

# Sustainable high-rise building (Case study: three example of sustainable high-rise building in Iran)

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**ABSTRACT:** Due to the rapid growth of population and urbanization, the need to build high-rise buildings felt more than ever. This, along with the advancement of technology in various areas of construction could pave the way for structural engineers provide more to its architectural design ideas efficiently into their appearance. Technology can be a way to reach a solution for engineering purposes and also can lead to disturbances in nature and natural organisms. Since the high-rise buildings directly associated with the manufacturing technology should consider solutions that would prevent disruption of the technology in nature. One of the most important and fundamental mechanisms of high-rise buildings are some examples of sustainable architecture building Iran. *Keywords:* High-rise building, Sustainable, Architecture.

# INTRODUCTION

# The problem and the need

The seventies and the beginning of the green movement in the world and the use of fossil fuels as well as all aspects of human construction sector was affected. The population growth and the demand to accommodate more people in residential and consequently the lack of high-rise buildings could be remedial. The creation of high-rise buildings in Chicago this need was felt not a new issue, but from the seventies onwards to establish the feasibility of high-rise buildings in harmony with nature. The important results of the project were architects and designers. In the meantime, we can produce results that "ken Yeang" and "Norman Foster", especially in the building of sustainable long found out that the project and its architectural monuments witnessed the results were displayed. Buildings such as the "Menara mesiniaga" by "Ken Yeang" was designed and built or "Commerzbank" by Norman Foster created from the samples. The main concern in choosing the topic and this study is to identify and introduce high-rise buildings sustained in Iran to Iranian architects outmoded samples for analysis of the country's according to the climate to be there. Certainly far beyond the scope of these buildings will be the introduction of the sample.



Figure 1. Commerzbank Tower. Source: [12].



Figure 2. Menara Mesiniaga, Malaysia. Source: [13].

#### The central research question

The concept of high-rise building and sustainability in architecture, how and in what way they are? What are the sustainable high-rise building in Iranian architecture and what are the features?

# History and the need for high-rise buildings

Construction of tall buildings in the world of the late 19th and early 20th century for a wider foot came into being. Chicago started this evening can be engineers and innovations such as "James Bogardus", "William Le Baron Jenney" and "henry Hobson Richardson" said. Leading architects such as" Louis Sullivan's" later teachings were causing the architects of the fullest use. "Richardson's teachings in the work of Louis Sullivan for a clear run is visible. The architect "Louis Sullivan" had a huge impact on the visual systems of buildings is not Richardson's Marshall Field effect its light"[1]. Chicago style by "Ludwig Mies van der Rohe" later in the twentieth century combined with modern technology and create a new generation of high-rise buildings are. "In the twentieth century, issues such as population growth, the need to accommodate more people in the cities, the need for greater use of land in densely populated urban centers, the need for restructuring and modernization in urban areas, for people to live and work in urban centers and the need cost reductions resulting from the horizontal expansion of cities of factors that build high-rise buildings in major cities worldwide as a must have"[2].

The idea of creation of high-rise buildings in different architectural styles can be found in the Chicago style, modernism, Constructivism and Mega-structure ever seen.



Figure 3. The process of high-rise building. Source: [14].

#### The definition of tall building

A precise definition of all experts in the field of building construction is not. "From the perspective of tall building structural engineering is the design and implementation of lateral forces of wind and earthquake is more influential than the vertical forces (about 32 meters) high, but from the point of view of building architecture is the ratio of height to diameter is at least 3.14."[3].

"From the perspective of tall building fire was a high-class fire engines available for Nyst.br Accordingly, Iran is building height of more than 23 people is high." [4].

"From the perspective of social issues and family is the tallest structure in the courtyard and outdoor activity monitoring children Bashd.br this problem by building more than 32 meters long it is." [3]. "International Conference on fire safety in high-rise buildings, it said that any structural height evacuating people from their work seriously affected. Culture New Oxford English Mini says it is building classes. Massachusetts General Laws Sublime to anything more than seventy feet (23 meters) in general. Most building engineers, inspectors, architects and other professionals to more than 75 feet high (25 meters) are defined. "[21].

