HOW SUSTAINABLE ARE OUR CITIES?

The Triple challenge of Development, Quality of Life and the Environment.

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ABSTRACT

Currently, over half of the world's population resides in cities. This urbanization trend is expected to continue and more than 80% of humanity is expected to live in cities by 2050.To secure the ongoing prosperity and wellbeing of our communities; we must ensure that our cities meet the needs of current and future generations. We must aim for economic growth to sustain and increase without compromising the natural environment or our quality of life. This is the basis of a sustainable future. Choices made today on building design, waste management, urban ecosystem management, transportation, water, energy and food systems – and how well these choices integrate across sectors – will have critical implications for the future of cities across the world. Think globally, act locally this slogan stands for a new comprehensive and integrative approach which is the essence of sustainable& resource efficient development.

Keywords—*Sustainable, resource efficient, GHG-green house gas, urbanization*

I. Introduction

The growing middle class population & urbanization in developing countries like India, Asia & Africa will be home to 80% of global urban population in the near future. These cities will continue to house the urban population providing more employment, entrepreneurial opportunities and good quality of life. Urbanization is placing an environmental load on natural resources as cities account for 60–80% of energy consumption across the globe and for more than 70% of worldwide carbon dioxide emissions (GHG emission). Hence it becomes important to integrate & coordinate across different city sectors & scales to achieve city level sustainability & resource efficiency.

Carbon footprint is defined as the total set of greenhouse gas emissions caused by an individual, event, organization or a product. The direct carbon emissions are through fuels & transportation. The indirect carbon emissions are through food, textiles, materials & cement. Between 1990 and 2012, global emissions of carbon dioxide increased by over 50%. Our major cities generate around 80 per cent of our gross domestic product and employ 75 per cent of our national workforce. Cities are centers of economic activity where labor, industry and social institutions are concentrated.

The reasons why the urban environment must be improved are threefold: 1.The quality of life in cities is declining and urban pollution keeps increasing in terms of N0x and $C0_2$, waste, noise, ugliness, dirt, lack of greenery; 2.The demand for a good local environment is becoming increasingly loud and is therefore having a growing political impact; 3.Many modern activities seek to establish themselves in pleasant, non degraded, non-polluted areas.

This paper proposes a mix of strategies, incentives, and enforcement measures in a broad range of sectors at different levels to improve city sustainability, health, environment, ecology, economy and resource efficiency.

II. Global Warming

Global Warming is the increase of Earth's average surface temperature due to effect of greenhouse gases, such as carbon dioxide emissions from burning fossil fuels or from deforestation, which trap heat that would otherwise escape from Earth. Global warmingis already taking place and has become the biggest challenge of ourtime. The challenge is to find ways for the world to switch from a path of increasing emissions to a path of more high advanced technologies where the majority of the GHG emissions are eliminated.

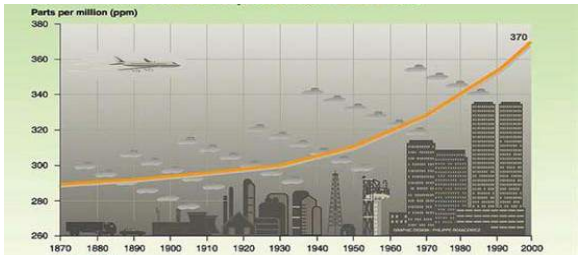


Fig 2.1: Global Atmospheric Concentration of CO_2

The Kyoto Protocol (2005) is a protocol to the United Nations Framework Convention on Climate Change (UNFCCC), aimed at fighting warming. The objective of the Kyoto climate change conference was to establish a legally binding international agreement, whereby all the participating nations commit themselves to tackling the issue of global warming and GHG emissions. The target agreed upon was an average reduction of 5.2% from 1990 levels by the year 2012.

III. Scenario in Developed Countries & Developing Countries

Understandably the developing countries want the right to economically expand the fastest ways they can, like developed nations have been doing for the past 100 years. Developing countries face a difficult decision, whether to sacrifice their economic development for protection against possible ecological problems in the near future. Many developing countries have neither the resources nor the technology to defend against rising sea levels, increased incidence and ferocity of tropical storms, and expansion of tropical diseases.

