

Applying renewal energies, step to archive sustainable architecture

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Abstract

Energy supply and consumption is one of the vital issues in human life. New energy resource achievement has a basic role to create and challenge civilization, as industrial revolution and fossil energy consumption lead to creation of modern civilization. by this human life has been challenged and promoted quickly. Although consumption of these types of energies has been resulted to challenge and perfection, there are some problems. World energy critics point to non-renewal energy consumption increase of environment pollution, necessity of renewal energy consumption, especially in building due to have 40 % of energy consumption of country. To create environment balance, new viewpoint has been created to development that is named as sustainable development. Therefore, applying sustainability and sustainable development concepts in architecture have been resulted to draw new discussion as sustainable architecture. Firstly, we introduce sustainable architecture and its principles. According to this issue one of the most important sustainable architecture principles is energy reserve and renewal energy consumption, we provide summary of these energies. Finally, some approaches, are provided to use these energies in architecture.

Key words: architecture, renewal energies, sustainable, sustainable architecture

1. Introduction:

As we know, local architectures of various points of the world have been configured with goal of combination to environment and better use of natural possibilities.

Iranian traditional architecture had been included of different forms based on various climates different and various approaches had been applied as experimentally that point to this issue. There are various examples in Iranian local architecture that were not included in this paper.

Occurring industrial revolution, easy achievement to fossil fuels had become possible and technology have been developed and head and cool systems have been promoted, therefore, cool and heat application supply had been performed without attention to architecture frames. Modern architecture that shows technology effect on architecture leads to basic challenges in architecture. Therefore, applied technology to **modern** construction lead to challenge of architecture and modern installations beside to their developments create fundamental changes in architecture. The most important change is related to neglected architecture **patterns** that had been created to conformity to climate.

We can see return to nature in some theories from 1970. That had been revealed in architecture. At the middle of 1970, human recognized resulted problems of industry age. Damage to ozone layer, acidic rains, acknowledged about non-renewal fossil fuels and environment pollutions are some of the issues that lead to draw new approaches as sustainable development and creation of greed peace groups and others. Continuous development included of three parts, social stability, economic stability and environment stability. Sustainable architecture is one of the goals of environment stability. In fact stability means to maintain land and natural possibilities with the best conditions to future human. Therefore, bellow issues should be considered: minimum use of pollutants, renewal energy consumption and decrease of fossil funnels.

Fortunately due to have solar energy in most areas of country, wind blow in some areas and water reservoirs, performance of wind and solar plans are necessary. Therefore, applying these forms of energy in urban and rural areas would be lead to decrease gas oil and other fossil fuels consumption. In fact one of the approaches to supply human demands is applying sustainable architecture patterns. Using renewal energies we can achieve to this goal.

2. Continious development:

Charls Jeckens pointed to this issue in last chapter of his book that earth destruction by our hand lead to 27000 bio samples death during one year. It means 74 destructions during one day or 3 destruction during one hour!

Base on new evidences of time magazine, dated 31 Jan 2000, these data are more than said. It means hundreds destruction during a day!

Earth warming, damages to ozone layer due to apply pollutants , increase of environment pollution and bio samples destruction show necessity of knowing environmental issue to save future human life. Therefore, creating green view to future is one the most important issues of present century.

The term of sustainable has been introduced firstly by global environment development committee by title of present age demand supply without destruction of future human resources in 1987. Today related areas have been developed to provide appropriate strategies to world people.

The term of sustainable has been used to describe the world having natural and human systems to continue life. Sustainable development means providing approaches against economic, social and structural patterns of development to prevent of destruction of natural resource bio-organs global environment pollution, non-proportional increase of population, non-justice and decrease of human life quality.

In this world, architects attempt to find new approaches to desirable life. It is clear that life, world, recreational activities are activities that have been preformed in designed areas by architects. According to importance of advantages and disadvantages of these areas, architects are responsible against them.

