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WASTE MANAGEMENT FOR SUSTAINABLE SMART CITIES IN INDIA

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Abstract: **In developing country like India development has got direct link with rapid urbanization. As per present assessment India's population will be about 600 million by 2030, which will be about two times of US population. This increase in population will create lot of imbalance in urban infrastructure, unless some innovative solution is evolved for long term sustainability. The strategies considering green building concept can be evolved for sustainable cities and towns. It is a fact that way in which are population growth is taking place, the natural resources of the world is nearing to a breaking point. The real challenges is Global warming, pollution of air, degradation of land, scarcity of fresh water, overall shortage of food and bio-biodiversity is getting reduced, which are the real issues to be encountered. Recently smart city concept is gaining ground world-wide. In smart city concept sustaining water, energy and management of waste including restricting greenhouse emissions will be major priority areas. All these are deliberated for smart cities being planned in India. We can formulate our policies based on various experiences gained by advanced countries while carrying out planning/execution of their smart cities.**

Keywords *– Smart Building, Environment, Sustainability, WTE, Global warming.*

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I INTRODUCTION

The innovation in planning/designing, management and operations is essential for implementing smart building concept. There are number of on-going projects world-wise demonstrate, how opportunities and challenges can be met while implementing this concept. As we are aware, how our various cities are getting choked due to environmental problems and for long term sustainability. The smart transformation is taking place world-wise by following constant persuasion in this direction. All over the world, all major cities and towns are undergoing socio-economic crises. The demand of fresh water, energy requirement for development of urban infrastructure is a real concern for city planners. This is happening, since requirement of various infrastructure developments is exceeding our availability on various resources apart from major problem of environmental sustainability. For reducing costs, improvement of efficiencies and for delivering quality of life, citizens are looking for cost effective solution utilizing new technologies on information and communication technology including efficient working practices. So, there is an urgent need to manage infrastructure and resources of cities for fulfilling needs of present and future generations. Simultaneously new trends for urbanization, growth of economy, progress in technological growth and environmental sustainability including proper waste management is a new found urgency in India, in line with other advanced countries.

In the smart city concept, we have to ensure proper planning/designing of the facilities and construction including maintenance by using various latest techniques available. In India we are going ahead with plan of certain existing cities and towns to convert into smart by carrying out various types of repair, rehabilitation and retrofitting of structures and other services, art from constructing new cities/towns, utilizing this new smart building concept.

II ENVIRONMENTAL SUSTAINABILITY

As we are aware that the human activity is mainly responsible for whatever rapid environmental changes / deterioration have occurred and further, the way in which population growth is happening in certain parts of the world, the world's natural resources are getting exhausted rapidly. Air/water pollution, Global warming, availability of fresh clean water, and utilization or disposal of wastes are some of the real challenges. So, priorities will include recycling of water, utilization of renewable energy sources and managing

wastes, since about more than 90% of cities/towns in India still dumping sewage into water bodies like rivers raw and thereby reducing greenhouse gas emissions. The various processes of smart cities can be mainly divided into planning, management and operations.

Planning

The role of urban planners is crucial while collecting data's about existing infrastructures and future likely growth of the cities, for making realistic assessment, considering the human behaviors and ethos they follow. The limitation of certain non- renewable resources is to be identified and maximum utilization of renewable energy like solar energy is to be explored for long term sustainability. Analyzing data's available from experiences gained by planners, while calibrating new urban requirement and also the difficulties encountered by them while planning/implementation of scheme. The lessons learnt by various international players can be gainfully utilized, while planning in India's smart cities. Special attention need to be given in transportation system of the future cities and disposal of wastes, since most of the big cities in India is almost choking due to mismanagement of traffic on roads and waste products.

