

Clean Energy Efficiency of Vernacular-Traditional Architectural Indicators for the Development of Sustainable Tourism

Farid Ghasemi¹

¹Department of Architecture, Faculty of Architecture, University of Guilan, Guilan, Iran

Correspondence: Farid Ghasemi, Department of Architecture, Faculty of Architecture, University of Guilan, Guilan, Iran. E-mail: laarchitecto@hotmail.com

Received: February 20, 2017

Accepted: March 13, 2017

Online Published: May 31, 2017

doi:10.5539/jsd.v10n3p250

URL: <https://doi.org/10.5539/jsd.v10n3p250>

Abstract

Over the decades, due to the different crises, in which people are involved, they are trying to remove these big challenges with their dynamic mind. The consecutive changes in climatic conditions on one hand and energy crises on the other hand have affected human life every moment. It seems that through considering the attitudes to clean energies and their efficiency through inspiring past experiences in a combination of past and present time can not only show response to the coming problems, but also it can cover some parts of economic considerations. Tourism industry that has been considered for many years as one of the sustainable economic aspects can be valuable base for the said combination. This study tends to introduce a triangle of sustainable origins of tourism based on 3 mentioned factors including decline of energy resources, vernacular-traditional architecture experiences and tourism industry. According to the mentioned, it is necessary to implement some plans in way of use of nature of clean energies with approach of sustainable development and create some powerful foundations for this purpose through an overview of Iran's traditional architecture, which has paid specific attention to climate and the designations and constructions have been based on climatic approaches.

Keywords: clean energy, vernacular-traditional architecture, sustainable architecture, sustainable tourism industry

1. Introduction

1.1 Statement of Problem

Over the decades, energy crisis is one of the most important concerns of human societies. This happens under conditions that consumption of fossil energy and the climatic pollutions and changes caused by it has been changed into a problem that buildings can be considered as one of the most effective factors in accelerating this issue. Necessity of comprehensive investigation and modification of structure or the buildings under construction seems important. In a vast country like Iran with different climates and various weather types in different seasons, traditional architecture has innovated logical and adequate solutions and methods to provide conditions for comfort of human (Ghobadian, V, 1998).

1.2 Significance of Research

Over the time, the costs of mechanical facilities are being increased day by day and supplying energy is becoming more difficult than before. Moreover, environmental pollution as a result of using modern technology is also being increased. The focus of scholars, researchers and engineers in developed countries is being increased on eternal and pollution-free energy such as solar, wind, water and even soil energy. Along with this issue, one of the current values considered by tourists and sustainable tourism industry is paying attention to nature and environmental values. However, returning to past construction methods is impossible and certainly, the past lifestyles can't respond to lifestyle and living conditions of current people. Although other countries are conducting wide studied on climatic designation methods, Iran should also conduct relevant studies in this field due to its long history and background in this scope. Also, it could be mentioned that learning and training traditional architecture is not imitation of past forms, but also the logics of traditional forms should be learnt and used.

2. Methodology

In order to achieve objectives of the research, combined method (descriptive, analytical and survey) is used.

Documentary and library investigations and field studies (visiting traditional buildings of Iran) have been also used for purpose of data collection. According to the issue of clean energy caused by wind, water, soil and solar energy resources, these resources are firstly introduced in field of construction and energy. Then, through referring to definitions of sustainability and sustainable architecture and its principles in field of accommodation-touristic buildings, the final conclusion is presented using comparative method.

3. Theoretical Framework

3.1 Definitions

Sustain: supporting, maintaining alive and continuing and description of the world, at which human and natural systems can continue living alongside to distant future. Sustainability is a feature belonged to systems. Architecture is the most similar system to entire world and architects have been always thinkers of the systems (Fort Mayer R, 2008).

Sustainable architecture: the aim by sustainable construction is reducing damage of building on the environment and energy resources and the natural environment and it typically includes following laws:

- 1) Reduction of nonrenewable energy consumption
- 2) Development of natural environment
- 3) Omission or reduction of use of toxic or harmful materials to the nature while construction
- 4) Context-sensitive architecture

Sustainable development: this is a method of development that in addition to meet social needs, it doesn't decline capabilities of future generations to meet their needs (Brontild, 1987).

