Having discussed the markets and the technical solutions, the report moves onto a number of recommendations for ensuring that we make swift progress to achieve what is possible. The most pressing are the policy recommendations, and these are accompanied by recommendations for research, and for action by the construction industry. The paper ends with a summary of the support already available to assist with the construction of high energy performance new build housing, from organizations such as the Energy Saving Trust.

C. Low –Carbon Building –A method for estimating GHG emissions and emissions reduction performance Ref. [3]-

The authors stated that buildings are responsible for higher greenhouse gas emissions than any other sector of society. Furthermore, the portion of emissions due to building construction and operation has been increasing in recent decades. These emissions are primarily due to heating, cooling, and lighting, though the embodied emissions in materials are also significant. Major new initiatives are under way to reduce the energy consumed by buildings, but there are numerous technical, economic, and policy barriers. This paper summarizes some of the key challenges for the design and implementation of future low-carbon buildings in the United States and identifies opportunities for the engineering profession. More efficient building design represents one of the most cost-effective opportunities for large-scale Carbon reductions on a national and global scale. A greater emphasis on integrated building design for the full life cycle can lead to dramatically improved building performance. Finally, a series of recent projects demonstrates successful life-cycle design for low-carbon buildings.

D. Use of cost-effective construction technologies in India to mitigate climate change Ref.[4]

Concentration of greenhouse gases play major role in raising the earth's temperature. Carbon dioxide, produced from burning of fossil fuels, is the principle greenhouse gas and efforts are being made at international level to reduce its emission through adoption of energy-efficient technologies. The UN Conference on Environment and Development, 1992 made a significant development in this field by initiating the discussion on sustainable development under the Agenda 21. Cost-effective construction technologies can bring down the embodied energy level associated with production of building materials by lowering use of energy-consuming materials. This embodied energy is a crucial factor for sustainable construction practices and effective reduction of the same would contribute in mitigating global warming. The cost-effective construction technologies would emerge as the most acceptable case of sustainable technologies in India both in terms of cost and environment.

As already mentioned, there are other improved alternate technologies available like bamboo panels, bamboo reinforced concrete, masonry stub foundation, etc. All of them can contribute significantly, if not more, in reducing in the cost of construction and CO₂ emission. For academic purpose, this article restricts discussion to

rat-trap bond wall, brick arches and filler slabs only, for which data on material consumption and reduction from conventional techniques are readily available.

III. IMPACT OF CLIMATE CHANGE

A. Global warming:-

The environmental community rightly recognizes global warming as one of the gravest threats to the planet. and the increase is accelerating even faster than scientists had. Global temperatures are already higher than they've ever been in at least the past millennium, predicted. The average facade temperature of the globe has augmented more than 1 degree Fahrenheit since 1900 and the speed of warming has been almost three folds the century long average since 1970. This increase in earth's average temperature is called Global warming. The expected consequences include coastal flooding, increases in extreme weather, spreading disease, and mass extinctions.

As said, the major cause of global warming is the emission of green house gases like carbon dioxide, methane, nitrous oxide etc. into the atmosphere. Buildings, both commercial and residential represent a larger source of global warming pollution than cars and trucks. Building of these structures requires a lot of fuel to be burnt which emits a large amount of carbon dioxide in the atmosphere.

B. Ozone Depletion:-

The ozone layer protects the Earth from the ultraviolet rays sent down by the sun. If the ozone layer is depleted by human action, the effects on the planet could be catastrophic. Ozone is present in the stratosphere. The stratosphere reaches 30 miles above the Earth, and at the very top it contains ozone. The sun rays are absorbed by the ozone in the stratosphere and thus do not reach the Earth

C. Rises in Sea Level:-

Large-scale emigration from coastal zones is expected due to submergence of coast-lines after sea levels have risen. This will create large numbers of environmental refugees especially from low-lying delta regions in poor countries. Furthermore, intrusion of sea-water in the ground water and changes in temperature can reduce agricultural and fishing incomes. Countries dependent on coastal fishery and agriculture, which most often include developing countries, are likely to be adversely affected.

IV. NEED OF LOW CARBON BUILDING

Today we see that there are many new technologies are available for construction in the market. For construction variety of attractive materials are available that helps in minimizing the construction time and enhance its beauty. Different and attractive materials are available for the construction which helps in reducing time of construction as well as good looking. It is one face of construction but if we see other face of large amount of carbon is emitted during the manufacturing of construction materials. Carbon emission associated with building construction is mainly coming from embodied carbon. Embodied carbon is nothing but carbon associated with the embodied energy used for construction. Embodied energy is defined as the commercial energy (fossil fuels, nuclear, etc) that was used in the work of making a product. Embodied energy is an accounting methodology which aims to find the sum total of the energy necessary for an entire product lifecycle. This lifecycle includes raw material extraction, transport, manufacture, assembly, installation, disassembly, deconstruction and/or decomposition.

Constructions consume a variety of building material. Abundant raw materials are to be transported from far off distances to the industry which requires further processing thus consuming primary and commercial resources. The finished products from the industry further need to be distributed to the local areas and construction sites which increases the pressure on the commercial fuels. The most common building material used in construction activity today are cement, steel, bricks, stones, glass, aluminum, timber, paints etc.

The estimated of the energy consumed in the manufacture/extraction of few major building materials chosen from various sources have been discussed below:

A. Cement.

The principal methods for the manufacturing of the Portland cement are 1) Dry process 2) wet process. The dry process is preferred on account of very significant fuel economy. The dry process is adapted in the most cement industries. The heat energy requires per Kg of the clinker in dry process is 3000-4500(KJ/Kg) while in wet process it is about 5000-8000(KJ/Kg). World cement production is over 1600 million tonnes. Demand for cement is to reach over 2500 million by 2011. Cement manufacturing involves burning of fossil fuel for calcination and clinkerization, which generates CO₂ and is emitted to atmosphere through chimney. CO₂ is the main GHG responsible for global warming. 5% of global CO₂ is originated from cement production. One-ton cement production emits around one ton (0.82) CO₂ to atmosphere.

B. Steel

Steel industry is the largest consumer of energy among all industries. It consumes about 10 % of total electricity and 27 % of coal used by Indian industry. The production of steel include various process like melting, refining, casting, rolling makes steel as an highly energy intensive material. About 1.7 ton carbon is emitted in the nature per ton production of the steel in India. It varies company to company of steel.

C. Bricks

The manual production of the bricks involves mainly four operation namely, Soil preparation, molding, drying, and firing. The main process in which carbon is emitted is firing of bricks. Brick manufacturing units in India, which use coal as the principal fuel, produce CO₂ at the rate of 38 tonnes per 0.1 million bricks. The above figure was calculated by GEF (Global Environment Facility) during their study on brick production in India.

Carbon emitted associated with the building construction also content transportation of construction material from manufacture to site or from dealer to the site of construction. It is seen that an average of 2.62kg carbon is produced per litre of diesel consumption.

As carbon emission is emitted abundantly, there is a need to take action immediately to reduce this. Construction of Low carbon building is better option. Low carbon content building or low carbon homes is nothing but it is one of technique of Green Building or Sustainable Building in which attempt is made for reducing emission of carbon by using low carbon emission materials and low carbon emission techniques for construction or low carbon content building. Low carbon building is a building which has been engineered to release significantly less GHG than a regular building over its lifetime. Typically a low carbon content building or low carbon building will consume much less energy than a traditional building and integrate distinctive technologies, such as renewable energy system, which will reduce its GHG emission. Hence, going towards construction of Low Carbon building is need of today and will help in future.

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