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Energy Consumption Optimization and Providing the Environmental Indices in Green Architecture

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Abstract: This study investigates the energy consumption optimization and provides the environmental indices in green architecture (sustainable) through the Exergy analysis. Therefore, we first investigate the indices of green architecture and the role of determinants for our utilization, and then study the cases which can lead to the green architecture in the building. The closed-loop solar collector systems is utilized to get the solar energy, and thus the Exergy analysis is applied in this regard. Various parameters are obtained for Exergy analysis of collector. The results of this analysis suggest that the use of solar collector is one of the best ways for green architecture and not applying the fossil fuels and environmental pollution

INTRODUCTION

The green or sustainable architecture is one of new trends and approaches which have been taken into account by numerous designers and architects in contemporary world during the recent years. This architecture, which is derived from the concepts of sustainable development, is one of the basic human needs in coordination with the environment in today's world Adams[1] because the energy is now known as one of the main factors for creation and development of industrial societies, so that the country access to various sources of energy indicates the economic and political advance and power. Due to the high energy prices and high costs of capital sectors on the one hand and the strong growth of industrialization in societies and their growing needs for energy on the other hand, the countries have implemented the policies called the energy consumption optimization to avoid the uncontrolled and non-optimal consumption as well as reducing the production costs and increasing the welfare.

The problem of limited available energy resources is almost common for all countries including the developed or developing and industrial countries. From 30 to 40 percent of the total energy consumption are related to the construction in different countries depending on their industrial activities. From this amount, about 50 to 60 percent is consumed on heating and cooling the building in different seasons. In other words, from 15 to 20 percent out of the total energy consumption in the country is spent on heating and cooling consumption of residential space in the building. A detailed review can specify the amount of energy consumed by each of the consumers in different sectors. Any measure, which that is done to improve the quality of construction for thermal exchange, leads to the considerable savings in total energy consumption.

Energy consumption optimization and architectural design: Given the growth of technology and introduction of sustainable energy issues and the continued reduction of non-renewable energy reserves as well as the existence of sufficient sources of sustainable energies (sun, water, wind, biogas, etc.) in our country, the architects can create the appropriate space with optimal thermal comfort by designing an appropriate architecture consistent with the climate and utilizing the Iranian architectural models which have used the sustainable energy in architectural design through appropriate procedures with respect to the new technology and sciences. Therefore, there is a need for extensive and applied studies to achieve these goals.

The renewable energy refers to any types of energy which is applied without decline of its energy suppliers and they include the solar, wind, biomass, geothermal, marine and water energy. It is expected that these energy sources play an important role in long-term global energy supply. The increasing use of limited resources of fossil fuels and their harmful impact on the environment have attracted the global attention to the consumption of renewable energies. The effects of fossil fuels on the ecosystem, climate and living creatures especially the humans particularly through the production of greenhouse gases and global warming, the acid rain and other environmental phenomena have attracted the global attention to the use of other forms of energy. According to the first and most obvious characteristic of these types of energy sources, these energies are environmentally friendly. The environmental, strategic, social and economic advantages, etc are the other advantages of renewable energies compared to fossil fuels.

The Exergy is defined as the access to the maximum useful work which is taken from disordered energy while it is in equilibrium with the environment. The Exergy analysis of thermodynamic systems is among the new theoretical subjects developed gradually in the past two decades and engaged an important part of theoretical subjects in books of advanced thermodynamics. The use of second law of thermodynamics is among the factors which lead to the development of this analysis in order to explain the exact and optimal function of a system and this is expressed by analysis of irreversible factors which lead to the destruction of Exergy and lower efficiency. Since different types of energy are directly considered in Exergy terms. It can be concluded that the Exergy efficiency is an objective and accurate criterion for assessment of thermodynamic systems. The Exergy analysis method is applied by Kotas and Zsargut for thermal, chemical and metallurgical analysis of plants and the Grassman diagrams, in which each flow is specified with its Exergy value, are applied to determine the Exergy of flow in the system. Furthermore, the topics including the thermal economics and economic optimizations of thermodynamic systems are proposed by Kotas. The Exergy balance is written as follows for a system in steady state with input and output Exergy based on its concept Kam[2]:

$$I = \sum_{in} Ex - \sum_{out} Ex \tag{1}$$

Therefore, the Exergy efficiency can be defined as follows according to the above-mentioned equation:

$$\eta_{II} = \frac{\sum_{out} Ex}{\sum_{in} Ex} = 1 - \frac{I}{\sum_{in} Ex} \tag{2}$$

To explain the Exergy and efficiency of the second law, it is essential to represent the introduction on the thermodynamic relations along with an overview of thermodynamics.