Clean energy: it refers to same renewable energy as a group of energies, which their supplying source, despite to nonrenewable (fossil) energies, has the capability to be created by the nature in a short period or be renewed. Now, if this energy has least negative impact on the natural environment while production or while supplying it, it can be regarded as clean energy.

Ecotourism in line with sustainable development: in the theory of Oslo about ecotourism, its function is emphasized to support sustainable development, achievement to Millennium Development Goals, future and considerable reduction of poverty. Moreover, along with The International Ecotourism Society (TIES) held on 2007, 4 main issues were emphasized:

- a) Recognizing key role of ecotourism in local sustainable development
- b) Increasing the potential for good ecotourism management as an important economic tools and natural environment protection
- c) Supporting holding and implementing ecotourism investment and relevant activities through effective marketing and increasing information and education in this field
- d) Introducing some key principles to sustain ecotourism

3.2 Climate-Based Design

Derived from perception of human about comfort, supplying biological needs against hazards such as heat, radiation and humidity, it is an essential issue. Sometimes such factors are in conflict with comfort aspects and sometimes, these factors can optimize accommodation comfort of people in case that they are provided. In Iran's traditional architecture, due to geographical location, a building resists against the outside environment through ceilings, reduction of external surfaces against direct sun radiation, central yard, the canopies of windows to sun, choosing proper ceiling materials, wall materials, warehouse and other elements. Such resistance can provide best internal comfort with no use of complicated energy-consuming and pollutant machines (Kamasaei, M, 2003).

According to this fact obtained from the geographical location of Iran with various climates, different constructions systems are existed that no one should neglect confrontation of outside environment and valuable experiences in designation and construction of buildings and choose of materials in traditional buildings. in this field, climate can be used for 2 purposes:

- **Climatic design implementation:**

It refers to special construction techniques, which are aimed in declining the costs of heating and cooling buildings using natural energies to provide comfortable conditions in buildings. The implemented examples of such techniques include thermal insulation, embedding windows to adsorb solar energy in winter and natural

ventilation valves and so on. Climatic design is a method for comprehensive reduction of costs of energy in a building (Watson, Donald, 1998). Building design is the first defending line against outside climatic factors. In all types of climate, buildings that are built based on principles of climatic designation can minimize necessity of mechanical cooling and heating systems and instead, they use natural energies around the building. Designing buildings based on natural flow of energy has also other advantages (table 1). Climatic design can provide better comfort conditions for the buildings. Instead of imposing high costs of cooling and heating systems, the buildings can provide comfort conditions with making no noise and without fan and other cooling devices and without imposing maximum activity on the central generation machines.

Table 1. summary of principles and methods of climatic design

		conduction	displacement	radiation	evaporation
control methods	winter	increased heat adsorption		use of solar heat	
	preventing heat loss	reduced thermal conductivity	reduced outside airflow reduced air infiltration		
summer	preventing heat adsorption	reduced thermal conductivity	reduced air infiltration	reduced sun heat adsorption	
	increased hit loss	use of land coldness	use of air conditioner	use of radiation cooling	use of evaporative cooling

Assessment of climatic factors:

Elements and factors such as sun radiation, humidity, wind flowing and rainfall level can have significant impact on human comfort with a concept called climate.

Sun radiation: the radiation factor is one of the elements that can affect human comfort significantly in hot and dry climate. The radiation angle, direction and volume can affect building depending on different seasons. The more the buildings are kept out of reach of disturbing radiations using designation sciences, one can claim for concept of climatic design while formation of building. Hence, the postural of building in front of sun radiation is in east-west direction (figure 1). It means that the length of building should be along this direction and the width of building should be in north-south axis. As south wall takes highest rate of energy in winter, the wall can be protected by canopy in summer.

