STUDY OF FACTORS LEADING TO ENERGY PLUS HUMAN SETTLEMENTS

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Abstract

With the growing population the energy demands also adds up every year around the world and a huge percentage of this energy demand is shared by the building construction industry. Urban development adds to the economic growth of a nation, the national annual reports around the world indicates the increasing level of urbanization globally and urbanization requires energy in various forms. This paper is about such factors which collectively leads an urban settlement towards energy plus category. Energy plus is a concept in which an urban settlement is not only able to produce and return the amount of energy its consuming but is capable of generating clean energy more then its consumption using renewable sources of energy.

This study is about factors such as conservation of energy, conservation of land, conservation of water, reduction in waste production and accessibility of resources. It is important to be assured that urbanization should not lead to lack of resources. This study will help the current model of urbanization to mark its independence from the non-renewable sources of energy as the depleting sources is generating a severe threat for the upcoming generation to live in an urban scenario.

Key Words: *Urbanization, Energy Plus, Renewable Sources, Clean Energy, Conservation*

1. Introduction:

The energy demands around the world are increasing gradually due to industrialization and urbanization of societies for better living standards. Being a basic component of growth consumption of energy can not be reduced and can neither be banned but a search for clean energy generation is going from many decades around the world. Hence the solution to energy crisis in near future lies in conservation, intelligent distribution and generation. Although the factor of generation is dependent on clean energy generated from renewable sources of energy. Its not only because we are running out of oil reserves and other non-renewable sources of energy but it also doesn't harms our living environment as energy generated from sources such as air, water sun have no carbon footprints. Sustainable living is the need of tomorrow and is being researched and practiced since past two decades and there are many examples around the world of different scale.

The concept of energy plus settlements is the need to upcoming urban settlements on account of sustainability. Energy plus is a concept which states that if a building or a group of buildings (settlement) is capable of generating more then the amount of energy used in an fixed time interval then such building or settlement can be called as an energy plus building or energy plus settlement.

There are many other concepts which were researched and lead to the concept of energy plus such as: Low carbon emitting buildings, Zero carbon emission buildings, Less energy consuming buildings, Energy generating buildings, Nearly zero energy buildings, Net zero energy buildings and as all these were dependent of some factors to achieve such tags Energy plus is also dependent upon such factors which are not so different but actually a combination of factors for above stated concept in an appropriate percentage.

2. Factors leading to Energy Plus Settlements

The appropriate management of resources and a good architectural framework can lead to an efficient urban settlement. Resources such as usable form of generated energy, land, water. Also the after part as waste production management and accessibility of required facilities by the end used on each level of the human settlement.

2.1 Conservation of Energy

Comfortable and habitable environment under any extreme weather condition is one of the primary goal

of architecture. To maintain such conditions energy is one of the basic requirements. Unlike individual buildings urban settlements have a different scenario regarding energy conservation. Since it is not dependent on a small group of user but a mass or human settlements hence the conservation is required from the root level. Following are some distributions of the energy conservation as a factor of energy plus human settlements

2.1.1 Non-dependence on non-renewable sources of energy

Since the industrial revolution the demand of fuel increased massively by the countries having industry based economy. The demand of fuel such as petroleum products went up so rapidly that some of the countries are having their economies based on crude oil production. In middle east many such countries exists who registered their growth in last five decades. Fuel in different form and basic as crude oil is almost backbone for many types of industries internationally.
According to a study the proven oil reserves held by all middle eastern countries were 742.7 thousand million barrels by the end of 2006. Which is 61.5% of the total world (*Rosenthal & Elisabeth,2010)*. According to the CIA world factbook; January 2016 Venezuela individually tops with maximum oil reserve in the whole world by 300 million barrels.
But in last two decades the concern over the climate change due to the adverse effect of byproducts and residues of such fuels in our environment. Global warming is one of the major factors leading to the climate shift and effecting the living beings including humans. It is high time that all different sectors should approach towards an economy non based on non-renewable sources of energy.