Management

For management of infrastructure in smart city concept various activities like construction and maintenance of roads, equipment and other assets, a planned approach is required. The innovative solution can be explored for saving money and effort, while undertaking work of replacement of electrical utilities under a street intersection etc. The waste products management is becoming real challenge for most of the city Municipal corporations, due to acute shortage of landfill areas, which needs to be planned/executed by using modern management tools.

Operations

A smart city integrates large number of data to represent urban domains interdependence in real time. Environmental aspects including various non-renewable energy sources, which is depleting rapidly needs to be taken care off. Further, utilization of renewable energy sources like sunrise needs to be explored in a big way, for sustainability.

III UTILISATION OF WTE CONCEPT

As we are aware that most of the items from wastes are most suitable either for energy generation or for landfilling. Landfilling areas are day by day getting reduced due to non-availability of lands in most of the city areas and its surroundings. It is also a fact that developed nations are utilizing lands of developing nations to burry various dangerous items like wastes of nuclear, oil/acid tankers demolished items etc. It is happening mainly because developing nations is heavily dependent on financial assistance from developed countries. Thereby they accept the various garbage's of the developed nations. So it would be justified, if such garbage can be utilized for the Waste to Energy (WTE). However technology transfer from developed nations along with financial assistance will be required initially. All the items of wastes are not suitable for converting waste to energy. So lot of research work is still required to be done for making it a grand success.

IV MODERN CONCEPTS & TECHNIQUES OF WTE

The following are various techniques for converting waste to energy:

- Waste heat to Electricity conversion
- Reduction of costs by using Thermo-photovoltaic Cells.
- Hydrogen from water using waste energy.
- Chicken feathers into fuel
- Fuel from water and CO2
- Waste to Energy continues to gain steam
- Laptops and Cell phones battery life can be doubled by using waste heat.
- Ethanol from waste water.
- Garbage converting to Bio-fuel
- Waste water into Electricity and desalination.
- Waste materials into Hydrogen
- CO2 can be transformed into Fuel using Nano-tube technology
- Renewable sources from waste
- Energy technology from incineration-based waste Technology
- Biomass from Anaerobic Digestion
- Fuel from Airborne Carbon
- Harvesting Hydrogen from Farm waste

Most of the technology brought out above can be utilized for effective waste management in sustainable smart building concept.

V EXAMPLES OF SMART CITIES IN THE WORLD

There are number of Smart Cities/towns of various sizes, illustrates various aspects of transformation of Smart city. The name of those smart cities is brought out below:

- Arlington Country, Virginia, USA
- Columbus, Ohio, USA
- Ipswich, Queen island, Australia
- South Dakota, Mitchell, USA
- Taipei, Taiwan
- In Brazil Rio de Janerio
- In British Columbia, Surrey, Canada
- Dubuque, Towa
- Bornholm, Denmark
- Songdo JBD, Korea
- Stockholm, Sweden

The first seven cities were declared by the ICF as "World top 7 Cities" in 2015, from 5 different nations.

VI WHY INTIATIVE FOR SMART CITIES

The concept of smart city came into the mind of city planner, to tackle the problem of rapid urbanization of cities and to optimize the use of energy, which is depleting rapidly. The need for smart cities is felt more and more due to socio-economic reasons across the world. It is facts that since there are requirement of large number of smart cities; the supplier with proven record is in great demand. Countries/city administration is seeking various partners and suppliers to collaborate on ambitious programs for long term sustainability.

VII SCOPE OF SMART CITIES IN INDIA

India is getting help from various developed countries for implementing scheme of smart city. Honorable Prime Minister Narendra Modi's vision of "Digital India" has a plan to build initially 100 smart cities across the country. PM while delivering lecture said "Cities in the past were built on river banks. They are now built along highways. But in future, they will be built based on availability of optical fiber networks and next – generation infrastructure" along with other Govt., UK Govt. is giving help to India for growth of smart city. UK companies will invest in Indian infrastructure. Like this many other Countries are showing interest in developing PM's vision of smart cities in India. The Government of India had signed an agreement with the US to develop Ajmer, Allahabad and Vishakhapatnam as smart cities during the visit of US President Barack Obama in 2014. Earlier, an agreement with Japan to develop Varanasi as a smart City was signed also in August 2014. Cisco has already announced the" Cisco Smart City" for smart city in India at Bangalore and planning/designing and construction work is already in progress. The modern underground infrastructure and Office blocks on river bank of Sabarmati in Gujarat has already been constructed.

