DESIGN PRINCIPLES FOR SUSTAINABLE RESTAURANT: A CASE STUDY IN SHIRAZ

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Abstract. As climate change and global warming effects have increased worldwide, sustainability becomes the main aspect for constructing new buildings and conserving existing ones. Sustainable design should be applied in all phases of the life cycle of a building, including programming, design, building construction, building operation, and finally demolition. Sustainability is not yet a term which is described in the building decree. However, it is a very important theme of this moment. The ultimate scenario would be when architectures meet all the requirements concerning energy and comfort. This article is going to give solutions for designing a sustainable restaurant. Iran is basically divided into four climatic regions. One of its regions including most parts of the central Iranian plateau receives almost no rain for at least six months of the year; hence it is very hot and dry. The present study is based on sustainable restaurant in Shiraz, a city which is located in Iran’s hot and dry climate zone with its wide spread area. The sustainable restaurant design is based on principles of architecture in harmony with the climate of each region and knowing its domestic and natural materials.

Keywords: Sustainability, sustainable restaurant, energy consumption, sustainable technology, Shiraz

INTRODUCTION

Architecture is always a response to tradition and culture of its time. It reflects the pulse of the society, environment action, life style of inhabitants and their aesthetic value as well as their building technology. Today, several specialists in architecture and building design believe that it is necessary to carry out an innovative creation of architectural produce, which keeps up a correspondence to the new demands of a full useful architecture but no more building (Almusaed, Biophilic and Bioclimatic Architecture, 2011).

Sustainability

The fundamental focus of the 21st century construction sector is to minimize environmental impacts. It is an urgent need to cut greenhouse emissions, to reduce energy consumption and wastes by creating eco-friendly new buildings and conserving the existing building stock, which accounts the most carbon emissions. This highlights the need to adapt sustainability in conservation.

The human comfort is the vital aim of architecture where the interaction appears between the energy such an abstract act and the human feeling and comfort in which the balancing is extremely complex (Almusaed, ibid)
The problem, though, seems to stem from a lack of appropriate knowledge about the nature of our given environment. However, the solution does not involve gimmicks, only understanding. All that which is necessary to exist in unison with our surroundings is a clear and objective analysis of the intricacies of the environment in which we live, and an honest reaction to those factors, which strongly influence the nature of such an environment. Sustainable development emphasis on limiting infrastructure and the materials used helps contribute to affordability during the construction of a project by eliminating some costs altogether. In the longer term, sustainable design principles of energy and healthy architectural spaces and material durability would help to make a habitat affordable.

Renewing ability is the key to our human range and our prime resource for architecture. Every site is definite as to its location, natural relief, local vegetation and its local macro-micro-climate.

Today's, upon reflecting on the various settings and experiences of our lives, we should be able to find some fairly close matches between characteristics we like and characteristics that would have improve our chances of survival. The natural contiguous keeps us healthy and in turn, probably promotes physical performance as well. Occupants of built environments do not want simply to work, play, eat or sleep in a functional building. They need to be inspired, invigorated, comforted and reassured by their surroundings. They require spaces that will make them more appropriate, comfortable and healthy. The book will take in evidence the challenges and the goals of human objectives for a healthy human architecture (Golabchi & Golabchi, 2013)

**Sustainable Architecture**

Sustainable development propounds new discussions with terms such as green architecture, sustainable architecture, and/or ecologic architecture.

Caring the quality of human life at present and in the future, using the materials that are adaptive with surrounding environment while producing, building and even destroying them are necessary. Minimum use of fossil fuels, maximum utilization of clean and renewable energies, and the protection of native culture of each region are important points of consideration (Zamani, Taleghani, & Hoseini, 2012)

As William has considered in his book environmental, cultural and technical aspects are the three viewpoints that the designer should consider for having a sustainable architecture. There are two main aims as Sassi said for sustainable architectural design:
First, sustainable buildings should metaphorically ‘tread lightly on the Earth’ by minimizing the environmental impacts associated with their construction, their life in use and at the end of their life. Sustainable buildings should have small ecological footprints.