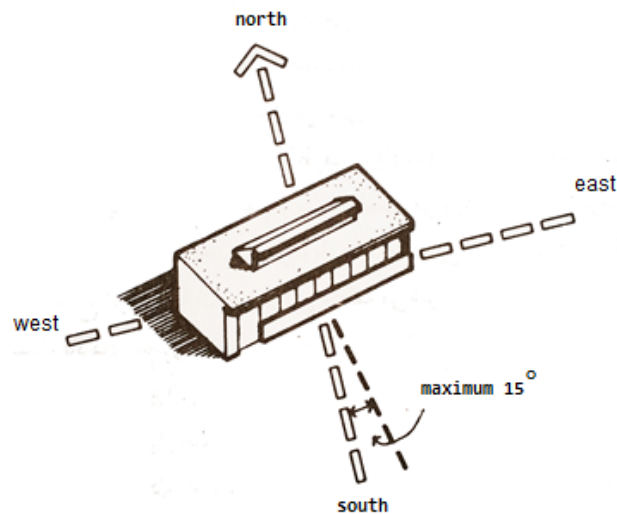


Figure 1. Postural direction of building in front of sun (Ghobadian V, climatic investigation of traditional buildings of Iran)

Wind: one of the most important elements in climatic conditions of a region is wind. Air flows act differently on each hemisphere of the earth. Sometimes, the flows are constant and some others are created just in some seasons. The climatic factor can affect energy loss conditions in house system in many cases and under such conditions, designation of building would gain identity due to favorable or unfavorable wind quality (figure 2). Evaluation of wind direction and intensity is mostly important in classification of functions and urban design. In case of transmission of sound, air pollution and odor can, wind can play vital role. The form of building and the location of openings should be also designed based on wind direction. In general, the building should be absolutely protected against cold wind in cold climate.

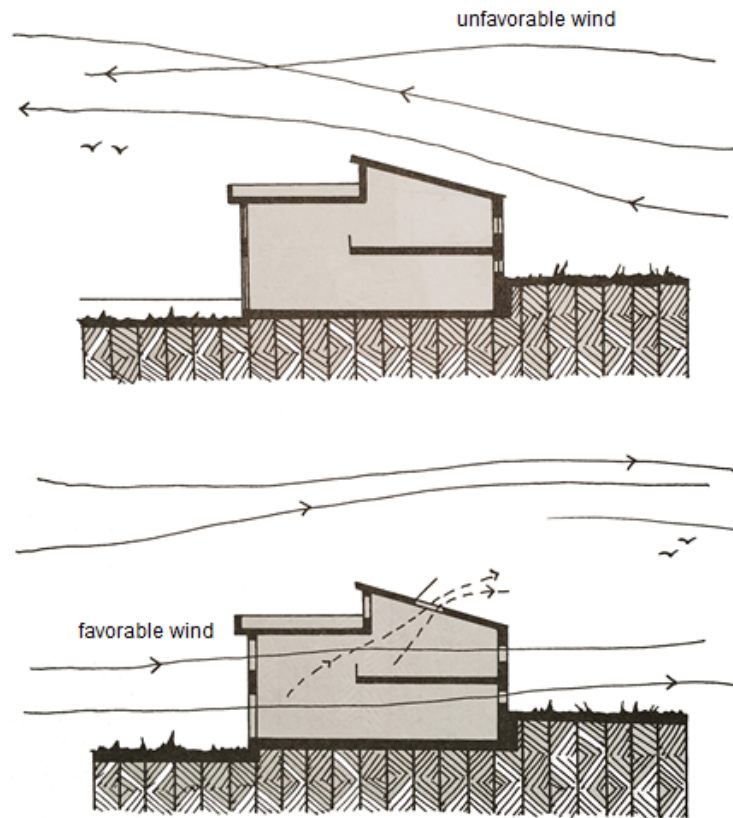


Figure 2. Designing form of building and openings based on wind flow (Ghobadian V, climatic investigation of traditional buildings of Iran)

Water: water encompasses various concepts such as light, life, cleanness and fluidity (Sultanzadeh H, 2011).

Now, if water is presented in field of comfort in frame of climatic factor in addition to valuable concepts, it will act for management of the water in climatic design, whether in flowing state or in humidity state. The humidity created at the building may be caused by factors such as infiltration of rain in walls and roof and infiltration of rain in internal surfaces and groundwater penetration from floor and walls (figure 3).

