



**International Journal of Biology, Pharmacy  
and Allied Sciences (IJBPAS)**

*'A Bridge Between Laboratory and Reader'*

[www.ijbpas.com](http://www.ijbpas.com)

---

**ENERGY IN ARCHITECTURE BY APPLYING THE PRINCIPLES OF  
SUSTAINABLE ARCHITECTURE**

**ALIREZA KARIMI KOLOOR<sup>1\*</sup>, FATEMEH KHOSRAVI<sup>1</sup>, MARYAM FALLAH  
BAGHERI<sup>2</sup>, NAZANIN SADEGHI MARJANI<sup>1</sup>, VAHID SAMIEZADEH<sup>1</sup>**

<sup>1</sup>Graduate student of architecture in Islamic Azad University, Damghan Branch, Damghan,  
Iran, [alirezaarchi7@gmail.com](mailto:alirezaarchi7@gmail.com)

<sup>2</sup>Undergraduate student of architecture in Kowsar Institute of Higher Education, Qazvin  
Branch, Qazvin, Iran

**ABSTRACT**

Population growth and especially technology and its incongruity with the environment have caused extensive changes and disturbance of natural circumstances in many parts of the world. Adverse effects of modern technology on the environment have raised a new awareness of environmental issues among people. In order to achieve Sustainable Development, reasonable utilization of natural resources, a fundamental shift in man's attitude toward nature, and a serious reconsideration of production and consumption patterns are required. Sustainable Architecture or Green Architecture is a phenomenon which is considered by many architects with differing views around the world. In the global movement towards sustainable development, architecture will certainly be one of its main strategic factors, because buildings are among the most significant, extensive, and lasting changes which man has induced on the earth, and since the strengths and weaknesses of buildings will have a direct impact on the ecosystem of the world, a grave responsibility falls on them. In this article, by choosing this topic and studying an example of a project based on the principles of Green Architecture, it is attempted to be a part of the effort which is made to transform today's gray world to a green future.

**Keywords: Green architecture, sustainable design, energy in architecture**  
**INTRODUCTION**

There is a lot of information about the implementation on many websites principles of Green Architecture and its including; "American Institute of

Architects Committee on Environment" ([www.aia.org.cote](http://www.aia.org.cote)), "U.S. Green Building Council" ([www.usgbc.org](http://www.usgbc.org)), and in Europe and the UK, "Sustainable Home" ([www.sustainablehome.co.uk](http://www.sustainablehome.co.uk)). Green process is an ancient process in architecture; for instance, since cavemen first realized that choosing a cave southward is much more suitable regarding temperature than a cave whose opening is to the North. The new issue is to understand that green architecture is the best process for built environments and human-made surroundings; so that all the resources applied to the building, its materials, fuel, or objects used by residents need a sustainable architecture in order to be created. Many of the existing buildings have at least one of the several recognizable features of green architecture, however, a few of these buildings have the entirety of this complete process. In general, green process is proposed in a way that all matters are co-dependent and every aspect of it must be examined in each decision; thus, the idea of examining the principles separately is in contradiction with it. In general, there are different principles considered in the construction of any kind of structure which have a lot in common for discussion; however, the presented topics are a set of different principles

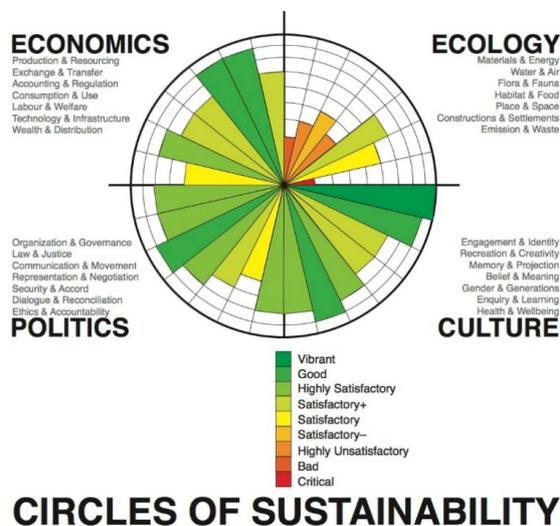
whose consideration will lead to the balance and emergence of green architecture.