Second, buildings should make a positive and appropriate contribution to the social environment they inhabit, by addressing people’s practical needs while enhancing their surrounding environment and their psychological and physical well-being (Sassi, 2006)

**Sustainable restaurant**

Global warming is a real issue, as air and water temperature indisputably increasing. Climate change has negative environmental consequences and it can displace people, threaten the food supply, diminish biodiversity and reduce quality of life. There are many issues that should really be highlighted for having sustainable restaurant as it is observed in the following table.

**Table 1. Some issues for having sustainable restaurant.**

<table>
<thead>
<tr>
<th>Energy</th>
<th>Restaurants over uses large amount of energy.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>In restaurants water is over used in different ways.</td>
</tr>
<tr>
<td>Food waste</td>
<td>Food waste has great potential to be turned into fertile Growing soil.</td>
</tr>
<tr>
<td>Building materials</td>
<td>There are many synthetic materials in restaurants should be less used and also recycled.</td>
</tr>
</tbody>
</table>

Restaurants are the largest consumer of electricity in the commercial sector. The goal of this section is to encourage foodservice facilities to move toward the goal of becoming carbon-neutral and using only sustainable sources of energy. This is achieved through using more energy-efficient equipment, offsetting energy usage, and generating on-site renewable clean sources of energy.

1. Water Efficiency
2. Waste Reduction and Recycling
3. Sustainable Furnishings and Building Materials
4. Sustainable Food
5. Energy
6. Disposables
7. Chemical and Pollution Reduction

Nowadays there are some organizations such as “Green Restaurant Association (GRA)“or”Sustainable Restaurant Association(SRA)” who gave certificates to sustainable restaurants. The certification requirements are as follows:

- Energy, equipment and services
- Water, equipment and services
- Waste, management and services
- Supply chain non-food
- Supply chain food
- Furniture and building design
- Grants and regulations
- Community engagement
- Responsible marketing and publicity

Regarding this article building design for sustainable restaurant is going to be discussed.
Figure 1. A chart of sustainable restaurant for analysis.

Case Study

Shiraz having 1.7 million population as one of Iran's greatest and most famous cities in Iran’s not and dry plateau has been chosen to conduct this survey on.

Shiraz is located in Fars province and it can be mentioned as a center of south Iran. People living in this city and also many international tourists and domestic travelers all enjoy spending their time in a place such as restaurant. Therefore, having a great sustainable restaurant in this region might be very beneficial and important.
Also, the central Plateau region covers a large section of the central and eastern part of the country. The main characteristics of Iran’s hot and dry climate region “Shiraz” as Dr. Ghobadian has mentioned are as follows:

- Cold in winter, hot and dry in summer
- Low humidity and precipitation
- Dust winds
- Enclosed urban spaces
- Adjoined buildings
- Convex roofs
- Ground floor lower than natural ground level
- Inward oriented buildings
- Central courtyards
- Construction materials: brick, adobe and mud. (Ghobadian, 2009)

**METHODOLOGY**

In order to identify under which criteria sustainable conservation is accepted, a case study analysis has been taken. Library search and reviewing related literature in the fields of sustainability and conservation will be of great importance.

This research may be most generally characterized as qualitative research. This qualitative research involves variety of empirical materials, case study, observation, the collection of relevant documents, photographs, different instruments, documents that contain surveys and applications from other researches, articles and books, doing research work and collecting useful information is important.

**DISCUSSION**

Climate has a major effect on the performance of the building and its energy consumption. Reducing energy consumption requirements, using natural resources and providing comfortable, healthier and sustainable living spaces are the aims of a climatically responsive sustainable building design.
The climatic factors such as altitude, latitude and distance from sea affect the climatic elements like solar radiation, temperature, humidity, precipitation and also wind intensities and directions. These are the main issues for starting the sustainable design.

Table 2. Shiraz climatic conditions and elements.