2.1.2 Dependence on renewable sources of energy

Using renewable sources of energy to generate usable form such as electricity is the need of today and a better tomorrow. The renewable electric portfolio includes; Hydro-power, biomass, geothermal, wind, solar thermal and PV. According to a report of International Energy Agency in 2015 the global energy consumption dependent on renewable sources of energy is 14%. This figure is alarming according to the today's situation.
One of the major change in this direction marked by a country Portugal is; in 2005 an program initiated by Portugal government to increase the dependence on renewable sources of energy and the results were massively positive, the share of electricity used in the country coming from renewable sources which was 17% in 2005 increased to 63% in 2014. The energy generated from wind was having a major contribution in this massive increase. (*Bousse Y., 2009)*
Renewable energy targets are required to increase the dependence on renewable sources of energy. According to the European commission many European countries adapted the national renewable energy policy to meet renewable energy targets. Such as Germany targets 18% , France 23% , Sweden 49% of energy generation by renewable sources of energy however all the countries in EU collectively targets 27 % of energy generation by renewable sources of energy by 2030. United states is one of the pioneering countries in this initiative have no set goals, but some states have individual targets such as California & New York 50% by 2030, Vermont 75% by 2032 and Hawaii 100% by 2045.

2.1.3 Monitoring climate change

Since industrial revolution petroleum and its products became the primary fuel for every sector around the world. Social and economic growth of any nation is dependent on its industry hence the continuous process of growth requires progressing industries. Although we had alternative fuels since the beginning but the technology transfer rate between different countries was slower then the growth rate of energy demands due to population explosion in many countries. Although petroleum, natural gas, thermal, nuclear power and backing different sectors very well but in return our climate is changing due to the residues left and harmful gaseous emission due to their use. Climate is getting extreme day by day.
Such conditions are becoming a challenge for the medical authorities as it is clamming the health of the urban population. It passively increases the cost of medical sector for keeping good health of the people of the society. Not only this but shifting climate is effecting the wild life and vegetation also. Since last 2 decades the rate of climate change has increased resulting in sudden natural disasters such as tsunamis, cyclones etc. Such disasters results in great loss of life and property specially in urban regions. Use of clean energy from renewable sources of energy can lead to reduce climate change and humanity will get enough time to adapt current climatic situations, which will finally lead to lower the risk of natural disasters.

2.1.4 Pollution Control

Increasing population also increases the use of resources in various forms for different tasks. One of the major change that have been seen is in the automobile sector. Increasing number of vehicles requires adequate infrastructure and fuel. Which finally adds to the environment as pollution in the form of carbon. Increasing quantity of carbon in the environment leads to imbalanced ecosystem. Not only automobiles but manufacturing units also consumes fuel and add harmful content to the environment.
Many environmentalists from countries including India, China, United States and the European Union are working on emission standards from various industrial and automobile products to reduce the negative impact of the urbanization on the

environment. Since our environment is having a limited capacity depending upon the quantity and quality of green areas to filter carbon content in the air. (Frederica P., 2017) Also on the other hands technological transformation of automobile industry to change basic fuel type of engines from petroleum products to electricity preferably generated from clean and renewable energy sources.

2.2 Land Conservation

It is one of the most important factor fro energy efficient human settlements as use of the existing land features while planning an settlement can support in many construction works and mechanical systems. For example its easy to design rain water harvesting systems in valley areas, solid hills generally have high soil bearing capacity that helps to design an efficient structural design of the buildings. Considering the existing natural land features and making them a part of planning the settlements leads to conservation of land.

2.2.1 Geo conservation

This concept deals with the conservation of non living but important part of nature such as geological features, land forms and soil. These parts are significantly valuable for environment, disturbing the natural biodiversity is also an major factor for shifting climate in different parts of the world. (*Chris S., 2002)* Valuable natural features such as bedrock, landform & soil systems required to be conserve on top priority as loosing them will finally lead to loss of many natural vegetation which plays an important role in conserving environment. It reduces the need of artificial modes of conservation of resources of other prominent life supporting commodities such as water. Which finally leads to less consumption of energy for processing of resources regarding use for urban settlements.

2.2.2 Habitat Conservation

Inventory formation of natural resources and strategic planning considering the existing natural habitats. This helps balancing the ecological system of the human settlement. Also it requires the growth and preservation of the agricultural land which is an important asset for any economy to be self dependent. (*Charles B, 2006)*

2.3 Conservation of water

Water is one of the basic of life. Increasing urbanization is not only making it an even more valuable commodity but on the other hand it is also getting polluted which is finally a negative thing for an efficient settlement. In the process of urbanization we need to reduce the consumption of water, reuse water as and when possible and recycle water for other purposes.