VIII CHALLENGES IN ENERGY SYSTEMS FOR SMART CITIES

The Smart Cities strategies for environmental sustainability should include followings:

- Distributed generation systems promotion;
- Cogeneration promotion, which combined various energy requirement for construction of various apartments;
- Through use of electric vehicles, mobility is being made sustainable;
- The concept of development near Zero energy building by use of renewable energy and using re-cycling of water and other resources.

In addition, further development needs to be undertaken in terms of the overall vision to promote new methods, aimed at sustainable design and e-governance for energy systems by followings:

- The new generation technological development by integrating new techniques;
- To ensure adequate level of reliability and quality by development of new techniques;
- By reducing the infrastructure vulnerabilities by using new technologies;
- The environment in which the infrastructure is installed by ensuring proper analysis and control of interdependencies;
- Sustainable Energy Micro System (SEM) operation management , by using advanced methods;
- By studying the organizational issues and the factors involved in human management.

The above areas are the general topics of design and construction of almost zero energy buildings concept by carrying out research on new technologies like automation of various activities.

IX CONCLUSION

The smart city projects are to be planned/designed wisely, considering the total likely population as the key point. As such the utilization of concept of smart cities in our various planning process and its effective implementation is gaining ground in India. However, India as a fast developing country, the country needs to keep up with the development taken place at global levels. Hence planning and its actual execution can lead to sustainable development, keeping the environmental expect in mind. As our existing cities are choking with environmental problems, the future smart cities perforce have to use innovative concepts for utilizing resources in such a way that an environmental sustainability will be ensured. All growth in cities is now mainly at the cost of environment. Thereby there is an urgent need to address the issue, while planning our future smart cities, based on experience of advanced countries while developing smart cities. The policy makers could consider sustainable, maintainable, affordable, reliable and technically feasible solutions to make cities truly smart and propel India into higher trajectory of growth. Therefore, planners could consider setting of satellite towns as smart cities, to begin with, as modifying existing infrastructure in deeply congested existing cities may be more difficult as well as expensive. The environmental sustainability will be the key factor for future smart cities in India.

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BIOGRAPHY

Dr. J. Bhattacharjee is a Professor and Advisor in Civil Engineering Dept. of Amity University, Noida since Jan 2012. He is a former Chief Engineer and Jt. Director General (Ministry of Defense/MES). He obtained his B.E. (Civil) degree from Bengal Engineering (B.E.) College, Sibpore, (now IIEST), Kolkata; M. Tech. (Structure) from IIT Madras and had M. Phil degree from Madras University. Did PHD on Disaster Management (Civil Engineering) in July 2017. He has done number of Courses including prestigious NDC (National Defence College) Courses, Senior Defence Management Course at CDM, Secunderabad, while serving in the Dept. He has a vast experience of over 46 years in the industry in planning, Designing and execution of various types of Civil Engineering works including about 5 years in Multinational Consultancy organization "Gherzi Eastern Ltd" as a Head of Engineering at Delhi. He has Presented /published technical papers more than 95 no's so far on various subjects in National/International Seminars / Conferences and Journals. He is a Life Member of 17 (seventeen) Technical Bodies in India/abroad and is a Governing Council member of Indian Building Congress (IBC). He has written a Book on "Concrete Structures- Repair, Rehabilitation and retrofitting", which was published by CBS publishers on Aug 16. He is the recipients of CIDC Viswakarma Awards-2017 in the category of "Achievement for Academician".

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