Applying terms as sustainable and sustainable development created new discussion as sustainable architecture with subjects as Eco-tech architecture and architecture and energy- green architecture

3. Sustainable architecture

Sustainable architecture sub group of Sustainable design- is one of the important issues of present age that have been defined as rational reaction against industry age problems. For example 50% of fuel reserve has been used in buildings that lead to environmental crisis. Therefore, creation and development of sustainable architecture is necessary.

Sustainable architecture concepts in related to increase of life standard and quality, more than life maintenance.

From architect viewpoint, the best concept of sustainable architecture is construction of artificial environment based on increase of life quality and future demand supply.

From the other viewpoint, sustainable architecture should be in conformity to climate, considering internal condition of building to response human demand. We can supply sustainable architecture to any nation based on geographical, cultural and religious conditions to supply their requirements sustainable architecture is parallel to climate and there is no collision between sustainable architecture and environment. This type of architecture respects to climate, human, culture and environment conditions.

The building that have been designed based on sustainable architecture are flexible and movable based on Richard Rajers viewpoint as the birds extend their wings during winter to conformity to conditions, the buildings would be changed based on fuel consumption conditions. Therefore, this type of design created successful relation between nature and human life.

Iran sustainable architecture antecedent is more than west Iran traditional architecture is one of the best samples of sustainable architecture. Iran traditional architecture shows effective renewal energy consumption they used simple but effective methods based on climate and cultural conditions.

The goal of sustainable building design has been decrease of building effect on environmental due to using energy and exploitation of natural resources that include of below principles?

1. decrease of non-renewal resource consumption
2. natural environment development
3. remove or decrease of toxic material consumption or damage to nature during building construction. As noted, first and the most important specification of sustainable architecture is decrease of non-renewal energy consumption. Using renewal energies is one of the solutions.

4. Renewal energies

This type of energy includes of any type of energy that could be used without risk of reserve finish.

4.1. Solar energy

Sun is great energy reserve resource. It is origin of life and any type of energy.

Based on scientific evolution, 600 million years passed from this source birth and 8/2 million thon of sun mass have been transformed to energy during any second. As weight of sun is 333000 times of earth weight, this source may be maintained during future 5 billion years.

4.1.1. Solar energy application

During recent age, solar energy would be used in various systems to achieve various purposes that include of below items.

1. using sun thermal energy to domestic, industrial and power plant consumption.
2. direct transform of light to electricity using equipment as photovoltaic.

4.1.1.1. Using sun thermal energy:

This type of application includes of two types of power plant and non-power plant application.

1. Power plant application:

Facilities to transfer absorbed sun thermal energy to electricity named as solar thermal power plant.

Non-power plant application

This type of application includes of various items as solar water heating system, solar bath, solar heating and cooling system, solar ventilation system, solar desalination system, solar drying system, solar oven, solar furnace, solar homes.



Fig1: solar home

4.1.1.2. Direct transform of sunlight to electricity by photovoltaic.

In this method, motive mechanism has not been used and any system that works by this method has been introduced as photovoltaic system.

Locating solar cells as series or parallel, reasonable voltage may be achieved therefore, the group of parallel and series cells form photovoltaic panel.

4.1.2. Solar energy advantages:

1. Power production without fuel consumption
2. Lack of require to much water.
3. Lack of environment pollution.
- 4) Possibility of production small and local networks.
- 5) Low amortization and Lang life.

6) Lack of require to specialized personnel

4.2. Wind energy

Wind energy is renewal energy source that is dispersed and non-concentrated due geographical aspects.

4.2.1. Wind energy application

4.2.1.1. Power plant application

Power plant application include of connection to power supply network

1.Unique wind turbine:

These turbines could be used to supply domestic, commercial, industrial or agricultural **cons.**

This type of turbine would be located near to lands or group of homes.

2. Wind farms: in this type, groups of wind turbines may be used to supply distribution network.

4.2.1.2. Non-power plant application:

1. Wind pumps to water pumps. This type of pumps may be used to achieve below purposes:

Drink water of animals

Low scale irrigation

Water pump to fish breeding

Domestic water supply

2. Small turbine application as power producers to islands:

The most important application include of consumption island power supply.