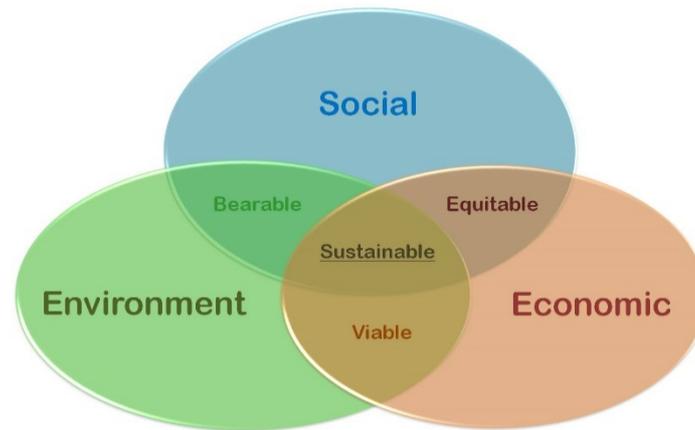
### **History and development of modern concepts of sustainable development**

With the rise of concerns about the consequences of human activities on Earth, based on the resolution of the UN General Assembly at the end of 1983, a World Commission headed by Mrs. Brundtland, Prime Minister of Norway at the time, was formed to study environmental issues and global development. Following the extensive research and international dialogue, the Commission published its final report under the title "Our Common Future" in mid-1987 and since then, the words "sustainable development" which were the central topic of this report, found wide acceptance and popularity. Items that can be used to achieve sustainable development (sustainable architecture):

1. Understanding the environment (facilities that the environment offers).
2. Contact with nature
3. Understanding the environmental effects (site analysis)
4. Collaborative process design (consulting engineers)
5. Understanding people (culture and religion)

6. Employing the sustainable consumption of renewable resources
7. Optimizing and verifying the use of non-renewable resources and minimizing the consumption of natural resources to a proportion which is less than their natural growth
8. Minimizing the waste and pollution which is absorbed in scale and capacity of the local to the global environment
9. Supplying the basic needs of man and society and creating a healthy environment for future generations (from the basic principles of sustainable city development and design)





### First Principle: Energy Conservation

Every building must be designed and constructed in such a way that it would need the minimum amount of fossil fuel. With regard to the construction methods, the need to accept this principle in the past, without any doubt, is undeniable and perhaps only because of the wide variety of materials and new technologies in construction in the contemporary era, such principle has been forgotten and now, by using different materials or with different combinations of them, buildings change the environment according to the users' needs. Biological Systems Theory is also worth mentioning which originates from providing shelter to stay safe in cold weather or providing a cool space for people's residence, because of this and other existent factors, people used to construct their buildings next to each other due to plenty of mutual benefits. Structures which are constructed in interaction with the local climate in an effort to reduce the dependence on fossil fuels, compared to the

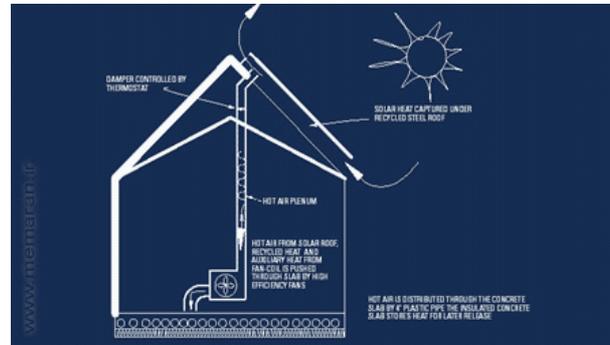
ordinary apartments today, carry distinctly individual and separate experiences and thus, are considered as fruitless efforts for creating green architecture. Many of these experiences were more the results of individual efforts, therefore, it is evident that they are not included as a sustainable principle in design and construction of today's society.

### Second Principle: Dealing with the climate

Buildings should be designed in order to be able to use their local climate and energy sources. The shape and placement of interior spaces of the building can improve the comfort level inside the building and simultaneously, through proper insulation of the structure, fossil fuel consumption will be reduced. Inevitably, these two mentioned processes overlap and have a lot in common. Before the development of the wide-ranging consumption of fossil fuels, wood was considered the main source of energy and also, it still provides about 15 percent of the energy today. When wood

became scarce and rare, naturally, many people got help from the sun to produce heat in order to reduce their need for wood. In Greek cities like "Pyrenees", the location of the city was changed in a way

that floods would be prevented from entering the city, and a rectangular network was constructed with east-west streets that would allow buildings orientate to the south and use the desired lighting of the sun.



Romans also continued following the principles of solar design by learning from the experiences of the Greek, but they also utilized transparent windows, invented during the first century AD, to enhance the received heat; by the increasing shortage of wood as a fuel, the use of south-facing facade in the construction of houses of the rich as well as the city's public baths became widespread. Traditional design, which was based on the climate for creating comfort inside the building, was not limited to heating regulations but in many climates, architects were required to design a cool space to create favorable conditions inside the building. The common solution in the present era, which is using air conditioners, is only an inefficient process in conflict with the climate and simultaneously, along with high energy consumption, which even in cheapness and

abundance of energy, is considered wrong due to its contamination.