IV. Our Cities, Our Future

IV.a What is Sustainability?

Sustainability is all about ecology economy and equity. Sustainability is the endurance of systems and processes. Our rapidly growing urban populations are intensifying pressure on the environment through increased demand for water, energy, land and other resources, and through the production of waste and pollution.We need to reduce the carbon pollution generated by our cities, produce environmental benefits, and become more resilient to future shocks, including the impacts of climate change.

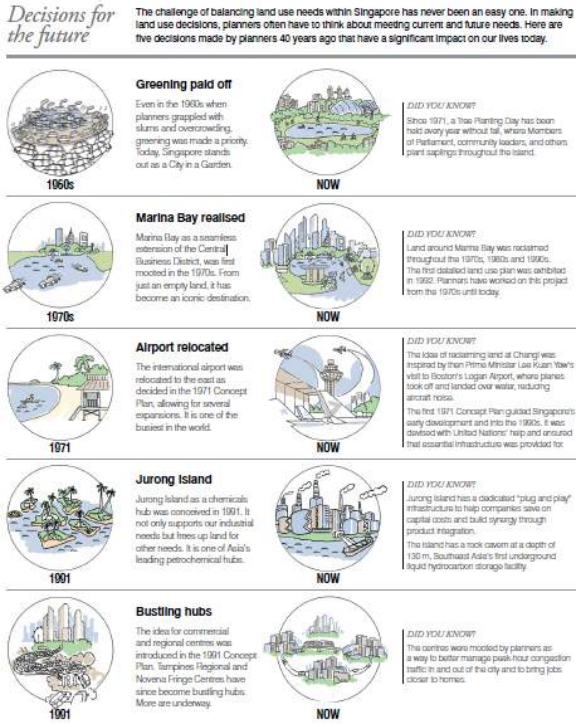
For this there was an action plan Agenda 21 by the United Nations which aimed at sustainable Development. It is a comprehensive blueprint of action to be taken globally, nationally and locally by organizations of the UN, governments, and major groups in every area in which humans directly affect the environment. Cities will therefore have a major role to play not only in improving their own environment, but especially in improving the environment at the international & global level.

IV.b Planning a Sustainable City

Cities as we know them today are already dramatically changing. Our living environments are reshaping the way we live. This new 'urban age' presents a unique opportunity for us to remake and reinvent our cities. How well we plan and design our living environments will matter. While our challenges today are vastly different from the 1960s, our priority remains the same: catering for economic growth and a good quality of life, maintaining a clean and green environment, and making the best use of our resources. What has constantly guided our approach to sustainable development is far-sighted, holistic, and comprehensive planning, which enables us to take into account future development needs through an integrated planning process. Our objectives are:

Economic: Sustain a robust and vibrant economy
Social: Provide a good quality of living and a sense of well-being for all
Environmental: Develop in an environmentally responsible manner
Land and sea: Optimize our limited land and sea space

V. Example of a city which has adopted sustainability as their policy and also implemented: Singapore



V.a Compact City

With limited land, planning for a compact city is critical. This strategy enables them to make the best use of the land, allow for more efficient provision of facilities, and maximize the use of the transport infrastructure. By building more homes and amenities around major transit corridors, residents can benefit

from greater convenience to public transport and ready amenities nearby. This will translate to greater travel convenience, lower car usage, and more social interaction and bonding. More housing units of high storey's can be injected in vacant land around these corridors. Even though the living environments are likely to become denser, quality living environments will continue to be planned for. There will be more ground level open spaces and parks, and community spaces at intermediate levels to facilitate community bonding. Good design and landscaping can also offer visual relief.

V.b Housing for All

A sustainable city is also one that offers a good quality of life for all. A key aspect of this is in ensuring that housing is available and affordable. Land is set aside for a variety of housing types to meet different needs and aspirations. This ranges from affordable and quality high-rise public housing, where over 80 per cent of the population lives, to private housing that include landed properties and high-rises.

V.c Quality Living

It is not just about providing good housing but it is also about creating a total good quality living environment around where citizens live. The planning of residential towns takes into account not only the physical layout and architecture of housing blocks but also how schools, shops, medical facilities, parks, places of worship, and offices are within easy access. Towns are also well-served by public transport and road networks. Adequate housing, healthcare, community, and leisure facilities should be provided in tandem with the growing population to meet the needs and aspirations of both the young and the old.

