

Designing the engineers' building of Qom province using eco-technological approach

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Abstract

As we know, sustainable human survival and human environment is dependent on maintaining balance and continuity of the world that requires accepting the role and moral responsibility of human stewardship of ecological resources and conscious and intelligent performance in regulating his relationship with the natural environment. Sustainable architecture in response to the conscious performance and growing concerns about the consequences of human activities on the environment has been proposed as a revised approach to architecture. Improvement of the quality of architecture in sustainable design is done in order to achieve comfort.

The aim eco-technology is use of natural and environmental factors, as well as modern technology to enhance the quality of life for the future generation. In addition to measures to reduce heat transfer through the building shell and the measures recommended in the chapter 19 of the national building regulations, the proposed and applicable technologies in buildings in line with the plan to reduce energy needs of the building like taking maximum advantage of solar energy, using active and inactive systems, taking maximum advantage of Renewable energies, energy recycling, energy storage, use of mechanical and electrical energy-efficient equipments, and the use of intelligent systems to adapt the energy production more to the real and transient needs. Qom province, with an average of 311 sunny hours per year, possesses suitable grounds for applying the branches that Some of these technologies applicable in building to reduce energy needs of the building are discussed in this article.

Keywords:

sustainable development, sustainable architecture, eco-technology, solar water heaters, photovoltaic system, solar cells

1. Introduction

In 70th, by the commencing of the energy crisis, sustainability era began. And following that, three effective dimensions of social values, environmental resources, designing skills entered into the development discussions. the category of designing skill and professional knowledge, due to three main issues of energy, environment, and ecology were defined again and were studied in the approaches towards sustainable development in scales ranging from city to building. now architecture as a super media has taken an important responsibility, because 50 percent of the world energy is consumed or wasted in this area, in line with Promoting

quality of life in sustainable development, architecture, with reduction of energy consumption and reduction of pollution of the environment coordinate its components as a small systems to attain sustainable development. sustainable architecture, like other categories of architecture, has special principal and regulations and it also has special stages. (Sayyadi, 2012, 25), like development and distribution of technology that began with the Industrial Revolution in the 19th century. On the one hand, brought the great blessing for humanity, While, on the other hand, they led to the destruction of the environment and natural resources by the use of fossil fuels. Sustainable development after the Rio summit in 1992 became widespread in scientific circles (Zarabi and Adhan, 2002, 5) that, as a process is the basis for the improvement of the situation and elimination of social and cultural deficiencies, And should be the driving force for the development of a balanced, appropriate and coordinated economic, social and cultural rights of all communities, especially in developing countries and and tries to answer to five basic needs: integrating conservation and development, providing basic human needs, achieving social justice, autonomy, Ecological and cultural diversity and maintaining unity in the seventies started with the beginning of energy crisis in era of world stability And consequently three dimensions of social values, environmental resources and designing skills entered into the issue of development. The category of designing skills and technical knowledge according to three main subjects of energy, environment, and ecology was redefined and was reviewed in the sustainable approach in scale ranging from city to building (gorji mohleban, 2011, 2). The application of the concepts of sustainability And sustainable development goals to reduce waste of energy and environmental pollution in architecture, has created a subject of sustainable architecture. In this type of architecture, building not only adapts itself to its climatic conditions, but also establishes a reciprocal relationship with it. The concept of sustainable architecture can be interpreted as a man-made sustainable environment. By applying the principles of sustainable architecture And sustainable urban development and development of sustainable cities we can, in addition to create a comfortable and peaceful space for the life of, prevent the forth coming threats. (Farhad, 2010, 25). Today, along with the