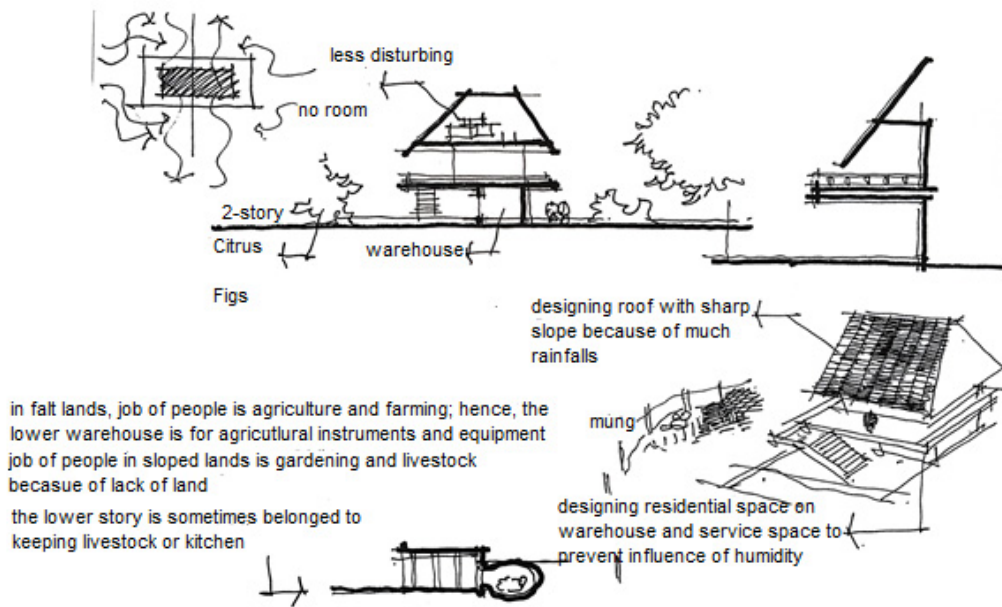


Figure 3. Diagram of climatic impacts on building (Sedigh M, climate in picture language)

Garden and plants: garden and plants have played important and vital role for many years in different fields of climatic and traditional architecture of Iran and they have had always valuable position in this field (figure 4). Hence, Iranian gardens (sometimes called as Kooshk) are highly valuable in group of monuments and cultural heritage of Iran to attract tourists.

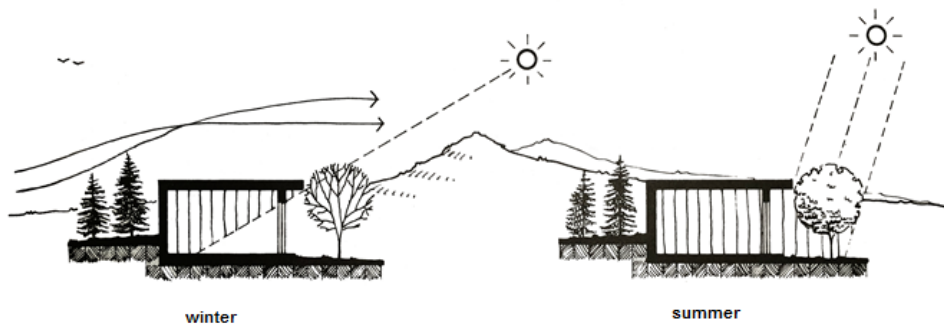


Figure 4. Reduction of influence of cold wind and use of solar energy in winter and preventing radiation in summer by trees (Ghobadian V, climatic investigation of traditional buildings of Iran)

Soil: soil is one of the climatic elements that can cover the special problems and needs of building. Soil is not only used as a source for supplying required materials, but also it can play key role in energy loss management (figure 5). Under specific conditions, soil can control management of temperature in hot regions (Baruch, Givoni, 2006).