V.d Sustaining Growth

With limited resources, cities need to continue to sustain its economic growth to provide good jobs, maintain high living standards, and remain attractive to visitors and investors. Decentralization to reduce peak-hour congestion from traffic flowing in and out of the city-centre, regional and fringe centers outside of the city centre should be consider to bring jobs closer to home.

V.e Identity

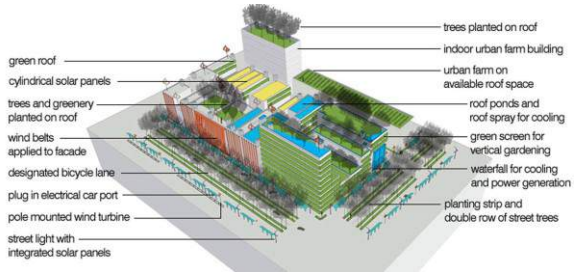
Sustainable development is much more than building infrastructure or preserving the environment. It is about putting the community at the heart of development. It is also about building rooted and cohesive communities, as well as preserving our local character and sense of identity through the preservation of our built and natural heritage.

VI. Architectural Design Solutions for a Sustainable Development

VI.a Green Buildings Strategy:

Green building brings together a vast array of practices and techniques to reduce and ultimately eliminate the impacts of buildings on the environment and human health.

It often emphasizes taking advantage of renewable resources, e.g., using sunlight through passive solar, active solar, and photovoltaic techniques and using plants and trees through green roofs, rain gardens, and for reduction of rainwater run-off. Many other techniques, such as using packed gravel or permeable concrete instead of conventional concrete or asphalt to enhance replenishment of ground water, are used as well.

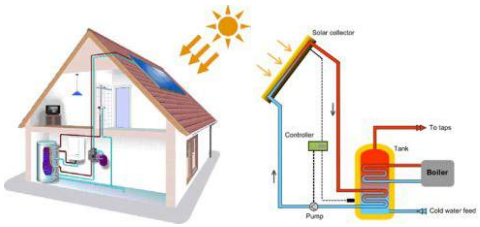


VI.b Solar panels:

Active solar devices such as photovoltaic solar panels help to provide sustainable electricity for any use. Typical efficiencies for commercially available PV panels range from 4% to 28%. The low efficiency of certain photovoltaic panels can significantly affect the payback period of their installation.

VI.c Solar water heating:

Solar water heaters-also called solar domestic hot water systems can be a cost effective way to generate hot water for a home. They can be used in any climate, and the fuel they use sunshine is free. There are two types of solar water systems- active and passive. An active solar collector system will cost approximately installed and produce about 80 to 100 gallons of hot water per day. The up-front cost of installing solar collectors is high, but with the annual energy savings, payback periods are relatively short.



VI.d Wind turbines:

A wind turbine is a device that converts kinetic energy from the wind into mechanical energy. Developed for over a millennium, today's wind turbines are manufactured in a range of vertical and horizontal axis types. The smallest turbines are used for applications such as battery charging on sailing boats; while large grid-connected arrays of turbines are becoming an increasingly large source of commercial electric power. A small wind turbine can be installed on a roof. Small-scale rooftop wind turbines have been known to be able to generate power from 10% to up to 25% of the electricity required of a regular domestic household dwelling.

VI.e Sustainable materials:

Some examples of sustainable building materials include recycled denim or blown-in fiber glass insulation, sustainably harvested wood, Tress, Linoleum, sheep wool, concrete (high and ultra high performance roman self-healing concrete), panels made from paper flakes, baked earth, rammed earth, clay, vermiculite, flax linen, sisal, cork, expanded clay grains, coconut,wood fiber plates, calcium sand stone, locally obtained stone and rock, and bamboo, which is one of the strongest and fastest growing woody plants, and non-toxic low-VOC glues and paints.

