

Green Urban Communities Sustainability & Energy Efficiency

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Abstract. Sustainability & Energy efficiency nowadays are considered the most challenging agenda in new urban communities. Modernization has led to increased initiatives regarding sustainability, where it became an essential concern in the discourse of architecture and urban planning. Although sustainability has received great attention, it still remains the most glaring challenge in terms of its demand. The article aims at bringing traditional solutions, modern technologies and knowledge in tune with such practices to provide sustainability interacting with natural climatic conditions. The article attempts at highlighting sustainability challenge including its implications for the built environment and consequently the various stakeholders, in order to design more energy efficiently and environmental friendly communities, growing the capability of building industry in the areas of design and operation of green building design.

Keywords: Sustainability, Urban Communities, Energy, Environment, Green.

1. Introduction

Architecture is the history of humanity's interaction with environment as cities are often large consumers of energy in buildings and public facilities. Thus, the transition to alternative energy sources & energy efficiency became a pressing need to avoid stagnant environmental and economic developments.

Egypt energy consumption mainly relies on oil & natural gas although some estimates indicate that indigenous natural gas and oil reserves, on which Egypt's electricity generation currently relies, will run out.

Egypt's total primary energy consumption grew by an annual average of 5 percent from 2000 to 2010, most of which was oil and natural gas. Egypt is the largest oil and natural gas consumer in Africa, accounting for almost a quarter of total oil consumption in Africa in 2012 and almost half of total dry natural gas consumption in 2011. The rapid growth of oil and gas consumption has been driven by increased industrial output, economic growth, energy-intensive gas and oil extraction projects, population growth, and an increase in private and commercial vehicle sales. Almost all of Egypt's 3.6 quadrillion British thermal units (Btu) of energy consumption in 2010 was met by oil (41 percent) and natural gas (46 percent), with the remainder from renewable energy sources (traditional biomass, hydro, wind, and solar) and coal [1].

The article addresses the challenges of energy consumption, climate change and development in developing countries, dealing with the role of urban centres and local governments in defining a sustainable development path and a new energy future in new urban communities, in order to provide high-performance buildings, designed and built to minimize resource consumption, reduce life cycle costs, maximize health and productivity for the building's occupants, and improve environmental performance.

Energy and atmosphere – how can we save energy, cut energy costs and encourage green energy? All are important questions that we will try to find answers for. As such, the article seeks to provide basis upon which decision-makers can formulate strategic frameworks for transitioning to sustainable, resource efficient urban development for new urban communities in this new era, to control, manage, maintain and improve the

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common property in the housing estates, giving residents more power to manage and participate in their estate's development, to come up with innovative new ideas creating sustainable quality living environments.

2. Energy, Environment & Design Techniques

One of the most pressing issues when it comes to sustainability is energy production, nowadays developing new methods and techniques are crucial to expand and ensure the quality of life while moving away from fossil fuels to more renewable and efficient energy sources. In fact, burning fossil fuel such as coal, oil and natural gas is a source of virtually all emissions causing global climate change. The global energy crisis coupled with the threats of climate change bring into sharp focus both opportunities and challenges for developing countries. In addition to these challenges is the global imperative to reduce carbon emissions to prevent climate change. Global warming raising the average temperature of Earth's atmosphere and oceans sea level became faster, which has been exceptionally rapid in comparison to the changes in climate over the past two millennia. The Intergovernmental Panel on Climate Change (IPCC) noted that the rate of global temperature increased in the last 50 years has been twice that of the last 100 years, [2].

Cities are taking advantage of their natural resources to source cleaner energy. Growing environmental conscience, rising energy prices and attractive subvention measures have new led to other energy generation forms being tried and/ or developed, [3]. Renewable energy is naturally replenished and generated from natural resources—such as sunlight, wind, water, bio-fuel, and geothermal heat .Design policies nowadays aims at the use of various renewable energy sources like, photovoltaic, solar heating systems, wind turbines, biomass ,wave & tidal, geothermal, biogas generation plants and district energy systems. Solar power as an important resource is considered a clean and renewable way to generate electricity by harnessing the power of the sun. Cities are trying to buffer themselves against energy price volatility and ensure energy security by supporting or generating power locally using local resources represented in renewable energy [4].

Employing passive design strategies is the simplest and most effective way in which designers can minimize the energy required by their projects. The principal passive design measures are solar gain, solar shading, thermal mass, thermal insulation, natural ventilation air tightness and natural day lighting [5]. Passive solar building design techniques allows buildings to harness the energy of the sun efficiently including building orientation, utilizing prevailing wind ,natural cross ventilation and selecting materials with favourable thermal mass or light dispersing properties (Figure 1). Passive solar design uses windows, walls, and floors to collect, store, and distribute the sun's heat in the winter and reduce a building's energy demand for cooling in the summer. Low energy designs also requires the use of solar shading, by means of awnings, blinds or shutters, to relieve the solar heat gain and to reduce the need for artificial cooling[6].