Ecological indices: Despite the fact that the sustainability and environmental performance indices are quite different, they have the similarities. These indices help to measure the movement to reach the objective with sustainable development and alarm in the case of risks. Numerous indices have been utilized and evaluated for local, national and international development and the emphasis is put on changing some of them. Therefore, we can evaluate the human activities and their consequences on the environment by sustainable development indices. Different researchers have introduced the environmental criteria in their studies. For instance, the FAO center has separately mentioned indices for water, soil and the atmosphere. In this regard, the amount of emission of greenhouse gases, the ozone depletion and air pollution are presented for atmosphere in the urban environment. The use of solar energy is an appropriate alternative to greenhouse gases. The use of solar energy helps all three indices of FAO index to preserve the environment.

Theoretical principles of research: In a research entitled "The Exergy analysis of a compression-absorption cascade system for refrigeration", Colorado and Velazquez[3] have simulated the system for different types of liquid and estimated the best fluid in terms of performance and relevant parameters through the first and second laws of thermodynamics and Exergy analysis. In a research entitled "Exergy analysis of single and multi-stage thermoelectric cooler", Sharma and Dwivedi[4] have investigated the performance of single and multi-stage systems based on the number of thermal elements and comparing them in terms of cooling rate, performance coefficient, efficiency of second law and the exergy destruction. In a research entitled "The Exergy analysis of solar energy applications", Saidur *et al*.[5] have studied the solar heating systems, solar desalination system, solar air conditioning, solar drying process and solar electricity generation and introduced the Exergy analysis and efficiency of systems along with the Exergy destruction resources. In a study entitled "Energy and Exergy Analysis of a Steam Power Plant in Egypt", Rashed and El Maihy[6] have analyzed the energy and Exergy in a Shobra El-Khima plant in Cairo. The analysis of component system is individually done in order to identify the highest Exergy losses in different loads.

In a research entitled "The Exergy analysis of steam power plant cycle components", Bafekrpour have studied the components of steam cycle in Loshan thermal power plant fueled by natural gas in terms of Exergy and calculated both Exergy efficiency and losses, which are the objective criteria of system evaluation, for steam cycle components and have calculated that the plant boiler installations including the heat transfer and combustion processes is the most important factor in Exergy destruction. In a study entitled "The Exergy and thermo-economic analysis of a heat pump", Molaei-Kermani et al have investigated and optimized the most important thermal design parameters of heat pumps including the condensation temperature and evaporation temperature simultaneously with the inner diameter of condenser and evaporator as the heat exchanger optimization parameter for three fluids and it is concluded that the highest Exergy destruction has occurred in compressor system. In a study entitled "The performance improvement of thermal cycle in Shazand steam power plant of Arak using the combined pinch and exergy analysis", Panjeshahi et al have optimized the operational parameters of Shazand plant steam cycle, which is a kind of Rankine thermal cycle, by a thermodynamic method with regard to the economic considerations and taking into account the existing facilities and thus the cycle efficiency is increased as well as enhancing the efficiency of main cooling tower and solving the problem of its limited production in warm seasons of year by reducing the heat load of condenser and combined Pinch and Exergy analysis. The utilization of this method in Shazand power plant has led to a 5.3% of reduction in fuel consumption and increased thermal efficiency of cycle from 39.4-41.9%.

MATERIALS AND METHODS

Research methodology: Here, we investigate and analyze the issue and thus we use the Exergy analysis. Therefore, this section includes the Exergy analysis and thermal analysis equations which are the bases of Exergy analysis and are essential for Exergy analysis study. In the next sections, we measure the Exergy efficiency for a type of collector with certain characteristics.