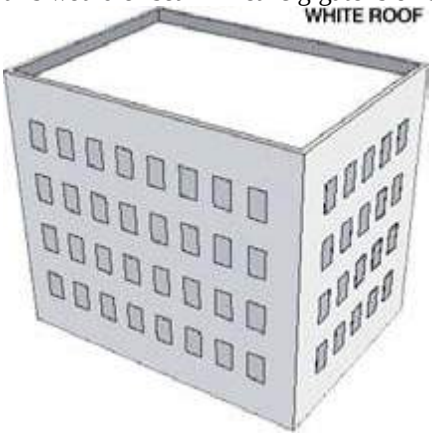
VI.f Waste management:

The management of waste is a key component in a business. Companies are encouraged to improve their environmental efficiencies each year. One way to do this is by improving a company's waste management with a new recycling service. Such as recycling glass, food waste, paper and cardboard, plastic bottles etc. There are a number of concepts about waste management which vary in their usage between countries or regions. Some of the most general, widely used concepts include:

- Waste hierarchy
- Extended producer responsibility
- Polluter pays principle

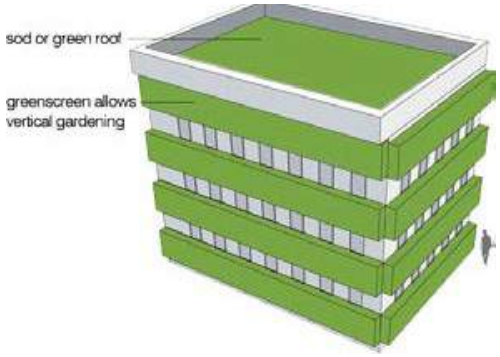
VI.g White Roof:

A physicist at the Lawrence Berkeley lab just released a study showing that the average American 1,000-square-foot white roof could offset 10 metric tons of CO_2. According to his data, roofs constitute 20 to 25 % of urban surfaces, while pavement is about 40 %. Therefore, if all of those surfaces were switched to a reflective material (or color) in the 100 largest urban areas in America, his calculations show, this would offset 44 metric gigatons of CO_2.



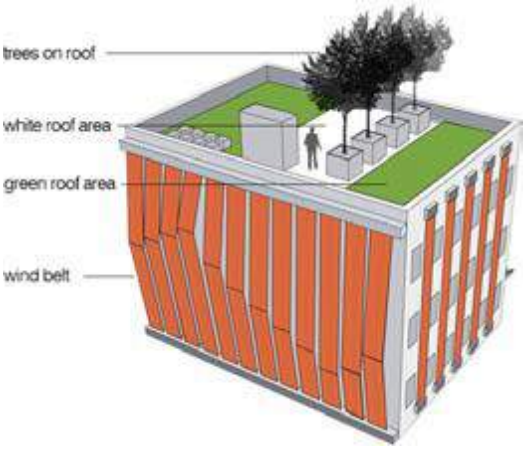
VI.h Green-Screen:

Green-screen is a type of metal structure that can be attached toexisting walls or used to create freestanding growing walls. Byintegrating more trees and photosynthesizing plants within the fabric of our existing cities, we harness the power of plants to absorb carbon from the atmosphere. The surface area of buildingsmultiplies the ground footprint of the city many times over, making vertical gardening and the integration of growing walls into our buildings an interesting practical solution. The roofs-cape of most cities is an area that is often forgotten but that could easily be used for the application of green technologies beneficial to all.



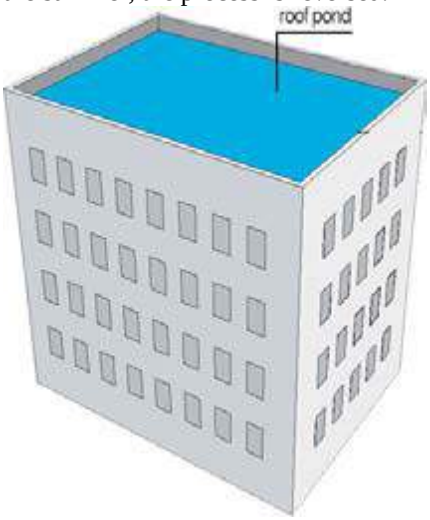
VI.i Wind-Belts and Green Roof:

Wind belts are a recent technology which harnesses the power of the wind to generate electricity. They are relatively inexpensive and suitable for both developed and developing countries and are the first wind technology not to employ turbines; Wind-belts could be used on the facades and roofs of existing buildings as a sculptural element, taking advantage of the building envelope as an available surface upon which to attach. Trees may be planted on the roof by using either planters or by using a new Japanese soil substitute, which is much lighter than earth.