Emporis Standards defines a high-rise as "A multi-story structure between 35–100 meters tall, or a building of unknown height from 12–39 floors."[5]. The New Shorter Oxford English Dictionary defines a high-rise as "a building having many storeys".

Association of tall buildings and urban habitat America (CTBUH) states:

There is no absolute definition of what constitutes a "tall building." It is a building that exhibits some element of "tallness" in one or more of the following categories: a) Height Relative to Context b) Proportion c) Tall Building Technologies



Figure 4. Classification of high-rise building. Source: [15].

#### Definition of sustainable architecture

"Architectural climate of the seventies and sustainability of the nineties has been the central issues in the field of architecture." [6].

"It is a kind of design planning to respond to current needs without damaging the resources of future generations. In sustainable design, economic and social sustainability depending on energy consumption as well as environmental approval of buildings and cities must be considered." [7].

Like other categories of architecture, sustainable architecture, has its own rules, and these three steps, saving, planning and design for the man to return to the life cycle covers each have their own particular strategies. Identification and study of these measures, the architect should be designed to further understanding of the environment in which it will do it.

The principles that must be made to achieve a sustainable architecture include the following: "First principle: the principle of energy conservation: coordination with the climate third principle: reduce the use of new sources of Principle IV: The needs of the residents of the fifth coordination site of the sixth principle: holism." [8].

In general, there are three main pillars in the architecture design:

"1-improve the quality of life and human health 2. Daily needs of the human 3-preserved ecological systems and energy sources the objective of sustainable design is that due to the correct efficiency of energy and natural resources to reduce the devastating impact of building on the environment. At the same time a sustainable plan to achieve aesthetic value, environmental, social, economic, moral and spiritual. So it can be a model of sustainable architecture offered the following:

Reduce the consumption of non-renewable resources and the use of renewable sources Develop and improve the natural environment

Remove or reduce the use of toxic or harmful to nature, in the building industry

Preserve the cultural and ethnic identity

Promotes healthy living

Rational use of land and the construction of environmentally friendly bags

Cost-efficient alternative construction technology

Avoid causing noise pollution and air."[9].

#### Sustainable architecture and high-rise buildings

Tall buildings can be categorized tech architecture. Style "High-tech" or the superior technology after the events that happened in the seventies onwards criticized the international community for the damage to the environment to see. These factors did not cause the building to stop but coordinated with the international community. Architectural style "ECO-TECHNOLOGY" and "ORGANISM-TECHNOLOGY" with respect to technology and respect for nature were created. Given the foregoing, sustainable architecture in high-rise buildings in the architectural style "ECOT-ECHNOLOGY" and "ORGANISM-TECHNOLOGY" search.

"Eco technology architecture with the objective of environment focuses on the following: 1) reducing waste of energy in the environment; 2) reduce in production of materials with adverse influences on human health; 3) using the recycled materials, 4) elimination of toxins of materials."[10].

"Looking at what has been done in the field of architecture can be realized that design of building has changed over time, From blocking outside area in order to protect interior spaces to the use of nature and natural energy in construction process. Obviously, traditional artichecture styles can't be used for people used to live in towers or believe in rational relationship with environment. Ventilation, lighting and mechanical systems are wide technologies benefited from both residents and architects. Natural ventilation allowing air flow from the ceiling, ventilation through the night refinement and air blowing under the floor, lighting control, etc., are all new achievements and innovative forms used them in some buildings caused getting benefit from energy and natural resources, such as heat, sun, wind, geothermal energy and rainwater. Meanwhile, various mechanical methods in order to save energy and produce new systems that minimize adverse impacts to the environment have been used. Designing of green buildings is an appropriate replacement with offices having ventilation system and using loads of energy and it is a serious struggle for air pollution and high energy consumption."[10].

Strategy for achieving sustainability is LEED rating system, passive solar gain, structure and material preference, facade technology, harnessing solar energy, harvesting wind energy, combined heat and power, fuel cell and other strategy for green tall building is biomass energy and geothermal energy.[11].