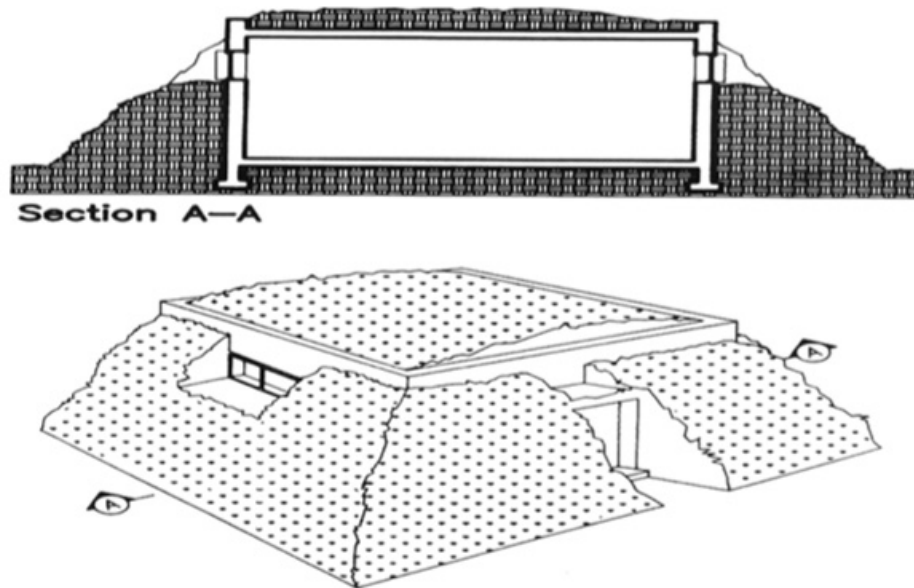


Figure 5. Soil in designation of building

Effects of clean energies on buildings

Nowadays, structure of a building should be able to display the source of renewable energies in its construction algorithm to gain a position at the current world of construction sciences. Even in traditional architecture, the concept has been used with careful and professional expression; whether in rural buildings in Alp Mountains Swiss protected against wind and are face to south or in plan of traditional central yard houses of Iran designed in hot and dry climate to save cold weather at night.

Windbreakers and wind towers, plants and water, indoor and outdoor spaces, protection of building by the ground, solar walls and windows, thermal skin, canopy against sun radiation, natural air conditioner, wind generators and solar panels play important role today in field of management of energy in sustainable buildings. Now, through an overview of the great treasury of architectural sciences of Iran, this study has tried to name the valuable solutions to pave the way for using them in the current buildings.

Badkhan (roof opening) and windward:

Badkhan is a kind of roof opening, which can provide air flow using the property caused by chimney or suction. In this field, sun radiation can be used to transmit the air flow. For this purpose, the sun radiates on badkhan and its heat can increase rise of air flow. Windward is also a component of architectural physic of Iranian houses that acts in way of improvement of thermal comfort. Windward could be used for cooling and conditioning the air of summer rooms in ground floor or basement (Yarshater, 1998, p.369).

Windward can be effective in creation of natural cooling system through 2 ways:

- 1) Air displacement, suitable for hot and humid climate
- 2) Evaporative cooling, suitable for hot and dry climate

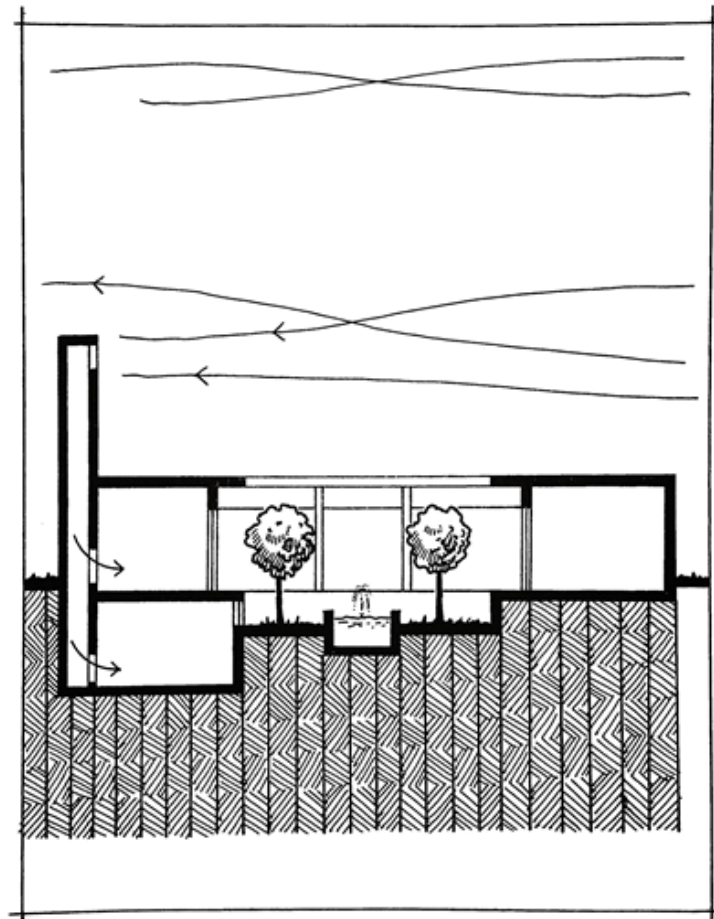


Figure 6. Windward mechanism (Ghobadian V, 1998)