increasing of population growth and rapid expansion of cities the need for urban constructions for social activities, Is inevitable. Although , paying attention to quantity and number of constructions are necessary and required for expediting their use , paying attention to the stability of the buildings also from the perspective of promoting the quality of constructing and increasing life period of the buildings must be considered in designing and construction. Achieve high standards of quality, safety and welfare that actually provides human health, are the most important aim of architecture that can be achieved through efficient management and using the latest technology . Also with regard to the increasing progress of the country after the Islamic Revolution of Iran And introducing Iran as one of the richest sources of renewable energy in the world, the construction industry in Iran are seeking new outlook. The situation in Iran today, the common view of traditional design and mass housing construction is needed to protect the environment is not suitable. Thus, due to the deteriorating of limited energy sources as well as the attention of the informed people to the advantages of using new and clean energies, preserving environment and preventing environmental destructions by the emission of artificial pollutants , also priority of development of sustainable design inspired by the modern styles of the world, the necessity and importance of applying this type of design become two folded. (M. Mustafa, M. Mostafavi, 2012, 7).eco-technological designing is done in order to achieve a goal, and that is comfort. An important point which is considered in this type of architecture is that , all the factors involved in comfort , are considered to be related to each other and as a single system. What is categorized as the subset of comfort in general sense is: comfort, tranquility, security, safety and health. in the case of emergency of the design, it was tried by verifying the most important centers of engineers of the province, the engineers organization, and due to the fact that designing is at the hands of the engineers of the society , we should prepare the ground for development of this type of architecture in all over the city and also due to lack of such center in Qom this is an essential issue.

2. Sustainable Architecture:

Sustainable survival of human and human environment depends on keeping balance And the continuation of life-world that requires the acceptance of the role and ethical responsibility of human patronage on ecological resources and conscious and intelligent on the regulating its relationship with natural environment. The approach of sustainable architecture in response to this conscious performance and growing concerns about the consequences

of human activities on the environment has been proposed as a revised approach to architecture.

Thus , The concept of sustainable architecture whether as an action in order to create a humanitarian space and regulating the relationship between humans and the physical environment, or as a product of this process is always combined with a stable environment, and in a general framework it can be interpreted as creating man-made sustainable environment. Improvement of the quality of architecture in sustainable design is done in order to achieve a goal, and that is comfort. The important thing which is considered in this type of architecture is that all of the factors involved in comfort are considered connected to each other and as a single system. The subset of comfort include: Comfort, tranquility, security, safety, health. Sustainable design is an attempt to create maximum comfort with high quality of life and to create the least damage to the environment.

Sustainable designing is not a formal style and it is not derived from transient conditions and instant excitements but it has deep concepts in its core that connects human beings nature and architecture. Homogeneity with the environment, biological structure , Biological architecture or sustainable architecture or architectural answer that gives importance to human life and the preservation of them both now and in the future. Such materials used in its structure that are homogeneous and stable with the environment both during production , use ,or even at the time degradation . To a possible extent materials obtained from construction sites are used. prediction of the least use of fuel energy and maximum use of solar energy and using heating systems with the maximum output and the least destruction of the environment , improving life, and settlement of human beings , and all the creatures live in that environment , and the most improvement of comfort from the psychological and physical point of view in the environment . In fact, sustainable architecture is living in nature and with nature (Farhad, 2010, 25). The challenge of sustainable architecture in conjunction with a comprehensive solution for environmental considerations and at the same time to get the level of quality of life and cultural, economic, social values, and comfort (WGSC, 2004). Falamaki puts sustainable development as a large incentive for innovations of the architecture. "in the final years of the twentieth century ecosystem Architecture, architecture that forms the communication and foundation of the life cycles or ecosystems as starting point of the study and the ending point of the of designing . On the one hand, architecture with all of its requirements to stay stable, comes, on the other hand, all sciences, each in its own way, deal with the natural world. " (Falamaki, 2003) He also continues that to count the mixing branches that have shaped the architectural vision, along and in parallel with developed side of cybernetic knowledge and other basic environmental knowledge's , it is not possible not to pay

attention to the branches of scientific imperial activities are more social- humanistic dimension of the world , where environment and various dimensions and relatively numerous and Sustainable Development, is discussed in its broader terms (Georgian Mahlabani, 2011, 4)

2.1 Eco-technological approach:

These days in the works of the architects it is observed that by the use of technology it was tied to use to maximum from the natural factors like sun, wind, underground water and plants to regulate environmental condition of the building. Thus, in the new architecture they are eco-technology (ecological + technology).

