

The Engineers Role in Climate Change Mitigation

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Engineers are recognized to be one of the major actors of development. As the custodian of build environment, Engineers have to be well equipped with the recent concurrent issues for exploring technology, wisdom and insight to serve the nation. Professional institutes are the platform of the technology for exchange, sharing and extension of knowledge management. Bangladesh has been recognized as the worst victim of climate change. Climate change issues should be incorporated in future infrastructural development policy which largely vested upon the engineer's community. The issues encompass transport management, promotion of renewable energy, compact city development, and travel demand management, promotion of green space, green building, and promotion of pedestrian facilities, roof top gardening and many other issues. The study signifies that Engineers pose a strong functional relationship to facilitate the holistic system for promoting climate change induced infrastructural development, renewable energy, roof top gardening and promoting green space by imposing FAR rules properly. The study was conducted based on both primary and secondary information collection, compilation, analysis and representation. Among various concurrent issues, this paper focuses on the selected issues which is being prepared to analyze and represent the role of engineers for incorporated those issues in future development planning.

Keywords: Renewable Energy, Solar PV system, RTG

1. Introduction:

Including Bangladesh, Many countries around the world are becoming endangered due to climate change. Within 2050, large areas of Bangladesh, Maldives, Vietnam, Egypt and most of the areas of London, Mumbai, Tokyo and New York cities will be submerged by water (Bhuiyan, 2013). Nature of clouds, rains, wind flows and sea flows will be changed. If the sea level increases by a meter, one third of Bangladesh's land areas will be underwater. Green house gases emitted by human activities are likely (60-90% chance) to have caused most of the observed global temperature rise over the past 50 years (Mitchel et al, 2008).

As a developing country, Bangladesh poses the potentials to incorporate the issues of mitigation and adaptation in the future planning and developmental agenda on the one hand. On the other hand, rigorous attention is needed to build holistic capacity how to protect the people as well as properly from the unexpected disasters as a result of the prevailing unplanned development (Sohag, 2014). Climate change in Bangladesh is an extremely crucial issue and according to National Geographic, Bangladesh ranks first as the nation most vulnerable to the impacts of climate change coming decades.

Bangladesh is the nation most vulnerable to global climate change in the world, according to German Watch's Global Climate Risk Index (CRI) of 2011. Bangladesh is

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vulnerable due to a number of hydrological, geological and socio-economic factors. One of the possible strategic measures to reduce CO₂ emissions may be identification, selection and implementation travel demand management measures that improve both the urban environment and the traffic situation with no budgetary burdens and be win-win situation. The study identifies policies, strategies and measures to reduce CO₂ emissions from the transport sector and recommends application options for implementation.

2. Designing Transport Infrastructure:

Climate change is likely to damage transportation infrastructure through higher temperature, more severe storms and higher storm surges. Coastal roads, railways and airports are vulnerable to sea level rise. Transportation Engineers typically refer to historical records of climate, especially extreme weather events, when designing transportation systems. Climate change is projected to increase the frequency and intensity of extreme weather event.

3. Impacts of Climate Change on Road Infrastructure:

Higher temperature can create rutting and potholes, particularly in high-traffic areas and can place stress on bridge joints.



Figure: 1

Heat waves can also limit construction activities, particularly in areas with high humidity. With these changes, it could become more costly to build and maintain roads and highways.

4. Impacts of Climate Change on Railways:



Figure: 2

High temperature cause rail tracks to expand and buckle. More frequent and severe heat waves may require track repairs or speed restrictions to avoid derailments. Heavy precipitation could also lead to delays and disruption. Increased flooding from heavy precipitation and storm surges could disrupt rail travel as well as freight operations.

5. Impacts of Climate Change on Vehicles:

As temperature increase, many types of vehicles can overheat, and tires will deteriorate more quickly. But milder winters, reduction in the number of cold days, delays in winter freezing, and earlier spring thaws may reduce cold-weather damage vehicles to vehicles. Bangladesh has considerable economic growth and road transport is one of the vehicles of that growth. A country having an area of 144,000 sq-km, and a population of 154 million, has about estimated 0.75 million motorized vehicle and 2.15 million non-motorized vehicles (LGED, 2013). At the current growth the number of vehicles in the country is expected to be double in the next ten years.