Now, at the world of industrialization of construction, products under the title of windward (Badgir) have been introduced as reliable and effective instruments to use wind energy. The products are being used today using definitions of traditional windward and badkhans through considering some arrangements in addition to solving defects of traditional type and can be regarded as the main idea to be used in modern and developing architecture. Modern windward acts with no moving section and using the vertical pores based on natural effects of wind and displacement of hot and cold air flow (Savadjani, A, 2013). In figure 6, the wind flows in traditional windward are illustrated.

Sun and efficiency of radiation system:

If sun radiation is considered as a factor of discomfort in arid areas, such radiation can be considered as a vital element in cold areas. In traditional architecture, use of south-directed walls and canopy can be the techniques for this climatic element to control its impacts. Today, sun has been today considered as one of the most efficient energy resources. Solar panels supply electricity power and through this, it can not only lead to supplying clean energy, but also it has special position in field of description of sustainability and its principles. Now, it should be found that how traditional architecture counters the radiation. The main climatic property of curved and dome arches in hot and dry areas is that the height of arch from floor to the beneath of arch is high and hence, a natural vertical air conditioning can be created there. As hot weather is light and goes upward and cool weather is replaced, through embedding several channels around or on tip of the arch, hot air flow can exit from the channels and a natural upward air flow is crated that is suitable to supply comfort in hot seasons (figure 7).

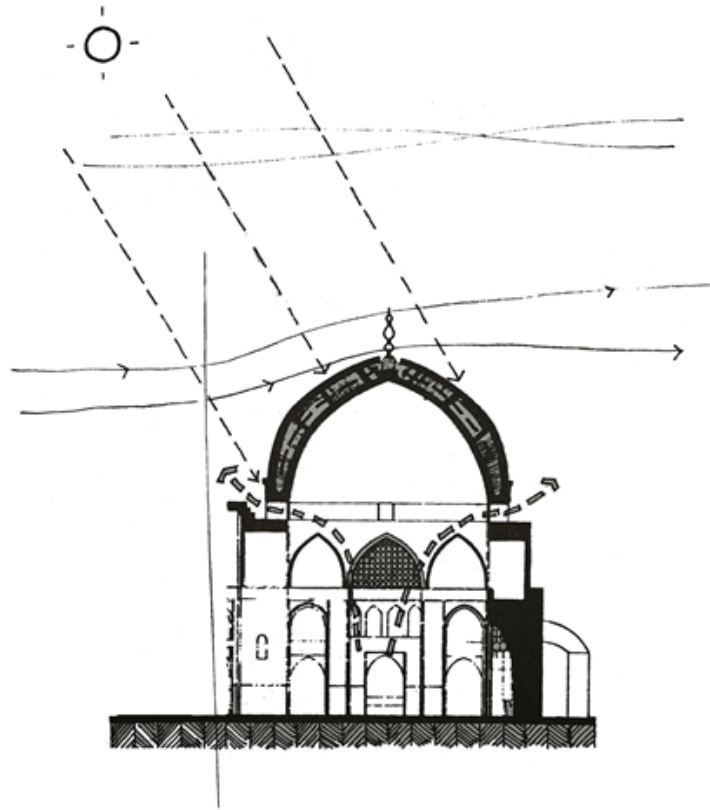


Figure 7. Function of curved and dome arch in hot and dry climate (Ghobadian V, 1998)

Springhouse (Hozkhaneh) for providing comfort of a building:

Garden and plants, along with water, have had special position since long ago in Iranian culture in arid areas. In building of Iranian gardens, through centralization of a spring under the dome of the house, properties such as coolness, humidity and reflection of various pictures are provided and such space is called springhouse (Haeri Mazandarani M, 2009).