Exergy analysis: The Exergy analysis of system is required to determine a part of thermal energy which can be converted into the efficient work under the ideal conditions. The measurement of Exergy efficiency or second law efficiency specifies the energy quality for us. In general, the Exergy is exchanged with closed-loop collector system by two ways. First, by fluid flow and then the heat transfer. The Exergy of any incompressible fluid flow at the temperature of T and the pressure difference of ΔP with the environment is shown by the following equation:

$$\dot{E} = \dot{m}C_p\left(T - T_a - T_a\ln\left(\frac{T}{T_a}\right)\right) + \dot{m}\Delta P / \rho \tag{3}$$

The Exergy exchanged through the heat transfer of between hot and cold temperature is calculated by the following equation:

The Exergy exchanged through the heat transfer of between hot and cold temperature is calculated by the following equation:

$$\dot{E} = \int_{T_c}^{T_h} \dot{Q}\frac{T_a}{T^2}dT \tag{4}$$

The Exergy balance equation can be generally written as follows:

$$\dot{E}_i + E_s + E_o + E_l + E_d = 0 \tag{5}$$

Where, $\dot{E}_i$, E_s, E_o, E_l and E_d are respectively the input, stored, output, leakage and destructed Exergy. The input Exergy for collector consists of two parts.

- Input Exergy with flow:

$$\dot{m}C_p\left(T_{in} - T_a - T_a\ln\left(\frac{T_{in}}{T_a}\right)\right) + \dot{m}\Delta P_{in} / \rho \tag{6}$$

- Exergy of radiation absorbed by collector. In previous studies, the researchers have utilized the following equation, which is according to Patella theory, for its calculation:

$$\eta_o I_T A_P\left[1 - \frac{4}{3}\frac{T_a}{T_s} + \frac{1}{3}\left(\frac{T_a}{T_s}\right)^4\right] \tag{7}$$

In the former equation, Patella is the term into the bracket of efficiency. Assuming that the sun is an infinite thermal source, the correct equation is as follows:

$$\eta_o I_T A_P\left(1 - \left(\frac{T_a}{T_s}\right)\right) \tag{8}$$

According to the sum of both equations above for input Exergy:

- The stored energy in the steady state is zero
- The output Exergy includes only the Exergy of output flow:

$$-\dot{m}C_p\left(T_{out} - T_a - T_a\ln\left(\frac{T_{out}}{T_a}\right)\right) - \dot{m}\Delta P_{out} / \rho \tag{9}$$

In the equations above ΔP_{in} and ΔP_{out} are the fluid pressure difference with environment in entry and exit of collector.

The leakage Exergy includes the thermal leakage from absorbing surface to the environment:

$$-U_l A_P \left(T_P - T_a\right)\left(1 - \frac{T_a}{T_P}\right) \tag{10}$$

The destructed Exergy is divided into three main parts. The destructed Exergy due to the pressure drop in the tube:

$$-\dot{m}\Delta P / \rho \frac{T_a \ln\left(\frac{T_{out}}{T_a}\right)}{T_{out} - T_{in}} \tag{11}$$

The destructed Exergy because of the solar temperature difference with the absorber surface is obtained according to the following equation:

$$-\eta_o I_T A_P T_a \left(\left(\frac{1}{T_P}\right) - \left(\frac{1}{T_s}\right)\right) \tag{12}$$

T_S is 4350 K of effective solar temperature which is equal to 0.75 of blackbody temperature of Sun (5800 K) and I_T is the intensity of solar radiation.

The destructed Exergy due to the temperature difference between the absorber surface and working fluid is extracted from the following equation:

$$-\dot{m}C_p T_a \left(\ln\left(\frac{T_{out}}{T_{in}}\right) - \left(T_{out} - T_{in}\right) / T_P\right) \tag{13}$$