Active solar techniques include the use of photovoltaic panels or solar thermal collectors (with electrical or mechanical equipment) to convert sunlight into useful outputs. The most widely used active solar technology is photovoltaic (PV) modules. PV technology uses solar cells to convert sunlight directly into electricity, [7]. Photovoltaic cells as panels containing semi-conducting material that triggers an electrical field when sunlight shines through it , are generally roof mounted, although wall panels exist. Active solar technologies are employed to convert solar energy into usable direct light and heat, cause air-movement for ventilation or cooling, or producing energy.

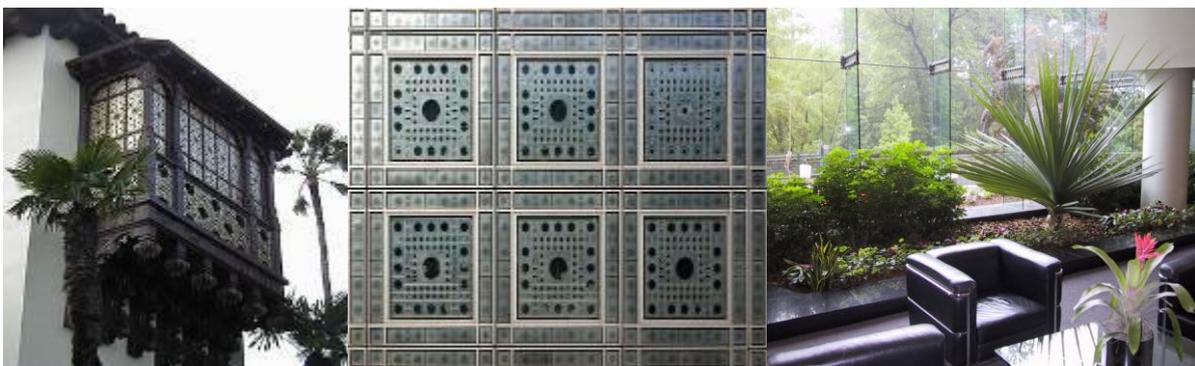


Fig. 1: Passive Lighting Design Solutions

3. Sustainable Green Design

In traditional planning and design process, building systems were viewed as separate elements - site, structure, systems and use, and design decisions were based on budget and/or schedule considerations. Changes to a design in order to meet a certain budget or follow an accelerated schedule did not take into account the final performance of a complete sustainable and energy efficient buildings. Nowadays buildings are becoming more energy efficient and are more sustainable to last longer.

Sustainability has been defined by the Brundtland Commission in 1987, as the ability to meet the needs of the present without compromising the ability of future generations to meet their own needs. In general, sustainability is the term for all things that decrease our dependence on non-renewable energy and increase the idea of living within the means of our current environment without damaging it for the future [8]. Sustainable design begins when projects are first imagined and requires thinking 'green' at every stage in the project's lifecycle. The challenge of sustainable development is to make trade of, finance and globalization work for all members of society and environment, [9].

Green buildings are the practice of creating structures and using processes that are environmentally responsible and resource efficient throughout a building's life cycle. Traditional building models focus on function, aesthetics, cost and scheduling. Green building goes one step further, adding sustainable ideals to these imperatives, [10]. Being endorsed by industry, green designs are designs that reduce the overall negative impact of the built environment on human health and the natural environment. Government officials nowadays support the ideas of becoming more environmentally conscious to reduce human exposure to toxic materials giving preference to systems, design guidelines and materials that reduce environmental impacts over their life cycle, conserving non renewable materials, using energy, water and other resources efficiently, improving household productivity resulting in good design (Figure 2) , [11].

In the broad context, the idea of sustainability, or green design, is to ensure that actions and decisions today do not inhibit the opportunities of future generations. This can be framed in the context of a conscious approach to energy and ecological conservation in the design of the built environment.



Fig. 2: Green Design Solutions

4. Sustainable Communities Integrated system

Cities are the greatest legacy of humanity and achievement of our civilization .When the concept of sustainability extended from the global to the local level, the term "sustainable communities" became another buzzword among academics, politicians, media and general public. Each city nowadays wants to be "branded" as sustainable. Although New Communities were inspired from the "garden cities movement" the question of environment was not a real concern for the decision makers in charge of designing the New Communities some decades ago, [12]. Building in the desert is an important issue for the future of several countries like Egypt and other desert countries. Egypt forecast estimated population of 125 million inhabitants by 2050. As the population is today about 85 million residents, Egypt will need to provide housing for 40 million more inhabitants within 40 years, an incredible challenge.