Technology is not against the environment but it is located by the side and parallel to nature in order to have maximum use of the environmental equipments and providing comfort. In the latest works of the architects this style Always exists along the beautiful pictures of the buildings they exist part of the building where the way of applying climatic factors by the help of equipments such as air chimneys , reflecting mirrors smart covers of the greenhouse, glass steps or exchangers of the heat , And the exchange of heat stabilizers shown. The school building itself is also due to the angle of sunlight and wind speed and direction at different seasons is designed.

(Fishing, 2013, 49). Expression and instrument of scientific and technical achievements

Has always been the task of modern architecture. Early modernists such as Le Corbusier and Gropius, the technology as a force that causes the change, they note Rychardrajrz, Which can be knowledgeable and insightful today as one of the architects of the country, says "Creating new IT architecture that is removed Requires a break with the Platonic idea static world, a world that will be explained Bashy' great finite, that nothing can be added to it and not separated from it."(Qobadian, 68, 2011) Among the most active in the field of architecture can have a leading research firm noted LOG ID. The group of architects, engineers, doctors, botanists, physicists and specialists in communication technologies which are making every effort in order to take advantage of green energy And solar energy are used. And thus reduce fossil fuel consumption result. In this way deal with the fundamental issue of sustainable development according to the material that is at home both in time-consuming While others look to focus on the fundamentals and basics and simplifying the architecture and reducing all aspects involved in the construction. One of the ideas can return to principles inspired by nature, learning from the environment, preserve the visual beauty of landscape architecture, enviro2013nmental land by assimilation raised.

(Concessao & Ponni, 2011, 1-5) His work, which means being involved with the environment in all stages of life, is central to the green building movement. And ultimately

provide better conditions for healthy living based. His project for Schlumberger's research labs in America at the hilly beautifully shaped. The idea that architecture is seeking interaction with the environment is greatly indebted to Frank Lloyd Wright in the first decades of the twentieth century. Another approach that can be used to homogenize the buildings with the environment posed on the architectural design of buildings inspired by nature. This approach works well in landscape Vjnbhhay organic architecture should also correspond with it. Screw Home Jersey Doyle benefited from such thinking. Its location near the river located Fvrkt surrounded by forest and near some buildings were made of wood. To shape seems to be more harmony with the surrounding environment established And of course, the exception of other issues also have considerable environmental considerations Such as the use of solar panels to reduce electrical energy consumption have helped. Jones Fi architecture of these structures has been so much focus on the beauty of these buildings for the viewer. From within your building with a very attractive space and yet a ritual designed to encounter the very large windows allowing excellent views of the beautiful surrounding scenery gives you.] According to Jones, an important aspect of sustainable building has a very long period of time, life and long-term use. While a handful of laws have been passed to sustainability the upshot is that politicians and governments than at a pace too slow to admit the importance of sustainability. In any case, these are all steps taken in order to reflect changes in building materials and designs are common today. Like the lights on top of the human environment has made it possible The better the effects of their behavior in exchange for Nature And wireless uses criteria that will ultimately lead to adverse natural events such as floods and fires are increasing the temperature of the biosphere or break.

They have human consciousness and long-term vision could very well justify the expense of a little more sustainable and environmentally friendly construction in front of the buildings is common today.

Human beings are at the center of concerns for sustainable development. They are trying to make healthy and productive life in harmony with nature have one.