Consumption Island is region that is power supply and is very hard through power distribution **network.**

3. Battery charge:

To perform this, wind turbines with middle or low cost may be used. Small turbine would be proper to domestic consumption. Some of types include of marine navigation and telecommunication devices.

4.2.2 Advantages of wind energy:

This type of turbine not require to fossil fuel free type, possibility of supply power lower cost comparing to fossil energy, lower cost of current and investment costs during long times, creating variety of energy resource during long term, nigh expiation from several watts to several mage watts lack of require to water, lack of require to land to installation, lack of environmental

Pollution, Comparing to fossil fuel, reliable increase of power production

4.3. Geothermal energy:

Thermal energy of earth crust is geo themed energy. Earth center is great resource of thermal energy that is manifested as hot waters or eruption and would be conducted t earth surface.

Generally, haring three important specifications, the earth would have high potential to exploit geo thermal energy:

1- thermal resource 2 middle fluid 3- porous surface

High potential regions of earth in clued of seismic and volcano regions.



Fig2. Seismic regions of the world

4.3.1 Exploitation methods.

Geo thermal power plants may be divided into

Two types:

1. geo thermal power plant with two phases fluid eras and liquid)

Usually, two phases fluid may be achieved from geo thermal wells. The fluid word be gathered in reservoir to separate liquid from gas.

Then separated gas would be entered to turbine and turbine world be spin.

By this generator axis would be moved and negative and positive polarity would be created. Finally power would be produced.

2- geo thermal power plant with single phase fluid (liquid)

In this type, the reservoir would not require to separate fluid. In fact hot water would be entered to thermal convector and transfer its energy to other fluid as Soperton having lower boil temperature.

In this process, Isopentan would e transformed to vapor and based on above explanation, the power would be produced.

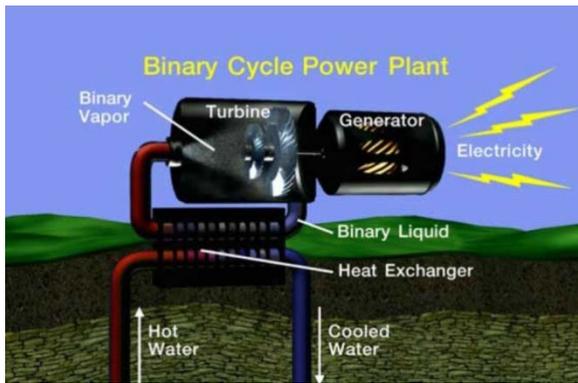


Fig 3: geothermal power plant with single phase fluid.

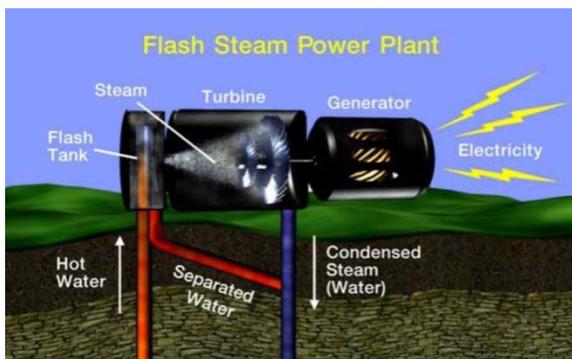


Fig 4: geothermal power plant with two-phase fluid

4.3.2.1. Direct application method or non – power plant method:

1- Hot water pools

In this method, hot water may be mixed to cold water to create tourist centers and water therapy complexes.

3- green house centers:

Geothermal hot water could be provided to green houses to supply required temperature to grow fruits and vegetables.

Home heating system:

Using piping or special radiators, geothermal hot water would be entered to environments as homes, hospitals and offices to warm them.

4) Fish basins:

To grow fishes using geothermal hot waters, specific conditions would be created.

5) Ice melt and ice prevention in roads: using under ground pipes, hot water would be passed through roads and streets to prevent of ice making on surfaces.

6) Thermal pump

Using thermal pump, we can supply heating and cooling systems of buildings.