The mechanism of springhouse is generally in this way that water enters from one side and passes over the spring and then, exists from the other side. In addition to this issue that water flow can result in cooling, cool air flow enters to indoor space in some springhouses through building 2 tall windward in the back section of building. Postural of spring in gravity center of building and considering the seat flat to watch water and the landscape and being in close contact with landscape views (water, light, air and so on) are other features of springhouse (fatehi M, Fazaullahi, A, 2006).

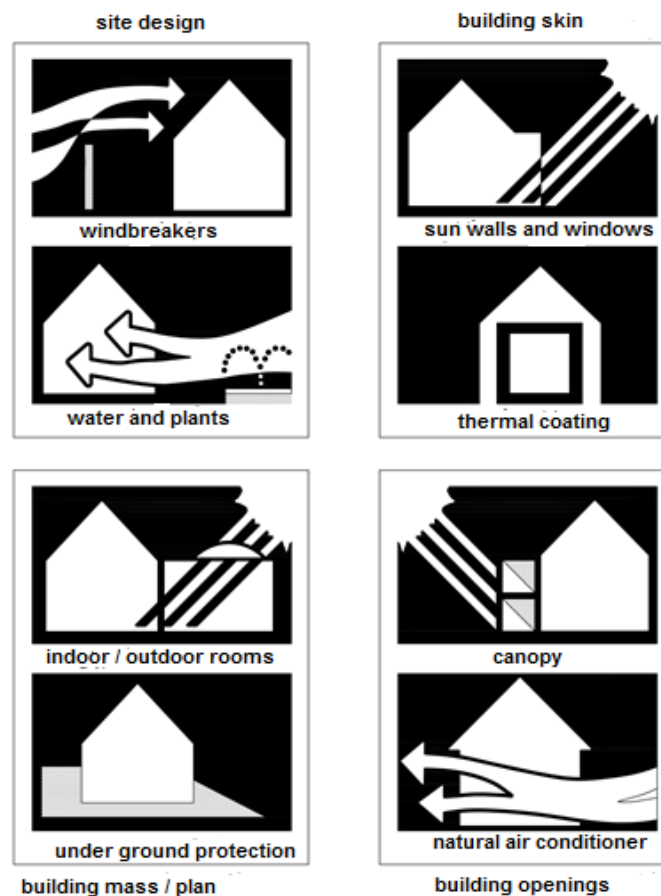


Figure 8. The implementation principles against climatic-environmental factors (Watson, D, 2008)

The relationship of sustainable tourism and sustainable architecture attractions:

One of the most important questions about tourism asked from audiences is in relation with the main issue of their interest during their trip. Depending on type of tourist including cultural, recreation, nature or ethnical tourist, majority of tourists recall their accommodation place as tourism indicator. According to this issue, it is important to rely on infrastructure in compatibility with the natural environment, reduction of using fossil fuels, protection of plants and wildlife in combination with cultural and natural environment (McLaren, T, 2002). In field study on investigation of interest of tourists in their accommodation place while their trip in line with 2 groups of experts and tourists, table 2 is provided:

Table 2. The interesting spaces for tourists in recreation-accommodation complex

spaces	experts	tourists
observatory space	17%	18%
simple rooms with low accommodation cost	16%	18%
desert restaurants	16%	17%
therapy complex including sand and hot water therapy	15%	10%
entertainment, sport, motor riding and safari	10%	12%
handicraft and nature exhibition	12%	10%
Desert tents as accommodation units	10%	6%
gym	-	13%
shopping centers	2%	4%
full option luxury suites with high costs	2%	1%

Ecotourism and sustainable accommodation architecture (site):

Certainly, choosing adequate site for a recreation-accommodation complex is very important to achieve the predetermined goals in regional sustainable development and respecting the natural context. Moreover, along with considering nature of design and special physic of natural tourism-accommodation complex, one of the most effective features in the process of gaining attention of ecotourism is use of traditional architecture techniques to provide comfort of tourists. If the construction techniques are operationalized due to the values and real and effective sciences of traditional-vernacular architecture, in addition to have direct effect on cost reduction, they can be considered as a strong factor to attract ecotourism. It could definitely be said that one of the said activities is recovery and renewal of traditional and old buildings and monuments like caravanserais, schools and even palaces. For example, Iranian caravanserais with abundant variety and due to different climates of Iran can be great source for the architectures. In terms of architecture, although some achievements are created in terms of building form in caravanserais over the centuries, these traditional accommodation buildings can be again in service of ecotourism and tourists based on a sustainable process (Ghasemi F, Gholamalizadeh, 2015).

