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Edited by
Eka Sediadi

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Architecture Department, Trisakti University
Jakarta, Indonesia
October 15-16, 2003

PROCEEDINGS

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Eka Sediadi
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Abstract

Urban development faces the increasing complex problems of population concentration, conflict among economic activities and expanding urbanization leading to degradation of environmental quality and resources. Thus, the city must be interpreted as a complex system of energy and material flows in the holistic point of view.

This paper describes the ways and gives general description on how to built an urban ecological system called ecoscape network model in the-tropics where life is geared by four main resources: the sun, water, wind and greenery. This model emerges from a new generation of research and development that seeks citywide application of renewable energy that will applied for the local need to develop the network.

Keywords:
Ecoscape network, citywide application, biosystemic thinking, local context, energy and material flows

1. Introduction

The form of future built environment should be based on a responsible approach to nature and the use of energy potential of the natural resources. Therefore, the design of building and urban spaces must be interpreted as a complex system of material and energy flows. Indonesian cities are resources in tropical built form areas and have a high primary content. The relationship between cities and tropical environment should be developed to achieve a symbiosis between energy use in urban activities and energy supply of natural system. To achieve the balance of ecological system the various urban activities of neighborhoods, buildings and open spaces, infrastructure and their functional, transport and communication system should be subject to a process of modification and reconstruction that follows nature recycles of renewal.

Urban functions such as habitation, production, service and cultural activities must be coordinated with each other that functionally possible and socially compatible.

These functioned are comprehended in its entirety as self-contained long-living organism. It should be possible to control the constant change and to ensure a minimum of disturbance and a maximum conservation of resources. This means that cities, buildings and their various elements must be interpreted as a complex system of energy and material flows which its use of environmentally friendly forms of energy should be planned from a holistic point of view. Therefore, the design of buildings and urban spaces in such a way that natural resources will be conserved and renewable forms of energy.
The concepts of sustainable city covers a wide range of issues and many of them related to including the provision of energy in sustainable manner. The targets of such way are:

- to investigate and describe procedures for assessing the potential of renewable energy resources
- to determine existing and potential existing and potential relationship between local area and their surrounding in term of the balance of energy supply and demand
- to evaluate strategies for increasing the use of renewable energy resources.

This paper explains the significance of ecoscape network approach for designing the low energy-based tropical city model. Firstly, it describes about the ecoscape network approach as a basic concept for urban space design. Secondly, it explains the characteristics and efforts of urban space design based on the tropical urban environment and energy aspects. Thirdly, it proposes an alternative model of environmentally symbiotic city by using energy efficient system in the ecoscape network.

2. Ecoscape Network

The urban space design is an architecture in which culture, in the form of urban life style, exists in symbiosis with climatic condition. Thus, the design of urban space should depart from the universal values of the nature and represent the creation of regional values. The elements of urban environment system could be evaluated in terms of its functioning, malfunctioning, overloads and bad connections by regional-based ecological analysis for identifying the problem points. With the advances of economic thinking, the task of urban environment planners is how to retain a balance among the three foundation of urban social structure as the Earth summit’s proposal for sustainable development of balancing the trinity i.e. economies, lifestyles, and nature.

To that extent it is possible to minimize environmental loading while sustaining urban economic growth and improving the urban living standard harmoniously. Achieving the balanced use of the limited urban resources the urban design approach should be based on the philosophy of human-nature coexistence by understanding the regional environmental energy characteristics. The “energy” in this context is defined as a characteristic resulting from accumulation of natural environment local history, people’s activities and urban functions. Therefore, it is crucial to identify and evaluate the features of regional environmental energy in order to utilize effectively and efficiently the urban resources in the design context of ecology, social and aesthetics (visual).

1. Increasing income (living standards)
2. Higher consumption
3. Effective use resources
4. Availability of resources
5. Maintenance of environment
6. Provision of amenity
Biosystemic thinking emphasizes the city as a complex system which categorized by process of change and continuity of urban life chains. It regards aspects of energy and natural resource use and waste production as chains of urban life that require management, maintenance, restoration and stimulation in order to contribute to sustainable development of urban architecture.

Cities are huge consumers of water, electricity, fossil fuels and nutrient. The sustainable city ideally should have a circular metabolism, using only local resources and recycling all wastes back into the system. This biosystemic thinking also includes a socio-economic dimension which considers the inhabitants as a part of the city ecosystem.

The renewable forms of energy give an opportunity to make the cities more livable. The relationship between cities and nature should be developed to achieve an environmentally symbiotic system. Thus, the design of urban space must be comprehended in its entirety as a self-contained long-living organism, the design should be able to control the constant changes in its use and appearance in order to ensure a minimum of disturbance and maximum conservation of resources.

The passive design is designing and systematic method to utilize natural energy, such as sunshine, changes in temperature, winds and terrestrial heat, and white considering the regional climatic conditions. It is important to development and apply the passive design, particularly passive cooling technology for urban space design, not only in the view of global environmental problems and possible energy exhaustion but also in the view of regional values characteristics.

To achieve the balance of urban nature, the urban function such as habitation, production, services, cultural and leisure activities system should be subject to constant process of modification and reconstruction which follows urban natural cycles of renewal.