Leaders and officials of local governments have started to become more involved in climate change policy-making by undertaking strategic planning; formulating, approving and implementing appropriate

policies, evaluating their effectiveness, and disseminating successful actions, where the present official energy strategy aims at increasing the share of renewable energy to 20% of the energy mix by 2020.

While many local governments are faced with budget deficits, the appeal of saving money is often the starting point for municipal energy management initiatives. Improved efficiencies in energy consumption offer plentiful opportunities for reducing operating costs. Local governments as an important stakeholder play a significant role in the energy picture of cities as they plan and manage city development and growth, establish and enforce building codes and approve building plans, [13].

Integrated Project Delivery integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction [14]. Experiences show that including residents in the process through information campaigns, involving them in metering energy use and allowing them to provide feedback to designated persons when problems occur improves end user satisfaction. This also helps to promote a positive image of the project itself, an often neglected aspect of project planning.

5. Public Awareness & Partnership

Owners, designers, engineers, and builders play vital roles in reducing the environmental impact of the built environment, starting with the decision to build. Talking about design efficiency it is important focusing on providing information & awareness-raising activities for decision makers, investors, building owners, developers, housing associations, building users, and the general public. It is important as well encouraging training activities to be targeted at decision-makers, planners, architects, developers, housing associations, investors, owners and users. The effects of providing awareness lead to outcomes ranging from better acceptance of construction works and general public interest about the results, to an improved perception, a tangible increase of property value and concrete improvement in health and the quality of life. Building user behaviour, so office worker, home-owner or tenant should be equally conscious of the influence of his/her behaviour when it comes to the energy consumption. The most efficient way to convince the end user to change behaviour is to highlight the non-energy benefits of renovation measures: increasing health and comfort while reducing energy bills. Partnerships between public authorities and private sector (PPP's) companies is very beneficial, notably through combining and sharing public and private sector budgets, skills, knowledge and expertise. Beyond this, PPP's achieve innovation and diversity in the provision of public services which is crucial in a fast-paced field of energy modernization. Traditionally, investors and developers look at the immediate outlay and aim to minimise the amount of the initial investment. Consequently, this reduces the ambitions for achieving an optimised energy performance of the building, [4]. Egyptian electricity consumption is increasing much faster than capacity expansions, and the government is planning to invest heavily in the power sector over the next decade, while also seeking financing from external sources. The private sector, international organizations, and renewable energy funds such as the World Bank's Clean Technology Fund have all provided investment in the sector. Under existing plans, Egypt hopes to produce 12-20 percent of its electricity from renewable energy by 2020 while also developing a nuclear power industry, according to IHS CERA, [1].

6. Conclusions

Prevention should be addressed by bringing environmental architecture into the mainstream helping transforming our society and putting us all on a path to save our planet and move into a world of better cities. There is a strong link between quality of life in cities and how cities draw on and manage the natural resources available to them. It is important to establish a vision for a sustainable energy and climate action future and establish measurable goals. Increasing the knowledge and awareness among decision-makers about the possibilities for sustainable buildings and urban development are key priorities to positively steer the way how citizens will live and work in the future.

With the aim of giving a sense of ownership over the project, in this respect, the key is to encourage participation right from the start, by taking a user-centric approach, and by evaluating the success by gathering information through specific district documentation of inhabitants (e.g. bills), interviews with

stakeholders and simulation of energy parameters. Making a set of recommendations for improving city sustainability, based on an understanding of the key drivers of change, challenges, we should work on sustainable energy and climate mitigation projects and programs projects that are consistent with national sustainable development goals. From an energy perspective, sustainability can be achieved by increasing the share of renewable energy sources on the energy supply side, and using efficient energy conversion systems.

As local governments manage or oversee all city activities and city development, they should play a central role in determining the energy and carbon emissions picture of cities where incentive-based measures are needed by all levels. Local governments therefore need to stimulate action at the local level in order to fully integrate renewable energy and climate considerations into urban development strategies making mandatory green building standards for all new urban communities by incorporating building performance standards building codes and other standards (rating systems). Egyptian Local governments and new urban communities can start with solar water heaters in new buildings as an initial target by making incentives for developers and designers building green, increasing the efficiency of buildings and their use of energy, and reducing building impacts on human health and the environment, through better siting, design, construction, operation and maintenance, taking into account every aspect of the complete building life cycle.

Egypt's current electricity-generating capacity now exceeds national consumption ,we must bear in mind that main responsibilities rests on the shoulders of the architects and engineers though it is essential to step up developmental and collaborative efforts to build up capabilities and expertise for optimizing the building form and properties in order to reduce energy needs, cooling and ventilation systems, controls and building management systems using passive and active design techniques and building operation promoting the adoption of green building design and technologies that improve energy efficiency and reduce the impact of buildings on the environment to improve the quality of life.

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