6. Implementation of the Floor Area Ratio (FAR):

Floor Area Ratio (FAR) indices were introduced in approving building plans after the enactment of Dhaka Megacity Building (Construction, Improvement, Preservation and Removal) Rules in 2008. FAR is an index to determine total build-up area of any building in respect to size of the plot. It is pre-defined based on plot size and width of the adjacent road. It was imposed in Dhaka as a consequential requirement of diminishing green space. The major objectives of introducing FAR were land accumulation, increasing green space and promoting vertical expansion. After its

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imposition of last five years about 20,000 new building plans were approved by RAJUK (Sohag, 2014). If FAR rules are implemented properly, it will contribute to increase green coverage in individual plot which is crucial for ground water recharge and making city resilient. Unfortunately it is observed some people to take advantage of FAR approving higher building height but practically they make houses deviating from approved plans without leaving green space properly by forgery. This happens due to lack of enforcement mechanism, personal ill intention and lack of awareness which must be prohibited for sustainable development. In some areas FAR contributed successfully creating up to 60% of the total land remaining green space which is essential for ground water recharge as the water level is going downward due to paucity of open space in Dhaka.

7. Promoting Renewable Energy:

Global energy demand increases as per economic development and improvement of standard of living. Engineers should facilitate the holistic system for promoting renewable energy use by policy and programs. Renewable energy includes such as wind, photovoltaic and thermal solar, tidal and wave power, biomass etc.

Bangladesh is one of the most disasters prone countries in the world. Despite the mounting costs of climate change and inevitable declining oil, natural gas and uranium reserves, the vast majority of cities and urban communities is planned and managed with REs in their daily lives.

In Australia solar city, an Australian registered company devised design principles which stated that climate change and dwindling global resources are challenging the professional practice demanding new design and planning approaches that achieve more with less. The rich volume of designers, architects, planners, policy makers and academics alike explores the current paradigm shift and illustrates how new thinking can convert investments in urban infrastructure, land use and development into resilient and enduring support systems for human and environment prosperity (Solar City,2013).

8. Solar PV System:

The amount of energy sent to the earth from the sun each year is equivalent to almost 15,000 times of the world's commercial energy consumption. The geographical location of Bangladesh as well as Dhaka city lies in one of the best location, which are well supportive to capture enough solar radiation for electricity generation. Due to the availability of sunshine throughout the year the GHI of Bangladesh is also satisfactory for solar power production (Kabir et al. 2012).

9. Biomass:

Although research initiatives started in the early 1970s on biogas based power plants, the dissemination of the biogas technology has not been widely enhanced mainly due to lack of people's awareness and willingness to pay for initial expenses (Kabir et al 2012). Space is one of the vital requirements where to install biogas plants. As the peripheries

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of the megacity are not yet developed, suitable locations for installation of biogas plants should be identified in the revised master plan. Any particular agency should be authorized to procure land for installation of biogas plant in the peripheries. This agency may be a centralized agency. NGO or IDCOL who may facilitate the process to produce biogas from segregated organ wastes of the megacity area.

10. Gardening on the Roof of Building:

Besides the decorative benefit, roof plantings may provide food, temperature control, hydrological benefits, architectural enhancement, habitats or corridors for wildlife and recreational opportunities. The importance of gardening has been becoming popularized in every countries day by day. The gardens not only serve as a place of recreation, it also serves as a place for educational by the way of establishing a home garden.



Figure: 3



Figure: 4

In Toronto, Canada Green Roof By-Law imposed green roofs for all new development above 200 sq/m. Coverage requirement ranges from 20-60% of the available roof space and the law effects all new application made after January 31, 2010. The Architectural Services Department of the Government of the Hong Kong Special Administrative Region has issued a study document includes a Green Roofs Overview, Design and Technical Guidelines and Recommendations for green roof directions for Hong Kong and the way forward.