By substituting the Eq. 22-29 in Exergy balance equation and sorting it, we will have:

$$\left(\dot{m}C_p\left(T_{out} - T_{in}\right) - \dot{m}\Delta P / \rho\right)\left(1 - \frac{T_a \ln\left(\frac{T_{out}}{T_{in}}\right)}{\left(T_{out} - T_{in}\right)}\right) = I_T A_P \left(1 - \left(\frac{T_a}{T_s}\right)\right)$$
$$-\left\{\begin{matrix}\left(1-\eta_o\right) I_T A_P \left(1 - \left(\frac{T_a}{T_s}\right)\right) + \eta_o I_T A_P T_a \left(\left(\frac{1}{T_P}\right) - \left(\frac{1}{T_s}\right)\right) \\ + U_l A_P \left(T_P - T_a\right)\left(1 - \frac{T_a}{T_P}\right) + \dot{m}C_p T_a \left(\ln\left(\frac{T_{out}}{T_{in}}\right) - \left(T_{out} - T_{in}\right)/T_P\right)\end{matrix}\right\} \tag{14}$$

According to the definition of collector Exergy efficiency, which refers to the increased Exergy of primary radiation by the radiation source, the collector Exergy efficiency equation is obtained as follows:

$$\eta_E = \frac{\dot{m}\left[C_p\left(T_{out} - T_{in} - T_a \ln\left(\frac{T_{out}}{T_{in}}\right) - \Delta P / \rho\right)\right]}{I_T A_P \left(1 - \left(\frac{T_a}{T_s}\right)\right)} = 1 - \{\ \}$$
$$1 - \left\{\left(1-\eta_o\right) + \frac{\eta_o T_a}{1 - \left(\frac{T_a}{T_s}\right)}\left(\frac{1}{T_P}\right) - \left(\frac{1}{T_s}\right) + \frac{\dot{m}\Delta P}{\rho I_T A_P \left(1 - \left(\frac{T_a}{T_s}\right)\right)} \frac{T_a \ln\left(\frac{T_{out}}{T_a}\right)}{T_{out} - T_{in}}\right.$$
$$\left. + \frac{\dot{m}C_p T_a \left(\ln\left(\frac{T_{out}}{T_{in}}\right) - \left(T_{out} - T_{in}\right)/T_P\right)}{I_T A_P \left(1 - \left(\frac{T_a}{T_s}\right)\right)} + \frac{U_l}{I_T \left(1 - \left(\frac{T_a}{T_s}\right)\right)}\left(T_P - T_a\right)\left(1 - \left(\frac{T_a}{T_P}\right)\right)\right\} \tag{15}$$

The terms of brackets on the right side of equation indicates the Exergy losses. The first term refers to the Exergy loss due to the optical losses. The second term refers to the Exergy loss due to the temperature difference between the solar temperature and absorbing surface. The third term indicates the destructed Exergy due to the fluid pressure drop inside the tube. The fourth term is the destructed Exergy due to the temperature difference between the absorbing surface and working fluid temperature and the fifth term is the destructed Exergy due to the heat losses from absorbing surface.

RESULTS ANS DISCUSSION

Here, we represent the necessary parameters with certain values. The wind rate is 2 meters per second and the collector angle is 25 degrees:

$$A_P = 0.64\ m^2$$

$$I_T = 800\ W\ m^{-2}$$

$$L_1 = L_2 = 0.8\ m$$

$$T_a = 300\ K$$

$$T_S = 4350\ K$$

$$\delta_1 = \delta_2 = 0.04\ m$$

$$\eta_o = 0.8$$

$$W = 0.15\ m$$

$$\varepsilon_c = 0.88$$

$$\varepsilon_P = 0.92$$

$$\delta_P = 0.002\ m$$

$$\delta_s = 0.04 \text{ m}$$

$$\delta_b = 0.08 \text{ m}$$

$$k_i = 0.08 \frac{W}{m.K}$$

$$k_P = 355 \frac{W}{m.K}$$

where, η_o is the optical efficiency and is equal to the effectiveness multiplication of absorption transmission. The increased T_{in} means an increase in temperature of fluid in the collector and can increase the heat loss, so there is an optimal T_{in} temperature; and for the temperatures above it, the effect of reducing the Exergy efficiency due to the heat loss is more than the effect of its increase due to the increased output fluid temperature. The fluid is in the water pipe. The pressure inside the class coatings is assumed equal to the atmospheric pressure and the resistance of connection adhesive is ignored. With regard to the equations 1-18 as the provisions of issue and according to this data, three parameters maximize the Exergy efficiency equation:

$$D_i = 0.06 \text{ m}$$

$$T_{in} = 358 \text{ K}$$

$$\dot{m} = 0.12 \frac{Kg}{s}$$

The maximum Exergy efficiency is equal to 9. After solving the equations, which have been used as the provisions for optimizing the efficiency, we will have for other parameters:

$$T_{out} = 360 \text{ K}$$

$$T_P = 361 \text{ K}$$

$$U_l = 4.9 \frac{W}{m^2.K}$$

$$F_R = 1.01$$

$$Q_u = 400.2 \frac{W}{m^2}$$

The graphs of efficiency changes with respect to various parameters are presented as follows:

