APPLICATION OF DESIGN THINKING & PLANNING IN NEW CITIES TO MANAGE CONSERVING ENERGIES

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Abstract:

Energy has become a crucial element that affects various aspects of daily life. In the process of design thinking and planning of new cities, energy conservation has become an important issue that can play a twofold role. The first one is to face the problem of the forecasted depletion of nonrenewable energy resources. The second one is to reduce the environmental pollution. The whole world started to develop new methods and systems in the design and planning process to create a new eco-friendly city. One of these systems and the most recognized one is "Leadership in energy and environmental design" (LEED). All these systems are made to keep pace with the new requirements of the future era, taking into account sustainable economic thinking and preserving a suitable life on the earth. It was found that with the expansion in the Arab republic of Egypt in the establishment of new cities, no regard was given towards energy conservation, so this paper is an attempt to apply design thinking & planning in the conservation management of energies in new targeted cities.

Keywords:

Egypt; Design Thinking; Planning of new cities; sustainability; LEED; Energy conservation.

Introduction:

Arab republic of Egypt tends to solve the housing problem through horizontal expansion by invading the desert to accommodate the increasing population. Such projects help in solving the problem of unemployment by creating new work opportunities. The government began this trend in the late twentieth century to develop comprehensive plans and design strategies for the establishment of new cities. As a result to this expansion major problems were faced such as shortage of energy sources, rising costs and the increasing pollution resulting from the improper and increasing rates of consumption.

However all the planning schematics for the new cities didn't take into account the utilization of energy sources, rationalizing consumption and reducing pollution sources by applying administrative planning thinking to design cities that maintain the environment.

Many countries in the world started creating new cities that apply proper design thinking and planning to achieve lots of goals regarding energy rationalization and organizing energy usage systems. This ensures the elimination of pollution sources to preserve the environment. The main target is to create a suitable atmosphere to its inhabitants that commensurate with the requirements of modern life without the effects of pollution. This was accomplished through many examples such as (Masdar city) UAE.

What is green architecture?

Green architecture has become the future goal for most cities in the new world which seeks to provide a good environment for residents with an attempt to reduce energy consumption and reduce pollution.

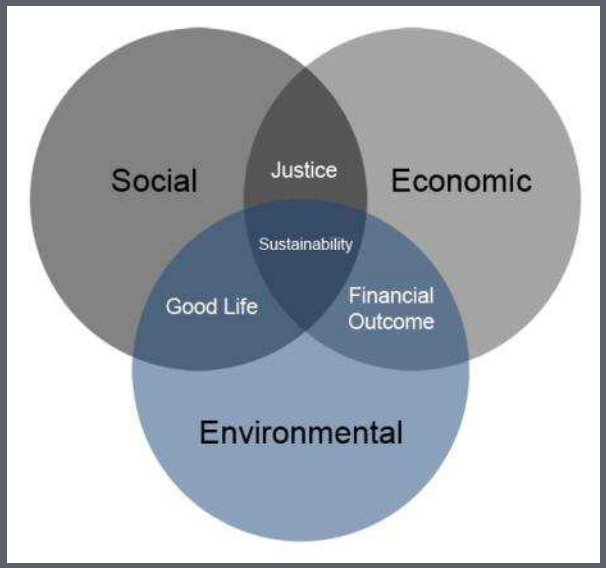

Fig.)1(.indicating elements of sustainable architecture. (From Green Building Basic Information [1], 2009)

Into the Definition of the sustainable city:

The sustainable city is a city designed with consideration of environmental impact, inhabited by people dedicated to minimization of required inputs of energy, water and food, and waste output of heat, air pollution and water pollution. As the existing problem in many cities is the absence of social, environmental, economic and urban harmony.

Sustainable Planning & Design:

The world started recognizing the close link between planning new cities and the extent of its relationship with economic & environmental development. And that in order to avoid the exploitation of natural resources, and the waste and pollutants produced by the cities.