<table>
<thead>
<tr>
<th>city</th>
<th>Lat</th>
<th>Long</th>
<th>Alt (m)</th>
<th>Climate</th>
<th>Biome</th>
<th>Av temp</th>
<th>Precip</th>
</tr>
</thead>
<tbody>
<tr>
<td>shiraz</td>
<td>2932'N</td>
<td>52 36'E</td>
<td>1489</td>
<td>Subtropical steppe</td>
<td>Warm temperate thorn steppe</td>
<td>18</td>
<td>306</td>
</tr>
</tbody>
</table>

For designing a sustainable building in Iran’s hot and dry climate region as Ghobadian has mentioned, these principles should be performed:

- Orient the building toward south.
- Building in the ground especially on the west, north and east.
- Transparent south windows and parapets.
- Basement windows toward south.
- Sunken courtyard.
- Use the room above the stair case as a greenhouse and wind tower.

In this paper, we are going to present some principles for designing a sustainable restaurant in Shiraz. The suggested site is near Ghoran gate and Shiraz hotel.
For this restaurant, which is organized in two levels, one main restaurant, a coffee shop, a meeting room, kitchen and other service areas are mentioned.

**Figure 4.** Supposition restaurant site near Ghoran gate and Shiraz hotel

**Figure 5.** First concept sketches.
**Figure 6.** Supposition restaurant plan.

**Figure 7.** Entrance level plan analysis with the wind tower and green house design.
In this region, designing a restaurant with central courtyard can be very useful for sustainable architecture and environmental preservation.

The building is oriented toward south, which is very important for using the solar energies. Luckily, because of the site's situation, the north part of the restaurant is located in the ground which the ground can act as good thermal mass for the building. Transparent windows and parapets have been designed in the south facades for getting the energy.

![Image](image_url)

Figure 8. Restaurant level plan analysis with the wind tower and green house design detail.

In this design, wind towers with frustum shaped are one of the building's main sustainable characters. These wind towers not only work for catching the wind and cooling the space but also provide a roof light for interior parts. Under one of these wind towers, there is a small water pool which helps cooling the restaurant. Beside the main wind tower, there is green house in the south side for having solar energy inside the building. Under the main restaurant, there is a rock bed, in day time the heat with fan goes to the rock storage and at night heat goes to the room.
Photovoltaic panels are located on the kitchen roof for getting the solar energy. There are sunshades toward direct west sun lights and also deciduous are located in west side and some other parts for summer shades. Evergreen trees which are useful for filtering and also controlling the dominant wind should be arranged toward North West winds (Shiraz’s dominant wind flows from this side).

On top of the meeting room, there is a roof garden which can be used for coffee shop’s open area and also it is a good insulation for the meeting room.

These design samples can be used for most sustainable restaurant in hot and dry climate such as Shiraz.
MATERIALS

Choosing the best sustainable materials and its color is a very great deal. Outer walls for having a sustainable architecture have a great role they have a direct relation between inner and outer part of the building. They not only act as a shelter and separator but also can be the beneficial part of a building for making a sustainable architecture. In sustainable architecture using local, natural, none toxic, recycled, recyclable and no PVC materials are very important. As it can be seen, traditional materials such as mud, adobe and brick with having a high thermal capacity and minimized temperature fluctuations between day and night are always good choices for sustainable buildings but new technology materials such as double membrane facades in transparent walls and light materials with suitable outside insulation can be more efficient for new design styles.

By the way, bearing green walls with suitable plants and also adobe walls beside the new technology materials seems very efficient and aesthetic for the general buildings such as restaurants.

CONCLUSION

In conclusion, for having a sustainable architecture and environmental preservation energy, building material, waste, water and place making are the main features that we should consider. Restaurants are one of the great building types in having lots of waste, using lots of water and energy. As the fundamental focus of the 21st century, it is urgent to reduce energy consumption, by designing a restaurant with sustainable aspects, which will help saving lots of energy and water.

REFERENCES