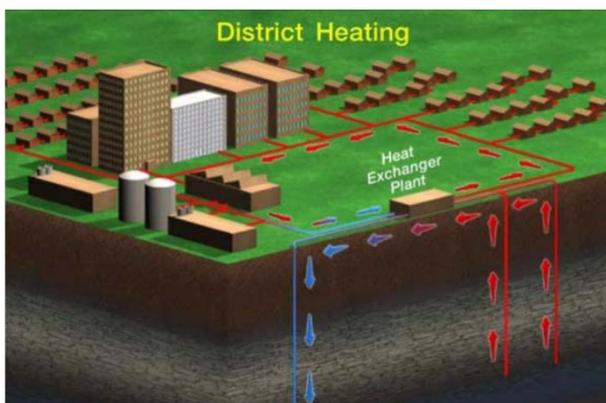


Fig 5: building heating with geothermal energy.

4-4- water and wave energies:

Seas and oceans reserves and lose energy having various physical factors.

This type of energy includes energy of wave, temperature difference that could be used.

4.4- 1- sea and ocean wave's energy:

Mechanical wind energy could be transferred to sea and create waves.

Scale of energy transfer is depended to wind speed and the distance that the wind passes waves transfer potential and kinetic energies due to water mass and speed of water that they carry.

Resulted energy in coastal area is 2 to 3 million mega watts.

4.4.2 Oceans, seas and tide energy:

Sea tide is result of moon and sun gravity during earth revelation. Moon gravity creates waves that move to west due to earth movement. Therefore waves would be created with 12, 25 duration.

During this process, we can gather water behind on dam that may be constructed in direction of sea width. Therefore, during ebb tide, gathered water would be transferred as water power plant.

4.4.3: thermal energy of seas and oceans:

Sun energy warms sea and ocean water in tropical regions, surface water temperature is warmer than deep water as 40⁰C. This temperature difference could be used to produce power. Using this type of energy is named as OTEC or Ocean Thermal Energy Transfer.

To perform this method, minimum temperature difference should be 36⁰C.

This technology could be used to water desalination, supply ventilation to fish growth.

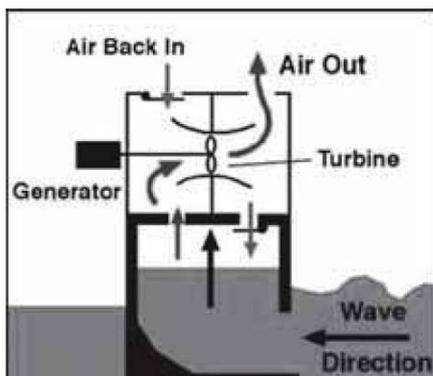


Fig 6: wave power plant diagram

4.5- bio – mass energy:

Any live organism that absorbs sun energy and save it is biomass.

One of the most proper renewal energy resources is biomass that is compatible to environment.

This type of energy has been used from past that has high application. Biomass energy resource can supply human energy demand as basic forms as power of energy carrier as gas and liquid fuels.

This specification shows the difference between biomass energy and other new energies.

Bio mass energy is first class renewal energy and 10% of world energy supply had been performed by this type of energy during 2000. After water energy, bio – mass energy has second position to produce power and 6% of world power production has been performed by this type of energy in 2000.

4.5.1. Bio mass resources:

Some part of sun light would be absorbed in vegetables during photo synthesis process. It is necessary to say that saved energy during photo synthesis is several times more than world energy consumption. This amount is 200 times of nutrient energy of the world. Also it should be pointed that 90% of biomass have been saved in trees that is equal to fossil fuels that may be exploited and registered.

4.5.2 .bio-mass applications

1. Heating factory boilers.
2. using in generators to produce power
3. using as fuel to heating and cooking
- 4- using in transportation industry as fuel (to decrease CO₂ as 65 to 85%)

4.6 – hydrogen energy and fuel cell:

Hydrogen is one of the plentiful elements in the earth. This element is not pure in nature but could be extracted from other elements. Hydrogen is the most important element as new energy resource. Comparing to other fuels, this element could be transformed to other types of energy with high output and clean ignition.