Figure 1 shows the changes of Exergy efficiency in terms of collector surface area and it is not very tangible as shown, thus the hypothesis of constant dimensions for collector is reasonable because since the losses are increased by enhancing the collector surface, we will not have the increased efficiency due to these changes. Figure 2 shows the diagram of collector efficiency changes in terms of ambient temperature.

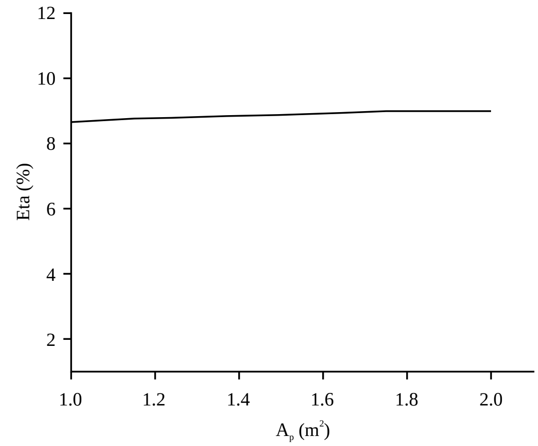

Fig. 1: Changes of Exergy efficiency in terms of collector area

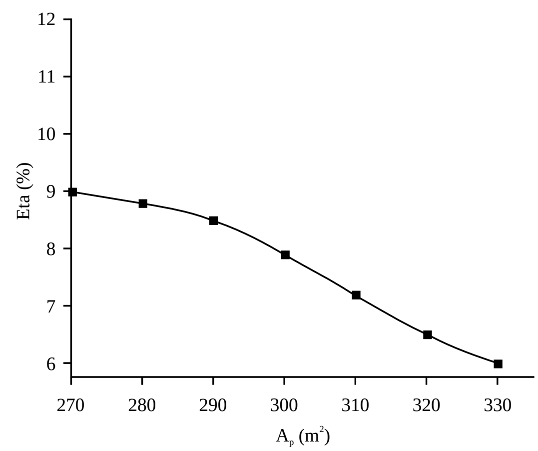

Fig. 2: Graph of Exergy efficiency changes in terms of ambient temperature

The exergy efficiency is reduced due to the increased ambient temperature. Since the ambient temperature changes during the day, other design parameters should be changed in order to have the maximum exergy efficiency. Figure 3 shows the Exergy efficiency changes in terms of solar radiation intensity.

The collector angle is one of the most important parameters in design and receiving the energy as shown in Fig. 4 and the Exergy efficiency is not significantly changed by increasing this angle. According to Fig. 4, the increased collector angle makes slightly increase in the exergy efficiency.

According to the results, the Exergy efficiency is increased and it is an appropriate quantity for optimization