The environmental and bioclimatic factors which govern the urban space structure are pattern and orientation of the street and building structure, temperature control of urban spaces, distribution of vegetation and planted area, topography, hydrogeology and waterways system, wind direction and intensity for systematic ventilation and cold air corridor. The natural resources available in a tropical region, especially, sun, wind and geothermal heat should be harnessed for the environmental and bioclimatic conditioning of urban spaces and should be reflected in the design of their urban form and spatial patterns.

Thus, the new urban design approach in the tropical region must be created in order to increase awareness of sustainable and recycling-based thinking. This means that it is essential to improve performance of urban space design in the light of tropical climate and to create favorable environment with less dependence on energy-consuming technologies.

3. Converting Solar Energy

The Sustainable Energy source, renewed daily and inexhaustible in human time spans, is the sun. Solar energy can be channeled by a number of means to provide usable energy in diverse forms that can replace all of non renewable energy forms.

After arriving at the earth's surface, the radiant energy of the sun goes through a series of conversions, to plant biomass, to animal biomass, to heat in various forms, before being eventually dissipated back into space.

The regenerative energy capacities in the ecoscape network system lie largely in six basic phases of ecosystem. These six basic functioning are conversion distribution, filtration, assimilation, storage, and where human development occurs, human thought. These basic processes of regenerative energy are the keys to sustenance of life itself and thus to sustainability (Iyle, JT,1994).
Each of natural conversion that solar radiation undergoes on reaching the earth plays an essential role in supporting the ecoscape network of urban energy system. The chains of transformation associated with each of the four can be summarized as shown in the table 1.

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<th>SOURCE</th>
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| Solar Radiation | Photosynthesis | Food web | Biomass | - Food  
| | Absorption and convection | - Thermal balance  
| | | - Climate patterns | Heat | - Space heating  
| | | | | - Electrical power  
| | | | | - Water heating  
| | Reflection | - Visible Light  
| | Evaporation | - Reradiation  
| | | - Watercycle | Mechanical Energy | - Process heating  
| | | | | - Daylight  
| | | | | - Electrical power |

Table 1. The Chains of Energy Transformation

Solar radiation in the ecoscape network provides the power-evaporating water, mostly from seas and lakes; the water vapor then rises into the atmosphere, forms clouds, and is carried by the wind over the land. It condenses, falls to the earth, and flows on the through the land, supplying every elements of the network before eventually rejoining the seas and lakes to repeat cycle. Plants play a multitude of fundamental urban ecological roles, they provide habitat for other plants and wildlife, use solar energy to create biomass, absorb carbon dioxide and give off oxygen to the air and hold the soil in place.

In a water and greenery network of urban ecological system, well vegetated landscape, the plants slow the flow of water, trapping it temporarily on their leaves and branches, releasing it slowly, and providing a layer on the ground into which it can soak. Their roots grasps the soil and prevent its washing away. A healthy landscape absorbs for more water into the ground than flows away on the surface.

When greenery are gone, erosion increases and the soil that sustained life is carried to the bottom of rivers and lakes to restrict their flows and cause flooding and other problems.
As the end of this paper, one may cite some points of the imageable environmental and bioclimatic characteristics and response to designing the future of sustainable urban architecture are as follow.

1. Target of environmental intervention are improving ventilation by a better aerodynamic pattern of thermally induced airflow (temperature differences) and street management system in relation to the wind direction; improving insulation and shadowing the building, courtyards, street and open spaces; and reducing pollution caused by traffic.
with a system of absorbing and processing pollution through a green filter along the busy surrounding streets.

2. Urban vegetation and bioclimate system concept of green belt against pollution and noise, urban forest connecting the lagoon system and the green border, inter-relation of specialized agricultural border and the internal green space and bioclimatic green central spine.

3. Ecological and energy concept of solar energy for water control (canals and ponds), urban district energy network, ecological and bioclimatic pilot project for mixed function districts by using innovative technology.

4. Water concept of cleaning lagoon system as new landscape, supporting the bioclimatic urban vegetation by water system, and introducing the rain, water channel and water point system.

As the conclusion, this paper noted some points:

1. It is crucial to identify and evaluate the features of regional environmental energy in order to utilize effectively and efficiently the urban resources in the design context of ecology, social, economy and aesthetics (visual).

2. The cities, building and their various elements should be interpreted as a complex system of material and energy flows in the tropical region.

3. The use of environmentally symbiotic forms of tropical urban energy should be planned from a holistic point of view.

4. The proposed model of ecoscape network in the citywide linkage delineate the three main system of biophysical, infrastructural and urban form and their interrelationship and determine the optimal form and pattern for different types of urban spaces and based on criteria of suitability, efficiency and compatibility.
5. Some Note For Implementation

For all the recommendations in shaping an energy efficient urban design in sustainable manner, there are two necessary conditions under which ecoscape network system can fulfill that recommendation and become a practical guidelines:
- They must cost no more (and preferably less), and
- They must be supported by public policy.

Thus, the next problem is "How can it fulfill these economic and policy conditions?"

6. References

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