11. Engineers Role in Roof Top Gardening:

The roof should be properly designed by the Structural Engineers so that it can hold the pressure of the soil, containers, draining out of irrigated water and so far. It is also needed to take safety measures- install fences and miniature shelters in order to protect

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the plants from falling. It is important to select the type of plants to grow and consultation of structural engineering specialist about maintenance.

12. Maximizing of Practicing Steel Structure in Steed of Concrete Structure:

Steel can be recycled repeatedly without any degradation in terms of properties or performances in quality. Steel Generates very little waste, with the byproducts of steel production widely reused by the construction industry. There is virtually no waste from steel products on the construction site.

Comparison between steel and concrete:

	CO ₂ emission	Energy Consumption	Resource Depletion
Steel	12.4 kg/sft	102.1 MJ/sft	2.8 Mg/sft
Concrete	16.4 kg/sft	102.5 MJ/sft	8.8 Mg/sft

Table: 1

Bangladesh produces 15,000,000 tons of cement; 145,763 tons of lime; 25,376,000 tons of brick to meet concrete construction requirements which are extensively pollutant and un-sustainable for country like Bangladesh considering its green future. So, The Engineers should practice steel structure for a safer environment.

13. Recommendation:

- ✓ It is necessary to develop more financial mechanism for all forms of sustainable energy in Bangladesh.
- ✓ It is necessary to bring awareness and comprehensive understanding on renewable energy systems among engineering professionals.
- ✓ Research should be prioritized and advocacy is needed how to plan renewable energy induced cities.
- ✓ In order to restrict travel demand and vehicular movement among citizens, compact city is recommended where people live within their workplace with all the amenities and civic facilities where travel demand is minimized.
- ✓ Plinth level of the roads should be raised considering flood level of 50 years and rural roads should be brought under routine maintenance.
- ✓ To conduct research to devise low cost renewable energy technologies compatible to our environment and social perspective.
- ✓ To provide financial support in research in universities, incorporation of the technologies in secondary curriculum to motivate young generation in research and innovation in low cost technologies for future cities.

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- ✓ Integrated urban transport solutions should make provision for non-motorized transport infrastructure together with pedestrian zones and walkways, segregated cycle paths, and bicycle parking and rental programs.
- ✓ Develop roadmaps and demonstration programs for renewable energy technologies. Solar PV infrastructure should be incorporated in BNBC (Bangladesh National Building Code), Building Construction Rules and Regulations for facilitation and motivating people rather than compulsory imposition.
- ✓ Compact city model should be incorporated in the reviewed structures plans of large and medium sized cities of Bangladesh which may contribute in reducing travel distance and trip generation reducing energy consumption as well.
- ✓ Technology research should be facilitated by the Government so as to devise low cost solar equipment and apparatus in the country.
- ✓ Roof top Gardening (RTG) induced roof design may be facilitated in cooperation with Real Estate and Housing Association of Bangladesh (REHAB), Institute of Engineers Bangladesh (IEB), Institute of Architects Bangladesh (IAB), Bangladesh Institute of Planners (BIP) with technical cooperation.
- ✓ In case of Public building, RTG can be facilitated by mandatory policy by the Government as some of the departments or autonomous organizations have the manpower of Gardener in the organ gram that can take care of it.
- ✓ Steps should be taken to formulate proper strategies of existing green areas of all the cities, rehabilitate what have been destroyed and plan for the judicious utilization of resources for sustainable development.

14. Conclusion:

Engineers should have a vision to protect and maintain the green characteristics of built environment. Sustainability aims at sustaining ability of a country. Engineering community is capable to contribute most of the policies regarding climate change mitigation to our built environment if facilitated properly. It should be realized that needs of people must be satisfied in compliance with the fulfillment of the needs of our ecosystem. Climate change is one of many concerns that must be addressed in planning transportation and the build infrastructure. Interaction and relationship among engineer along with other professional such as Architecture and Planners should be strengthened for mutual exchange, sharing and coordination. It will take into account the inherent uncertainties of climate change, as well as complex technological, social, economic and environmental interrelationships and devise development policy that will serve to survive the nation.

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