2.3.1 Efficient utilization of water resources

Aiming to develop systems on urban level to minimize the consumption and pollution of water resources. Carefully designing of rainwater harvesting infrastructure, Equipping individual buildings of the settlements with efficient plumbing and ecological sanitation systems which makes a self sustainable system of building sanitation requirements and also reduces the water pollution. This in whole reduces the large scale water requirement in different parts of an human settlement and ensures efficient use of water resources. (*Jt Gibberd, 2009)*

2.3.2 Efficient water supply systems

Water being an valuable commodity shall be handled carefully specially at urban level as handling large amount of water also leads to waste and misuse of water and its resources. Although there are existing water supply systems for urban water needs but and efficient system is need of energy plus human settlements. Use of quality pipes, making leakage of water to negligible, water treatment after collecting from source in efficient manner, manual level to level checks in quality of water at different points of distribution systems, time managed water supply to reduce misuse and wastage, adequate storage for emergency supply and designing the water distribution system to work using gravitational force for pressure management which will contribute to conserve energy for water supply system.

2.4 Waste production management

The management of waste is one of the biggest challenge in urban cities. Waste production is directly proportional to the urbanization. A per European union(EU) Waste Framework Directive 2008/98/EC, 'any substance or object which the holder discards or intend or is required to discard is defined as waste'.

2.4.1 Reduction in waste production

Producing less waste is better then preparing for waste management on large scales. Minimizing the use or resources up to the minimum requirement will lead to less waste production and also the concept of reuse will be an add on. For example the waste produces from kitchen can be stored for decomposition easily at home and finally can be used as manure for gardening. Reducing the production is as important as management of waste.

2.4.2 Efficient waste recycling system

The definition of waste varies in different countries however most of them include these categories; household waste, commercial waste, waste from maintenance of public areas. Waste is broadly classified in two types; Biodegradable waste which is capable of being decomposed by the action of biological processes. (George H., 2016) For example

kitchen and garden waste. Other type is non-biodegradable waste which can not decompose under normal biological process. Generally biodegradable waste is considering it to be managed by ecosystem on its own but non-biodegradable need attention else it can results to be disastrous. But management of both in an efficient way is required.

There are number of options for efficient waste recycling management such as; land filling, Mechanical biological treatment, Incineration, Composting, Anaerobic Digestion, Traditional recycling. Implement a balanced composite method with the type of wastes will not only solve the problem of waste recycling but process such as Incineration will helps to add in usable energy by combustive method or recycling.

2.5 Efficient urban transportation system

Transportation system is the backbone of an urban settlement and also transportation system is one of the highest consumer of fuel in urban areas. An efficient transportation systems is an collective result of pricing, traffic management, transport planning/land use, mobility management, Interchanges, non-motorized transport, implementation strategies. Using in an integrated manner advanced traffic management systems yields highest benefits. An advanced traffic management system is consisted of urban traffic control system, public transport management system and driver information system. Its implementation can reduce emissions by 20%.

Also the interchanges or connects between different means of public transportation systems plays an important role. For example the connection of urban city bus service system with urban rail/ metro rail systems. Reducing the distance to be covered through walk between can be one of the major plus. This will promote the use of public transport over private transport.

Another important issue is about managing the intercity traffic and outstation or passing by traffic. Since merging points of such traffic on entrance and exit points makes the city chocked which results in excessive burning of fuel and wastage of many other resources.

Also promoting national policies on manufacturing, importing and use of electric vehicles for public and private transport will also add to the efficient urban transportation systems. Installation of battery charging stations for such vehicles integrated in parking lots using renewable energy sources, so that no queuing in fuel station will be required which is common in many countries in case of other fuel options such CNG, LPG, Gas oil, Petrol, diesel.

3. Conclusion

The concept of energy plus human settlement can only be achieved in real by planning it in an manner that is open to conservation and is adaptive to the ecosystem. Which will reduce the load of energy required to counter the increasing negative impacts of ecosystems which are nothing but results of urbanization done without considering the concept of conservation of ecosystems. The factors discussed above are significantly responsible for development of such an settlement if considered adequately.

4. Further discussion

Implementation of the factors discussed above considering an specific climate condition and the role to technological products to increase the efficiency of the factors discussed can be further explored.

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