#### Case Study

### The headquarters of the Supreme Audit Court

The building in Tehran between Hay84-1369 solar passer-Mohammad Taghi Rezai Hariri- by consulting engineers designed and implemented. This is the first modern building to reduce energy consumption in Iran has been implemented. "A layer glass windows are seventy centimeters from the outer shell of the building, on all four sides it is designed. For ventilation between the two walls, seams Fans (shutters, aluminum) on the outer surface of the window is installed. The outer layer, the inner layer against the cold winter wind protection, while preventing sunlight into the building is not. There are seams due to ventilation and chimney effect in the summer of outside air through the seams down the vent into space double glazing and hot air between two layers of the upper apparatus seams to take out. The inner layer of the warming can be avoided. "[6].the device uses heat from the earth to reduce energy consumption in the building design and calculations were not implemented in practice.

#### Memorial twin high-rise

The tower was raised in an architectural competition and Ms. Leila Balial, Ardabil and Mr. Darius Sattarzadeh in 1390 won the first prize. This solar project is located in the city of Ardabil. The use of wind turbines, solar greenhouse, photovoltaic glass, green garden on the roof of the characteristics of this project is green architecture.



Figure 5. The headquarters of the Supreme Audit Court. Source: [16].



Figure 6. Memorial twin high-rise. Source: [17-18].

#### Kosar green residential towers [22]

Two towers of 18 and 22-storey green Kosar has arisen over the city of Mashhad and its new concept of luxury living and quality of life are defined.

According to the environmental aspects such as the use of clean energy and saving fossil energy an integral part of the project is the idea of green and what it towers above the green Kosar gives individuality, its designer's social and cultural aspects of sustainable development in the quality of life of its residents. Green terraces of each housing unit, private space, green and relaxing, with a wonderful view over the city of Mashhad vision and create for their residents. Courtyard and terrace green with trees, hedges and flowers are seasonal and are equivalent to 25% of the area of each residential unit will be mechanized irrigation. Intelligent BMS system for each residential unit, a winter garden on the north side floors of both towers, storage room in the basement with easy access from the central core of the features common to all units on each floor residential towers Kosar is green.

#### The view of Project architects

"Attention to environmental issues in engineering and architecture world today, and there is a natural thing. This is not an abstract concept but because of concern for us and future generations. Therefore, I have a commitment to integrate this architecture is. In Iran, despite having oil and gas wealth, address the issue of sustainable energy and attention to the environment is inevitable. The reason for my decision to work in Iran, the memory of my beautiful high levels of live art in Isfahan. So I accepted the challenge to the quality of life in vertical building two residential towers green I run.

Professor Philip Rowe. Supervisor and supervisor of the project Awesome "In view of the importance of addressing the new energy in contemporary architecture and in dire need of efficient use of energy in building our country today, the project aims to create a space for life and improving its quality on the one hand, and creating a model for future sign on the other hand was raised. It is in addition to the use of clean energy at all levels of the architecture, the people in all walks of arable offers a green yard. The building towers urban window acts like a as a linear park in height for people in the area. " Hammed kamel Nia (Architectural project management).



Figure 7. Kosar residential green building. Source: [19].



Figure 8. Kosar residential green building. Source: [20].

# Some sustainable charactistic of this project

Provide more than 20% of the electricity consumed by power plants in the project More than 40% of hot water supplied by solar energy Simultaneous production of heat and electricity by CHP plants Reduce energy consumption using geothermal energy (geothermal) Reduce gas consumption by using new technology facility Reduction of more than 35% of gas consumption by the boiler condensation Maximum use of renewable energy, wind turbine, solar energy, geothermal Reduce water consumption by recycling waste water Use heat recovery procedures in the various administrative, commercial and residential Optimizing energy consumption using intelligent room control system control thermal comfort, lighting, residential and office space by intelligent control system home (Home Automation)

Equipped with safety control various areas of the building

Remote control and management of residential building equipment

Separation of energy consumption of residential units

The energy, 76 kWh per square meter

Approximately 73% savings in energy consumption compared to conventional buildings Country

#### CONCLUSION

In order to answer the research question was defined first tall building. Tall buildings have different definitions of the different perspectives and expertise of different positions with different definitions. The following principles of sustainable architecture and its objectives were examined and defined the characteristics of sustainable architecture in high-rise buildings. It is hoped that with the advancement of technology in architectural projects in Iran more than before can be used to reduce energy consumption in high-rise buildings.

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