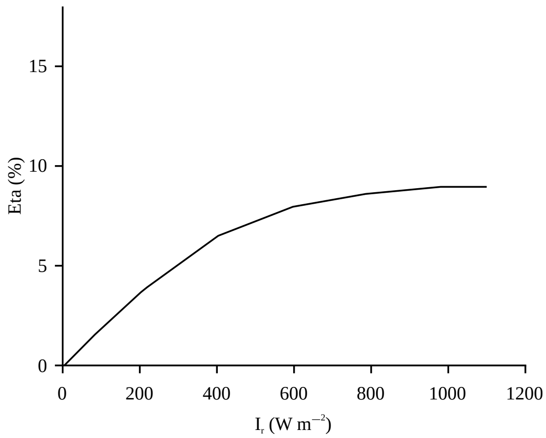

Fig. 3: Changes in exergy efficiency in terms of solar radiation intensity

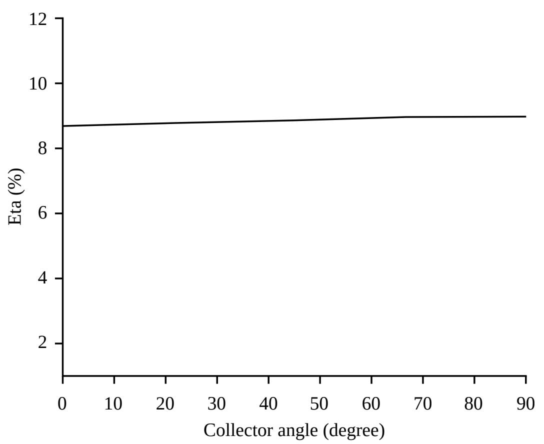

Fig. 4: Exergy efficiency changes in terms of collector angle

and design of solar flat plate collectors because the Exergy efficiency is expressed in terms of common quantities in solar engineering such as the thermal efficiency, temperature, pressure drop, the mass flow rate and so on. Unlike the other optimization methods, this method reduces the internal irreversibility and this issue is very important.

Environmental indices: This research investigates the use of solar energy in buildings in order to evaluate the use of renewable energies to achieve the principles of green architecture. Therefore, the solar water heater is analyzed by Exergy analysis. The equations of its Exergy efficiency are presented as well as the effective parameters on optimizing the efficiency. According to the results, the Exergy efficiency is increased and it is an appropriate quantity for design optimization of solar flat plate collectors because the Exergy efficiency is expressed in terms of common quantities in solar engineering such as the thermal efficiency, temperature, pressure drop, the mass flow rate and so on. Unlike the other optimization methods, this method reduces the internal irreversibility and this issue is very important.

The design and attention to the environment around the building is very effective in location of plan. Here, we offer some suggestions for better environmental design of buildings and the position of building in design site. In order to design a building with standards comfort, the designer should start his work with site designing. On the other hand, the layout of building on the land is correlated with the landscape, green space and building form. (This correlation and exchange with the environment and landscape depends on the functional layout of interior spaces, the implementation of outer wall, selection of materials, etc). The site study is the first important step in designing the building. In other words, the design of open space between buildings by avoiding the shading and using the herbs, windbreaks, etc in order to stabilize the micro climate conditions around the building. In fact, the micro climate is the weather conditions around the building. The compliance and alignment of plan with micro climate can improve the interior comfort conditions and fulfill the need for heating and cooling the buildings. The micro climate amendment is possible by the following ways:

- **Landscape and green space:** The trees around the building can protect the building from direct solar radiation and reduce the ambient temperature by surface evaporation of their leaves and finally create a suitable and protected space for residents in the building. The coolness created from pools and fountains in combination with the wind channels created by plants can improve the circumstances surrounding the buildings
- **Site design and layout of building in it:** The proper design of site and the layout of building in it can include the cases such as the existing topographic characteristics, adjacent buildings, vegetation for protecting the natural radiation, local breeze and winds for ventilation in the summer or existing vegetation and surface water for natural cooling
- **Vegetation - windbreak:** The right selection of type and location of vegetation in the site and around the building can be very positive and effective in reducing the winter cold and summer heat. The use of deciduous trees on the southern side of building naturally protects the building from the direct sunlight in the summer and allows the sun radiation in winter. Furthermore, the trees absorb a large amount of solar energy and cool the temperature of surface on the underside. On the other hand, the surface evaporation of plants helps to reduce the ambient temperature

- **Fountains and pools:** In addition to the vegetation and different techniques, which define the intensity and wind direction, the use of pond, streams and waterfalls for cooling or use of evaporation is another method of landscape and green space design. This method is well compatible with the hot and humid climate. The evaporative cooling mechanisms outside the building create the comfort for residents outside the building in addition to reducing the air temperature around the building (air surrounding the building) and internal cooling costs. The evaporative cooling methods in landscape design include the use of pond, fountains, water spray, drip irrigation and humid sandy or rocky surfaces
- **Building layout:** The designer is faced with numerous urban issues, for instance, he should build the structure in a ready place and it is very difficult to find a large empty land in city. Therefore, it is difficult to ensure that the buildings are facing the south and not shaded by adjacent buildings. However, the utilization of sunlight into the interior space, as recommended, can be possible by intelligent energy design. We are faced with fewer problems and more possibilities for using the energy-saving strategies in new settlements especially in the green areas. A special attention should be taken on selection of type and layout of vegetation on and around buildings in order to prevent the structure destruction