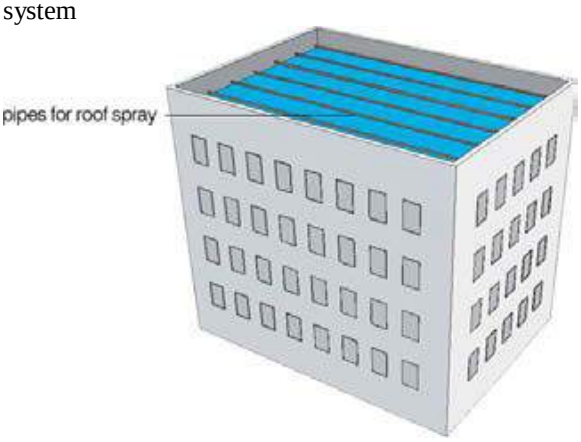
VI.j Roof Pond:

Roof ponds can be used for cooling in areas that are warm and not very humid. This technology has a lot of potential, but has been under used to date because of a fear of leakage on the part of architects and clients, however, if properly detailed it is a promising strategy and can help to reduce the heat island effect in cities. Insulating panels cover the roof and are heat of the sun, and at night, the panels are closed, allowing heat to radiate to the building's interior. In the summer, the process is reversed.



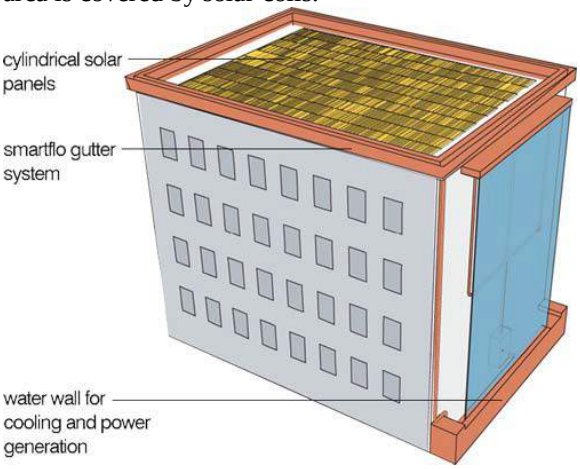
VI.k Roof Spray:

This is another method for cooling which could be employed in a retrofit of existing buildings. It can be used in combination with the roof pond, or independently with the water being stored in a tank. Here water is cooled by spray at night, via evaporation and night sky radiation, and then stored for use during the day in the building's cooling system



VI.l Water Wall and Solar Pipe:

It is well known that electricity can be generated from fast moving water. Here, we propose that a water wall be added to a blank facade on an existing building as a means of generating electricity. Water can be collected via a system of gutters on the building, and then can be piped and recycled to generate the necessary flow. This water can also be used to flush toilets and for other non-potable applications. In addition, the water provides cooling to the building's inhabitants. The roof in this scheme is envisioned as a space in which the entire surface area is covered by solar coils.



VI. Summary and Conclusion

1- Global warming is the increase in the average temperature of Earth's near-surface air and oceans since the mid-20th century and its projected continuation.

2- Addressing global climate change is a paramount challenge of the 21st Century. Since the beginning of the industrial revolution, atmospheric concentrations of carbon dioxide (CO2),the chief heat-trapping greenhouse gas, have risen 35 % , from about 280 to 377 parts permillion (ppm) , This increase is primarily from the burning of fossil fuels and from deforestation

3- There is no doubt that climate will continue to change throughout the 21st century and beyond, but there are still important questions regarding how large and how fast these changes will be, and what effects they will have in different regions.

4- Buildings alone are responsible for 15% of all human GHG emissions. It is the industrial sector which contributes the most to Climate Change. But according to the IPCC, it is also the sector which presents the most cost effective opportunities for GHG reductions.

5- Sustainability is the key to a survivable future on Earth: we must find ways to conserve our resources, reuse the materials we have extracted from the Earth, and turn to renewable resources for energy. Perpetual economic growth is physically impossible on a planet with finite resources.

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