In order to achieve sustainable development, environmental protection an integral part of the development process regarded and it should form a separate identity and looked out of the development. (Concessao & Ponni, 2011, 5-10)

3. Procedure

In this study, by collecting information from authoritative sources such as articles, scientific books and studying of the examples, it has been tried to provide examples of dominant features of a

sustainable building, and also by studying the climate and potential of Qom city, we try to provide potential solutions about designing which is compatible with the climate of Qom city. Independent variables of the study are eco-technology architecture and the dependent variable is the architects' building. Quantitative variables used in this project are climate parameters that using charts, Maps and tables prepared by the relevant department or the use of software is very useful measure in this direction. The Office space design parameters were also measured by the relevant regulations in publication of the organization of planning and budget number 178 or the Department of Housing and Urban Development. The population of the study consisted of three groups of architects and mass constructors, and three public groups. In order to gather the necessary information Cochran formula was used that at the end 100 people were chosen based on un-random sampling. In order to collect required information a self made questionnaire based on likert scale was chosen. Its validity was confirmed by specialists and the experts. In order to test reliability of the questionnaire chornbach Alpha was used. That the value of the benchmark for energy efficiency measures, environmental pollution, increase of efficiency, enhancing building capacity and the entire questionnaire, were obtained 81%, 76%, 82%, 79% and 89%, respectively, respectively indicating sufficient reliability. In order to analyze data, descriptive statistics such as frequency, percentage, mean and chi-square tests and multiple regressions using SPSS software is used.

4. Findings:

Based on descriptive findings it can be observed that 53% of respondents are female and 47% male respondents and questionnaires are almost equally divided. 31% of respondents have a high school degree or lower than high school diploma, 50% of respondents have associate's and bachelor's degree and 19% of respondents have with a masters' of art degree and higher. 27% of respondents engineer, 9% of respondent's manufacturer and 64% of respondents have jobs unrelated to the project. 64.625% of respondents believe that using this architecture results in optimization of the energy consumption. Only 14.5% believe that using this architecture does not lead to optimization of the energy consumption. 68% of respondents believe that using this architecture reduces environmental pollution. And only 14% believe that using

this architecture does not lead is to reduction of environmental pollution. 75% of respondents believe that using this architecture leads to increase in interactions between engineers and promotion of constructing power and innovation. And only 3.5% believe that there is not much relationship between this design and increased interaction between engineers. Additionally, it has been tried to increase the interaction by designing public spaces like exhibition classes and amphitheater. Over 80% of respondents believe that using this architecture improves efficiency of the employees and less than 5% believe that there is not much relationship between the architecture and increasing employee's efficiency. The relationship between the two items is not of cause and effects type. But because of climatic comfort which this type of architectural imposes on building, we observe increase in the efficiency of work. The first research question:

Does the building design in the city of Qom need climatic designing? In order to answer the above mentioned question frequency distribution tables were used, the results showed that 88% of respondents believe that the design of buildings in the city of Qom need climatic design. Therefore, the need for this design is considered a great need in the city of Qom. Only 3% of respondents do not believe in the climatic design.

The second research question:

Are you willing to pay the initial fee for the building with the ability to reduce energy consumption in exchange for paying the cost of energy during the time of use? The answer to the question is provided by separating the respondents by profession and education. According to the results it is observed that Architecting engineering and construction groups have the highest tendency to pay initial costs with the capability of reducing energy consumption. The constructors had the least tendency to pay initial costs. Also, those with a bachelor's degree or higher showed more willingness to pay for the initial reduction in energy consumption. And lower secondary school groups showed the least willingness to pay for the initial cost.

Kolmogorov-Smirnov test (K-s)

These tests are used to verify the claims made about the distribution of a quantitative variable.

Table 1: Kolmogorov-Smirnov test

variable	statistics	significance level (p-value)
Eco-technology	0.087	0.058

According to the output of above images ($p\text{-value} > 0.05$). Therefore the assumption of normality of distribution will be accepted.

The hypothesis:

Eco-technology, using the best technology in the world following the principles of sustainable development and optimizing energy consumption, minimizes environmental pollution.