4. Summary

Generalities of this research can be presented in 6 sections:

- 1) Energy and the crises caused by it in human life
- 2) Protection of natural environment based on physical planning in field of construction of function-oriented buildings
- 3) Comprehensive referring to traditional-vernacular architecture, in which Iran can be a strong example
- 4) Identification of climates, along with identification of policy making of ancestors against climate to supply accommodation comfort
- 5) Investigating vernacular-traditional architecture behavior with climate and their solution to use renewable and clean energies
- 6) Creating sustainable incentives in accommodation-tourism sites for ecotourism

5. Conclusion

Sustainable architecture, sustainable tourism and sustainable energy are issues that have been developed significantly in international level. As environmental damages have been increased in all fields over the decades based on use of fossil and harmful energies, it is imagined that use of traditional-vernacular technologies of residences of different climates can be suitable solution to meet this meta-biological problem of humanity. Features such as aesthetics and protection of environment to meet climatic needs in sustainable architecture (Iran is one of the pioneers in this field) are derived from clean energies such as radiation, wind, water, soil and plants and positive effects of these energies (Salehpoor et al, 2013).

Now, a combination of the presented issues in this study: as ecotourism has high value in economic system of states and, especially in developing countries, it can play key role in increase in their national revenue, making

incentives to gain attention of tourism using accommodation sites derived from traditional technologies to provide comfort of residences can take a valuable step towards promotion of rich culture of traditional sustainable architecture of Iran and can be also valuable effort in field of protection and survival of the natural environment as a result of forgetting fossil energy and replacing them with clean energies.

References

- Ahmadinejad, M. (2006). *Badkhan, physical considerations of wind in the building*, Isfahan, Khak Press.
- Fatehi, M. A., & Fazlollahi, A. (2006). *water in the desert architecture*, regional National Conference on desert architecture.
- Fort, M. R. (2008). *big ideas for small planet*, translation: A Fajr. *architecture magazine*, (48).
- Ghasemi, F. G. (2015). *Rahe Abrisham hotel-school design principles under the influence of caravansary performance in the International Direction, the International Conference on Science and Engineering, Emirates-Dubai: Vieira capital flight of ideas*. Retrieved from http://www.civilica.compaper-icesconot-ICEScont_0571.html
- Ghobadian, V. (1995). *climatic investigation of the traditional buildings of Iran*. The Tehran University, Tehran.
- Givoni, B. (2006). *Cooled Soil as a cooling source for buildings*, Science direct.
- Haeri Mazandarani, M. R. (2009). *the House of Culture of nature, architectural study of historic and contemporary houses in order to develop a process and criteria for home design*, publishing Center for the Study and Research of Urban Planning and Architecture, Tehran.
- Inskip, E. (1991). *Tourism Planning: an intelligent and sustainable development approach*.
- Kasmaee, M. (2003). *climate and architecture*.
- Minke, G. (2006). *Building with EARTH* (1st ed.). Basel (Switzerland), Birkhauser.
- Salehpoor, H., Ricky, A., & Javad. (2013). *the effectiveness of water in the arid climate of stability houses*, Congress of Architecture and Urban Planning and Sustainable Development.
- Savadjani, A., & Masood, M. (2013). *wind tower, traditional architecture approach of using clean energy, renewable energy and clean* Second National Conference.
- Sedigh, M. (2011). *ecology and climate in picture language*, p. 40.
- Sultanzadeh, H. (2011). *the role of geography in formation of a variety of traditional home life, preceding studies human geography magazine*, Issue 75
- Tyler, M. F. (2002). *A Strategic Approach For Community basecal Ecotourism Development*. Retrieved from [WWW.url:http://recoftc.org/documents/Inter-Reps/CBTdiscussion/Fergus-keynot.doc](http://www.url:http://recoftc.org/documents/Inter-Reps/CBTdiscussion/Fergus-keynot.doc)
- Watson - Donald, K. L. (1998). *climatic design and implementation of building energy theory*, translation: V., Ghobadian.
- Yarshater, E. (1989). *Encyclopedia Iranica* (Vol. 3.). Routledge & Kogan Paul Press.

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).