"Sustainability", "Green architecture" concepts in the construction sector:

Sustainable design, Green architecture, sustainable construction. All these concepts are new ways & methods to design and to construct buildings and cities that take into account environmental & economical challenges that face all sectors. Nowadays new buildings are designed & executed & operated by advanced methods & technologies that help in minimizing the environmental impact and in the same time help in decreasing the operation costs & maintenance costs. Also one of the most important contributions of sustainable design is providing safe & comfortable urban environment.

Sustainable urban strategy:

Sustainable urban strategy can be defined as a comprehensive strategy that takes into consideration and works on developing all aspects of the used systems in the city.

Sustainable urban planning:

- Sustainable land use planning.
- Location sustainable development.
- Building sustainable design.

There are multiple elements in the sustainable urban planning on all aspects in new cities such as:

1. Conservation of empty land spaces outside the limits of the built area and designing close urban community compounds to achieve:
2. creating multiple uses urban communities and encouraging pedestrian movement to achieve:
3. Studying construction materials and methods to achieve:
4. Applying environmental provisions & standards on all design elements and new cities planning elements through providing some elements in the design process related to:
5. Application of regulations & provisions that maintain the application of all standards including the following:
6. Encouragement to develop sustainable planning & design thinking, development of planning & design thinking is encouraged in order to find a new city with a special environmental characteristics through:
7. The preparation of the detailed integrated planning studies:
8. Planning & design thinking management to conserve energy:
9. Smart growth planning management for the new cities, the planning of new cities must be applied to management systems through the following:

Planning design management development elements in new cities

Planning design management in new cities can be developed through a group of elements as follows:

- Managing the location environmentally to find out the elements to benefit from in the design process.
- Design thinking management to create urban spaces suitable for the user's demands and to achieve general preservation to the environment.
- Achieving energy conservation systems and limiting pollutants in all the design elements.
- Benefiting from water management (especially) in all the stages of using it, plus achieving natural management to rain water.

Design thinking & planning in new cities stages

- Per-execution stage.
- Execution stage in new cities.

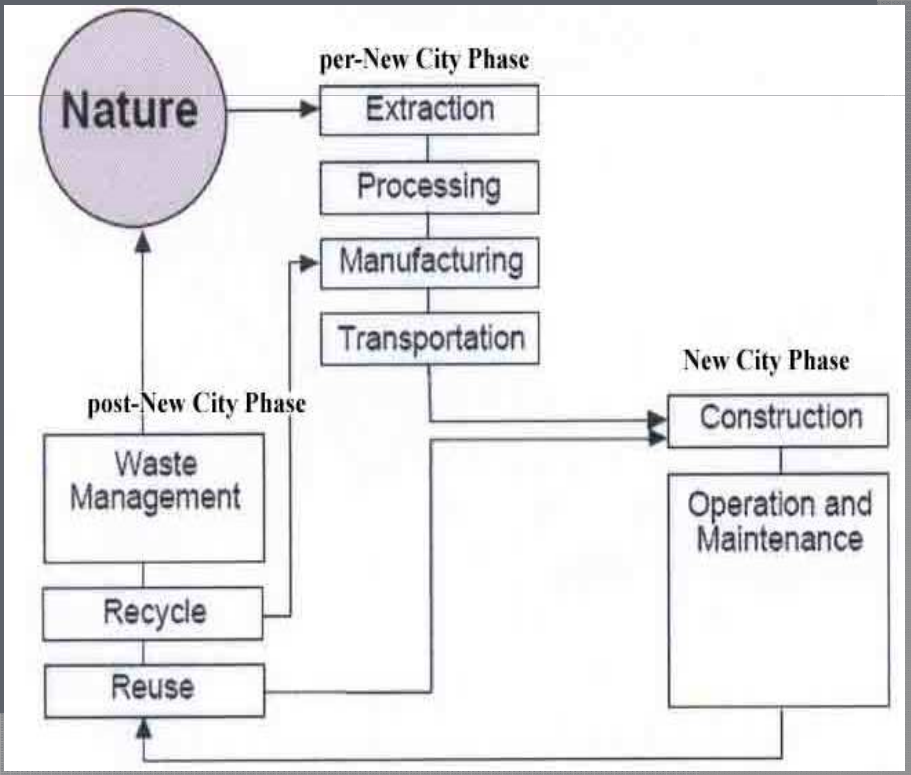

Fig. (2). Pre-execution stage steps. (From "Masdar City: Fast facts" [7], 2008)

Sustainable development elements in a building

1. Effective design in plans, where we can benefit from.
2. Good building orientation for better natural lighting and ventilation, where we can benefit from.
3. Using proper & sustainable building materials where we can benefit from.
4. Interior design that maintains good quality of internal air (fig. no. (3) shows using sunrays in natural lighting), where we can benefit from.