Table 2: Results hypothesis testing

model	Source of changes			Sum of squares	Degree of freedom	Mean square	R	R2	Durbin-Watson	F	Significance
	regression	residual	total								
simultaneous				2546.560	2	1273.280	0.816	0.667	1.489	96.949	0.0
				1273.950	97	13.134					
				3820.510	99						

According to the table above it is observed: the Durbin-Watson statistic is equal to 1.489 because the amount is in the range of 1/5 to 2/5 shows a lack of correlation between errors.

The amount of correlation coefficient (R) is 0.816 that shows there is strong correlation between independent variables (optimizing energy consumptions, reduction of environment pollution) and independent variables of the study.

Therefore, the relationship between the variables is proved. The correlation coefficient (R) between variables is 0.667, indicating that 66/7 percent of the changes of the variables are justified independent variables in the model. According to the significance of amount of F test in error level smaller than 0/01 that can be concluded that the compound regression model is consisted of two independent and dependent variables is a good model and set of independent variables can determine the dependent variable.

Table 3: Summary table of coefficients of the regression to predict eco-technology

model	variable	Beta	T statistics	p-value
Simultaneous	fixed		3.814	0.000
	Optimizing energy consumption	0.112	4.248	0.000
	Reduction of pollution	0.729	8.158	0.000

Given the significant level of regression coefficients to optimize energy consumption and reduce environmental pollution (sig = 0.000 < 0.05) the null hypothesis of zero coefficients will be rejected. So at 95% level of significance, the researcher's hypothesis on the eco-technological architecture on energy efficiency and reduction of energy consumption and environmental pollution is confirmed.

Site Analysis

Locating

The plan Site with an area of 3,600 meters is located on the 45m Mohammad Amen boulevard district 4 of the Qom city. The main access to the site is from the north and Mohammed Amin Boulevard. Reasons for choosing sites include easy access, existing and known users to the clients, the right angle for climatic design, locating in crowded place and usability to the public and appropriate view and perspective.

Access routes

The site has access number 2 forms the south to the 10 meter alley, from east to 12 meters alley, and from west to 8 meters alley.

Appropriate view and noise pollution

Appropriate view of the site is from Mohammad Amin Street. Also the most of the noise pollution is from the same side.

Surrounding land use

Surrounding land use of design site is mostly residential and commercial. Current users of sites is office also a small mosque, building of engineering organization in Qom and the bank related to Engineering Organization and just a small part is as residential. In the design, it is attempted to keep users in different parts.

Density of the Area

The site, form the point of density, has been located in the position, the northern part of the plan is part of urban agglomeration and the southern part is part of the local density.

Table 4: design of acceptable density of the plot area (detailed design of Qom)

Legal items		Building density (number of floors)	Commercial occupied area	The maximum allowed stores
local	4 floor	280	(1)100%	4
urban	6floor	440	(2)100%	6

Design process Depending on the type of project, which is an official cultural complex collection that adaptation with the environment to maximum use of natural resources and the least energy consumption are considered as the main objective. Locating and style of designing is very important. The design of this collection is completely compatible with the user and most of the ways and links between the plans are to minimize the waste of energy. And the form for maximum use of energy receives much significance. Qom, on average, with 311 days of sunshine a year has the suitable ground for the use of this eternal resource. Due to the investigations of part 13-2-2-6-5 and location of 30 degrees of south east which is suitable for designing space to install solar systems. The deigning began and most of the spread of the plan is also to this side. Due to the use of solar systems and installation of them on the roof, the roof should be sloped, to photovoltaic systems have slope of 24.63 and building with solar collector system was designed at an angle of 34.63. solar collecting system due to wasting of heat of hot water, in case of not approaching

to the design for the main collection has been considered. Also, with the studies on this thesis we know that in order to use Solar System the facade of the buildings should be designed with two shells. Retreating southern side of the buildings was due to shading of the building in front on photovoltaic system of the facade.