### **Third principle: reduce the use of new resources**

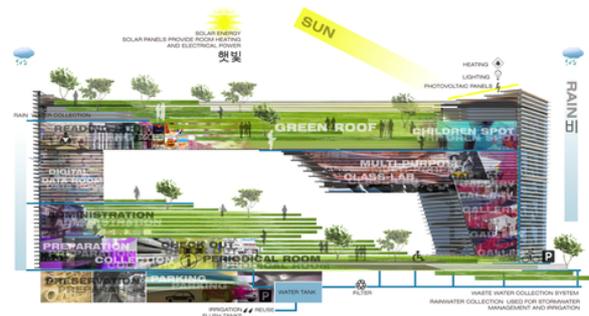
Every building must be designed in order to minimize the use of resources and at the end of their useful life, create a resource for the creation of other structures. Although the orientation of this principle, as well as other mentioned principles is toward new buildings, it should be noted that most of the world's resources are used in the current built environment and restoration and improvement of existing buildings to reduce environmental effects, is of equal importance to the creation of new structures. It should also be noted that the number of resources to create built environments in the world are not sufficient to use them again for restoring every generation of buildings. This reuse can be employed in the direction of recycled

materials or spaces; recycling buildings and elements within them is part of the history of architecture. Santa Elbasan Monastery, which was reconstructed in 1077 and 1115, used the bricks from the ruins of a building nearby. Wooden skeletons which were used in the Middle Ages were logs which were cut, connected, and encoded in the carpentry workshop and then were separated and transferred into buildings. Using this method meant that parts of medieval buildings could be moved if necessary, and even today they can be moved to another location. Sometimes the entire building structure was moved to build a new building. For example, when building Victoria and Albert Museum in London, the previous building on the site was no longer needed and in 1865, the transfer offer of this metal building was proposed to local authorities in the North, East and South London with the purpose of establishing a local museum in a new place. East London authorities accepted this offer and the construction of this local museum was completed in 1872, which today has become the Children's Museum. In most cases where access to new resources are minimized, methods are discovered through which buildings that were built for one purpose can be used for other purposes; however, some essential changes can alter the original form of the

structure or building. For those interested in conservation and permanent maintenance of the buildings this is considered a disaster and the question arises that whether a building should always be unchanged because it once had a valuable use or necessary changes are required in order to maintain its efficiency and effectiveness. A green process may possibly judge the investigation of this matter on the basis of available resources. If the resources needed for changing a building are less than the resources needed for its destruction and reconstruction, these changes must be welcomed. However, this does not cause lack of respect and commemoration of the historical significance of the structure. In addition, these structures might also have other values that paying attention to them is necessary. These difficulties in changing the existing buildings in order to prepare them to be consistent with the new requirements, particularly retrofitting buildings in terms of performance and efficiency which may lead to change its appearance with more inconsistencies and contradictions. Changes in some of the old buildings for new applications can have certain expenses and problems associated with them. However, the benefits of reusing these large buildings next to each other and in an urban environment can overcome these problems and expenses.

Modernization of existing buildings in large and small cities can also protect the

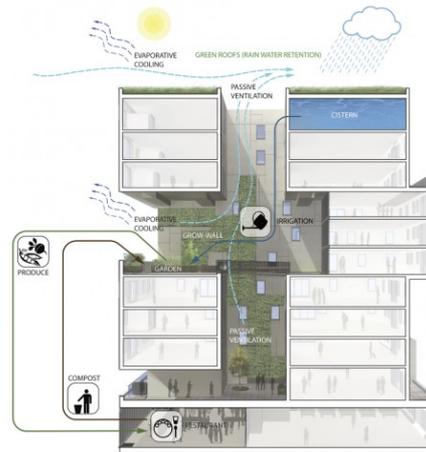
resources used for destruction of buildings and thus prevent the destruction of society.



#### The Fourth Principle: Respect For Users

Green architecture respects all people who use the building. It seems that this principle has little to do with the pollution caused by global climate change and ozone depletion. But the green process of architecture which includes respect for all the shared resources in the construction of a complete building does not exclude man from this collection. All buildings are constructed by humans, but in some structures, human presence is respected, while in others the effort to deny human dimensions can be observed in the construction process. In Japan, the robots have taken the role of humans in the creation and design of buildings, but for a robot, effective efficiency about the project includes the implementation of a specific task that can be repeated several times. But on a different scale, a man as an architect, can rely on his skills to do several unrelated tasks. Greater respect for human and labor force needs, can be experienced in two

separate directions. For a professional builder, it is essential to note that as much as safety and health of materials and processes that form the building are important for workers or consumers, they are even more important for the entire human society. Architects have gradually become aware of the existence of different toxins in construction sites and recently the use of insulation CFC-type materials or the use of other hazardous materials in the building have been banned. Another form of human engagement that needs attention is the participation and positive involvement of users in the design process and construction, which will waste an efficient and useful resource if not used effectively. A large number of buildings have benefited from this energy and its results have been satisfactory in the creation of large buildings.