Fig. (3). shows using sunrays in natural lighting.

(From "LEED Projects Directory - Certified Project Directory" [8], 2008)

5. Reducing the waste during construction operations and using construction materials effectively (fig. no. (4) shows using insulated construction materials to maintain indoor temperature), where we can benefit from.

Fig. (4). shows using insulated construction materials to maintain indoor temperature.

(From "LEED Projects Directory - Certified Project Directory" [8], 2008)

***Time stages in sustainable planning*:**

1. Post-execution stage
2. Pre-execution stage
3. Execution stage

Sustainable buildings in design stage:

- Phase 1.
- Phase 2.
- Phase 3.
- Phase 4.
- Phase 5.
- Phase 6.

Leadership in Energy & Environmental Design (LEED)

Design & planning for new cities is based on many items, but (LEED)is considered to be the most important approach that must be studied to ensure that the city is keeping pace with the requirements of our age, to design a building that uses technologies & strategies to improve performance in specific fields concerning energy-saving, water rationalization, reduction of carbon dioxide emissions and increasing the environmental quality of the internal spaces and to reduce the environmental impact of building on the surrounding space.

(LEED) application elements:

The LEED system application elements consist of the following:

- Design & implementation of green building.
- Interior design & implementation.
- Green building operations & maintenance works.
- Designing green residential neighborhood.
- Design elements of residential building & their implementation.
- Elements of the new city & taking into account the environmental elements in their design & implementation.
- Study of new cities networks and their relevance for the environmental elements.

Examples for new cities:

- ***Biometropolis near Mexico City:***

The city is designed on 71 hectares of land. It lays to the south of Mexico City. It is designed to contain a medical center, care facilities, teaching spaces, research institutions and laboratories.

Fig. (5). Shows the master plan of the Biometropolis City (From worldarechitecturenews.com [12]. 2009)

Fig. (6). Shows the perspective view of the Biometropolis city (From worldarechitecturenews.com [12]. 2009)

- ***Dongtan City in China:***

The design process started in 2005, with the target to create an eco-friendly city in china which would exclusively use sustainable energy. The city will reduce energy consumption by 66% in relation to its neighbor shanghai. It is planned to provide housing for 500,000 people on 8,400 hectare near shanghai city.

- ***Reasons for designing Dongtan city:***

By year 2020 China will need to provide housing in 400 cities for 300 million people from rural areas. This means a massive increase in energy consumption. So they will need to focus more sharply on energy efficient design, technology and the quality of urban planning strategies.

Fig. (7). Shows the perspective view of the Dongtan city (From Sustainablecities.dk [13], 2010)

Fig. (8). Shows the lake part of the Dongtan city (From Sustainablecities.dk [13], 2010)

- ***Greensburg city:***

  Following a devastating tornado there in 2007, the tiny city of Greensburg, Kansas has engaged in a sustainability-oriented recovery process through which it hopes to serve as a model for other communities planning for a sustainable future.

Why sustainability in Greensburg:

The city of Greensburg could have been rebuilt in a way that replicated its past as many communities that recover from disasters do exactly this. But when the new master plan was designed.