There is a small mosque in the present usage , that has been preserved under a building of a bigger mosque, and in order to consistence of the direction of kiblah and altar has been rotated . Also the infrastructure of Mellat bank has been preserved in the area of the design. There not a Congruous wind for the aligned design, the northwest winds are suitable for the design that has been used to create air flow and use of central yard and generate moisture and climatic comfort with creating a cut in north west and south part. In the design , the existence of open plan site , educational and commercial classes related to selling solar systems and designing collective spaces like amphitheater , exhibitions for familiarizing, growth and promotion of these sites, standard construction and promoting knowledge level of the engineer society has been contributed .

After gathering of the above mentioned data basic design of the project and then the main design began.

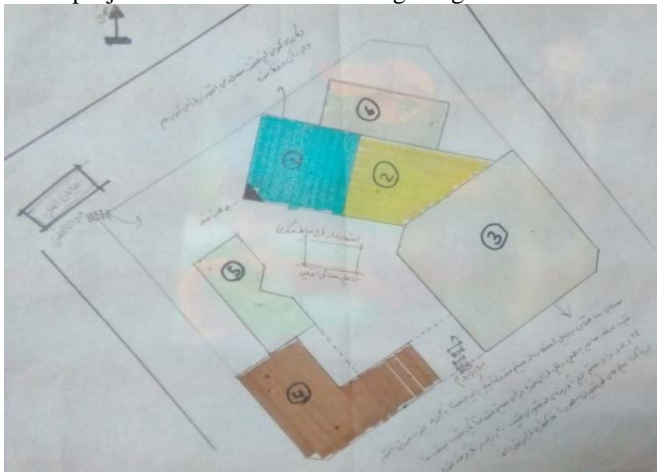


Figure 1: Preliminary design



Figure 2: the design of the primary replica

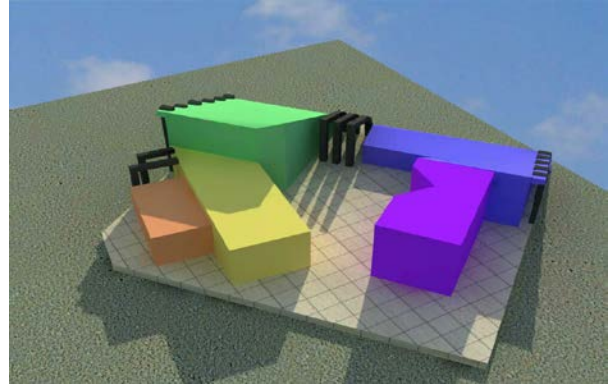


Figure 3: Initial volume of the design

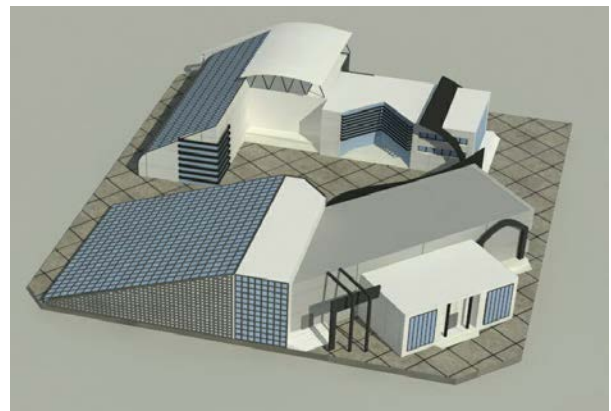


Fig. 4: Initial Study volume



Fig. 5: ultimate design render

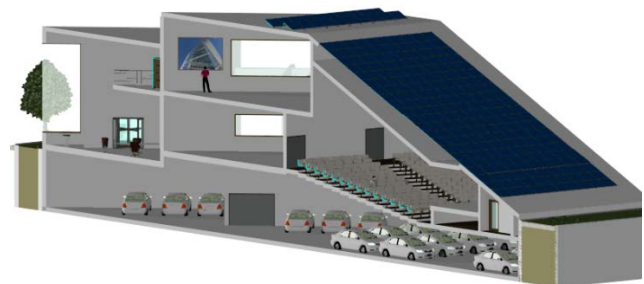


Fig. 6: ultimate design render

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