### The Fifth Principle: Respect for the Site

Glenn Murcutt states this strange sentence: "Each building must touch the earth in a calm and light way." This statement has a feature of the interaction between the building and site in itself which is essential in the green process and of course, it has more extensive features as well. A building that consumes energy greedily, produces pollution and is alien to its consumers and users; consequently, it never touches the earth in a calm and light way. A more explicit interpretation of this statement is that each building cannot be removed from its construction site and the conditions before the construction of the building in the site cannot be restored. This kind of communication with the site can be seen in the traditional Bedouin settlements, lightness and comfort among them in touching the earth did not merely lie in moving their houses, but included the materials they used and the assets they carried. Black Bedouin tents were produced

from the wool of goats, sheep, and camels, when these tents were set up, aerodynamically, the creation of a highly efficient cross-section prevented their destruction in strong winds; the tent was held in its location with long cords and wooden beams were used in it since wood in the desert was considered as a very scarce resource. While in urban communities, people have left their indigenous and traditional life for settling down in one location and architects have entered the design field, temporary structures are still constantly needed for holding exhibitions and other cultural activities. Such structures often take the form of a Bedouin tent. Designed by Dutch architects for Sonsbeek 86<sup>th</sup> festival, this structure was designed to protect the fragile sculptures outside the building; furthermore, it must have been designed in a way that it was not noticed. Four types of materials were used in this structure: prefabricated concrete for foundations,

transparent glass for walls and steel roof for trusses and steel fixtures and resin silicone for connecting the plates to each other. Glass fins were attached to the glass walls to create more stiffness and also to provide a place for connecting metal trusses which were carriers of light glass roof. The ground floor was normal land and was only covered with wood to prevent mud. After the festival, this building was once again separated and then was also removed from the site and the soil was returned to its place; thus, the land site returned to its condition before the festival with no changes. This building can be used for any other exhibition or event or its parts can be used in any other structure.

### The Sixth Principle:

#### Holism



### CONCLUSION

Green process is an ancient process in architecture; for instance, since cavemen first realized that choosing a cave southward is much more suitable regarding

All green principles need to participate in a holistic process of constructing the built environment. Finding buildings that have all the principles of green architecture is not an easy task. Since green architecture is not still completely understood. Green architecture should include more than a single building of its section and must include a stable form of the urban environment. A city is more than a series of buildings; in fact, it can be seen as a set of interacting systems - systems for living and recreation –which have bodies like constructed forms and with a closer look at these systems, we can outline the face of the future city.

temperature than a cave whose opening is to the North. Architects English, Brenda and Robert Vale in their book entitled "Green Architecture: Design for an Energy-conscious Future" have proposed one of the

simplest and most explicit frameworks for green architecture. With a broader and more comprehensive look, the most important factors in a dynamic process of sustainable development can be categorized into four factors:

1. Culture (beliefs and values)
2. Knowledge (education)
3. Ability (Technology, equipment, and capital)
4. Structures (laws and regulations).

#### **REFERENCES**

- [1] Ahmadi, Z. (2014) "Sustainable architecture (patterns of sustainability in architecture of Iran)", (first edition), Avval va Akhar publication.
- [2] Rezaei, D. Wathiq, B. (2014) "Analysis of Sustainable Architecture (in the local housing and rural and mountainous cold climate)," Tahan publication.
- [3] Wright, D. Trans. by Shali Amini. (2011) "The Alphabet of Sustainable Architecture (solar architecture approach)", (first edition) Parham Naqsh publication.
- [4] Koch Nielsen, H. Translator, Saqlaie, F. (2012) "Architecture in Harmony with the Climate (the principles of ecological design in warm areas)", (first edition), publication of studies and research in Planning and Architecture.
- [5] Sayyadi, A. & Maddahi, D. (2011) "Sustainable Architecture" (first edition), Luts publication.
- [6] Labs, k. Watson, D. Translators, Qobadian & Feiz-Mahdavi, M. (2013) "Climatic Design: theory and implementation of energy use in buildings" (first edition), Tehran University publication.
- [7] Fazli, N. (2012) "Energy Comfort Architecture" (first edition), Ensha publication.
- [8] Veyseh, S., Hakkakifard, V., Khodabandelo, N. Tahmasby, F. & Tariq, M. (2011) "Providing Appropriate Procedures in the Use of Local Materials", Islamic Revolution Housing Foundation Publication.