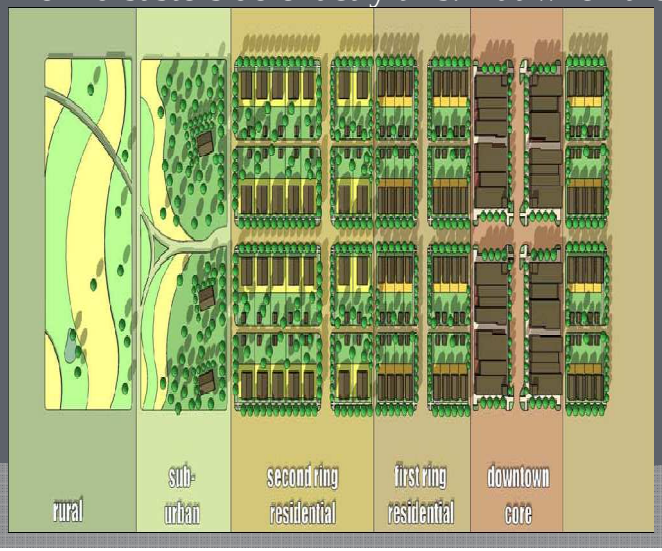

Fig. (9). Shows the master plan of Greensburg city. (From Stacey Swearingen White. [14] Jul. 20, 2010)

Fig. (10). Greensburg‘s Nearly-completed LEED Platinum City Hall (From Stacey Swearingen White. [14] Jul. 20, 2010)

Masdar City in UAE

Masdar city is one of the most famous green cities. It is located in the UAE, and its construction is ongoing nowadays.

Fig.(11). Shows the layout of “Masdar” city. (From "Masdar plan" - The Economist. [15] 2008-12-04)

Fig. (12). shows covering the city center with shades that open during the day to absorb energy.

(From "Masdar plan" - The Economist. [15] 2008-12-04)

Fig. (13). provide shade and close during the night and provide energy for lighting.

(From "Masdar plan" - The Economist. [15] 2008-12-04)

Design thinking & planning in "Masdar" city:

Although the weather in "Masdar" city is very hot, but can be characterized as sunny and that's what the city architects used as the largest source of energy.

Sustainability in "Masdar" city:

"Masdar" city will need about 200 mega watts of clean energy compared with more than 800 mega watts for a traditional city with the same size, the city requires around 8,000 cubic meters of desalinated water per day compared with more than 20,000 cubic meters per day for a traditional same-size city, 30% of Masdar city total area will be allocated for residential uses, 24% for business & research, 13% for commercial projects including light industry, 6% for Masdar institute of science & technology, 19% for services & transportation and 8% for civil & cultural rights events.