Optimized design strategies: Some of the best scientific solutions to achieve the optimal design of building in terms of energy consumption are presented as follows:

- At least one of the building facades should have the southern direction; and the maximum acceptable deviation from the south is 25 degrees
- The east-west construction is better for building in order to create the appropriate southern facade
- In a housing project either tall or short buildings, the building entrance is better to be located on the north side, so there will be no need for sunshade
- The building should be close to the north side of earth as much as possible, so that the distance of this building from the opposite building will become high and the possibility of shading will be reduced. Therefore, the solar radiation absorption will be easier and the green space will be increased in front of the building. Since this direction is a better direction for micro-climatic conditions, the better conditions are met
- The small lands and those with irregular shapes will make problem in terms of direction regardless of the density problem
- We should avoid designing the tall buildings in areas next to the narrow streets and streets with north-south axes as much as possible
- In general, most of the solutions, in which the building location in site is taken into special account, include the suggestions for study on the light and sunshade in any building and its blocks with regard to the axes of sun movement and earth axes
- Designing the streets in parallel and east-west axis is more appropriate because it allows the direction of buildings towards the south
- The functional layout of interior spaces (thermal regions)
- The residents' comfort inside the building is easily met with functional layout of interior spaces. Therefore, the following points should be taken into account
- The spaces with long-term functions (such as the living room, kitchen, dining room, bedroom, etc) need more internal temperature, so they should be on the south side of building
- The spaces with short-term functions (such as the work room and bathroom), which require lower temperatures, should be located in places with moderate temperature
- In the case that the auxiliary spaces (storage and garage) are used, they should be on the north side in order to be as a buffer space between the warm indoor space and outdoor space of building
- Due to the noise pollution of street, the bedrooms should not be on the side overlooking the street

CONCLUSION

Among the factors affecting the architecture designing, the energy consumption plays the decisive role and is considered as an inevitable factor and a fundamental principle and necessity for designers. The necessity of this issue, which has the international performance and vision, has remained despicable and less important. A major part of environmental problems in today's world is due to the consumption of fossil fuels especially in buildings. In a world where the architecture designers consider the effective and different cultural, social, mental, style, performance and climatic factors and have special attitudes to environmental indices and energy consumption in architectural designing as well as developing the legal programs such as the sustainable development, which are going to be the legal problems and force the countries to respect and implement them, it is extremely important to pay more attention and provide commitment to compliance with this solutions.

The green architecture is in fact a design for the future aware of the energy. An appropriate design is based on the use of natural sun energy including the light and heat and ensures the house residents' comfort. The construction of a green building helps to provide the health in person who lives there or around it and also protects and satisfy him. This requires the accurate use of authenticated strategies in the architecture. By application of durable nature and source of high quality materials, relying on the sun for heat, electricity and daily lighting and re-use of waste, etc through the architecture, we can show the public the utility and great economic and environmental values of energies which are known as the harmless and calm, etc energies.

RECOMMENDATIONS

With regard to the growing need for energy in the world including our country, it is essential to achieve the scientific and practical methods, make the use of solar systems rational in terms of economy, consume these endless resources in parallel with the population grow and provide the appropriate programs and solutions. Some of these solutions are investigated and provided as follows.

Promoting the scientific and research degree in the field of renewable energies and in particular the solar energy at universities and scientific centers which produce the necessary technologies in this regard.

Developing the appropriate promotional and financial policies by government in order to turn to the use of solar heating systems such as the proper and efficient subsidies.

Providing the free equipment to collect the solar energy in areas where providing the natural gas or electricity service is not cost effective.

Considering the real costs of fuels such as the natural gas and granting its subsidies to studies in order to optimize the quality and equipment in renewable and non-renewable energy sector.

Creating and developing the infrastructural structures to increase the production in equipment for collecting the solar energy and reduce the cost of producing these types of equipment.

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