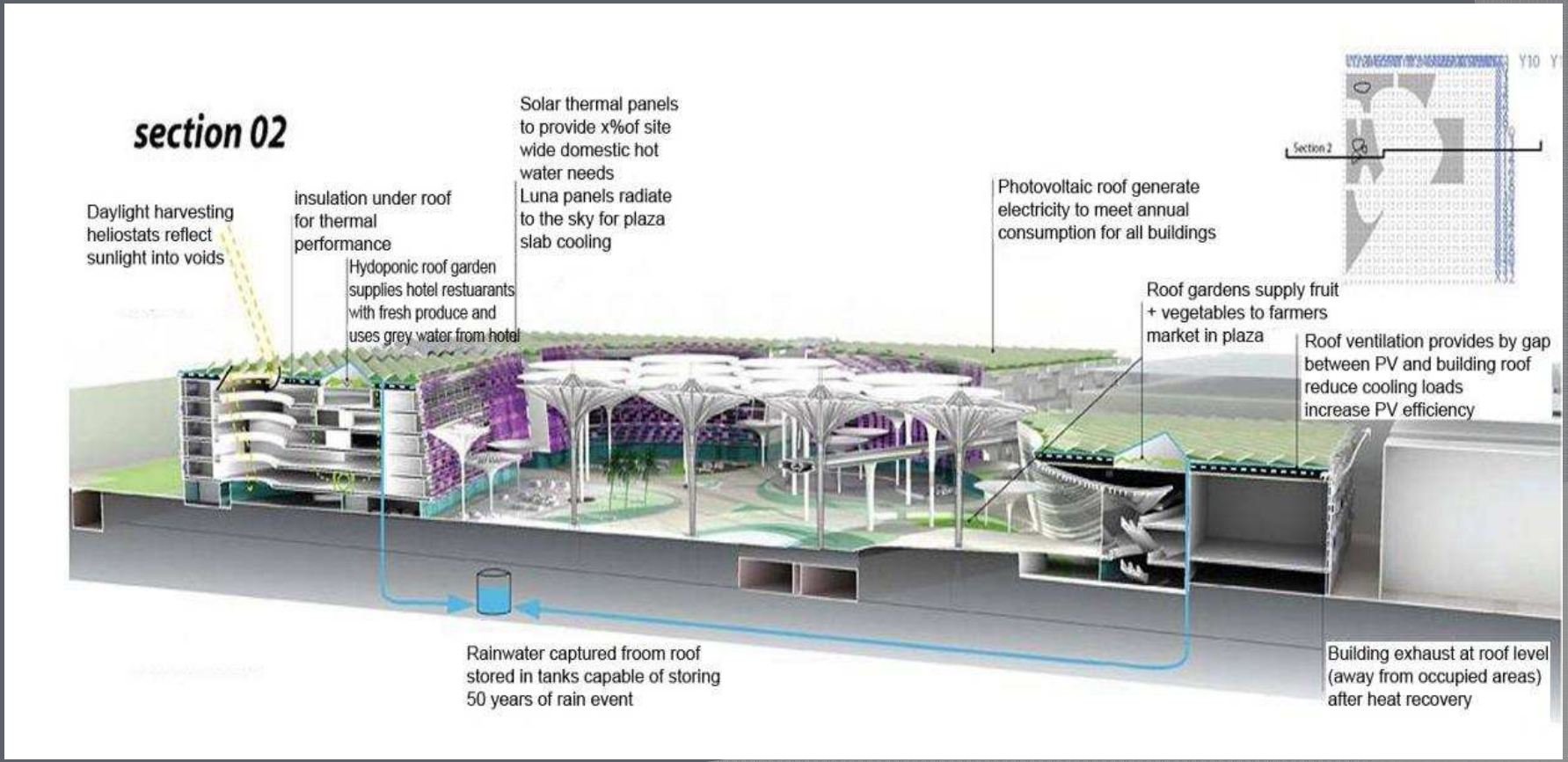

Fig. (14). shows cross sections demonstrating water flows to underground water tanks.
(From ASK magazine issue no.(9) [18]. March 2010)

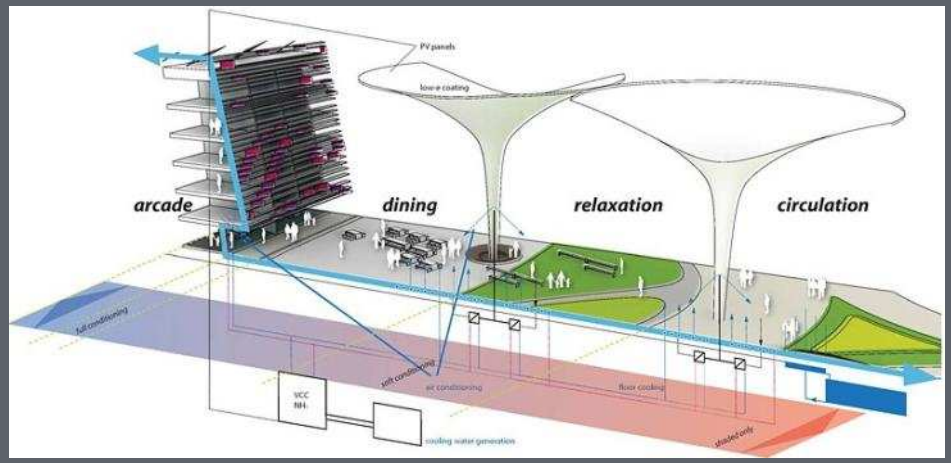

Fig. (15). shows cross sections demonstrating water flows to underground water tanks.

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A Carbon free city in Libya

Shahat Garden City - Madinat Hadaek Shahat - is located in the renowned Green Mountain region in eastern Libya, only a few kilometers south of the UNESCO World Heritage Site of the ancient city of Cyrene.

Fig. (16). Shows the general view of buildings in the city

Fig. (17). Shows the city's Master plan

Conclusion & recommendations

- On the governmental level
- On design & planning level