5. The role of new energies to building architecture:

Environment sustainability means natural capital maintenance. Therefore, we should observe principles to use renewal materials and energy and water consumption. In fact we should not consume more than what natural system can produce.

Maybe with scientists' effort, opportunities could be created to earth to prevent of human civilization destruction due to lack of energy and high pollution. One of the most important world pollution is fossil fuel consumption in domestic areas to heat water or environment. By increasing immigration of people from rural areas to urban regions, number of fossil fuel consumers would be increased. Fossil fuels are global industry bases. Therefore, enforcing sustainable principles, we can solve this problem. To apply these types of energy, especially in remote areas, energy consumption should be evaluated, then using appropriate consumable necessities as lamp, power appliances, heating systems and others, we should prevent of energy loss. In fact performing modern architecture principles to design would result of prevention of energy loss.

According to increasing use of new energies and development of systems to create variety of energy supply resources and decrease of fossil fuel consumption, there should be movement to produce these types of energy to tackle to problems by occurrence of global energy crisis in relation to energy supply.

6. The interaction between new energies and architecture:

One of the approaches to response human welfare, cultural and religious requirements is using sustainable architecture pattern. With creation of interaction between architecture and sustainable energies, we can active to this purpose.

6.1. Architecture and solar energy: using solar energy in buildings is one of the old applications of this type of energy. Generally solar energy may be used as active or passive to heat and cool buildings.

Passive solar system is the system to heat or cool buildings which applies natural factors. Therefore high fossil fuels consumption would not be required and building would be supplied with low energy. In the other word passive solar system is just the building and heating and cooling would be performed by the building.

Passive thermal system includes of 5 elements:

1- Light panel 2) absorber 3) reservoir, 4) distributor, 5) adjusting.

2- Generally there are three methods to cooling and heating in passive systems.

Direct method:

In this systems building residents are in contact to 5 said elements. To receive sun light, the most important factors are size and position of glasses. In fact, sun light would be absorbed by walls, floor, ceil and other elements and would be transformed to thermal energy.

Indirect method:

In this method, sun light would be absorbed in building materials and transformed to thermal energy. Then the energy would be supplied through movement. Therefore, we are faced to lower internal temperature tolerance and the condition may be controlled better.

Separated method:

In this method, absorbent and saving elements have been located in separated area.

Sun light absorbent rooms, green houses and areas that included of glass ceils are examples of separated areas. In these types, the area is direct receiver system. After absorbing temperature, there are systems to transfer it to basic areas. Temperature distribution methods have been performed using windows, doors and vents based on temperature movement. One of the advantages of this method is accurate control of temperature in required areas.

In active solar systems, mechanical tools and instruments would be used to transfer energy. In these systems, to receive and gather solar energy, air or liquids would be used.

6.2. Architecture and wind energy:

Due to climate aspects, wind can supply human welfare or create interference in internal or external area of building. To construct domestic area, this type of energy has been used traditionally and there are some written evidences. Aristotle said at 4 century: the best healthy cities are located on mild slope in direction of East to use morning breeze. In some of the cities of Iran that are located in desert margin or Persian Gulf and Oman sea coasts , we see high attention to wind to vent internal space of homes.

There are various types of air traps on home ceils that supply wind to internal space of houses.

Evaluation of intensity and direction of wind is very important to divide applications and urban design. The wind is very effective to transfer sound, air pollution and smells, therefore, some burial places as airports, factories and garbage should be outside of cities in opposite direction of wind to prevent of pollution dispersion.

Using wind to design landscape and building is very important. The wind should be conducted and controlled properly.

For example, cold wind should be prevented in cold climate and applied during hot seasons. This would be performed with proper design of building and landscape.

Using needle trees (as cedar and pine), carminative, up and down of earth or neighbor buildings, we can prevent of non-desirable winds or conduce them to desirable direction.

Also windows and doors should be designed based on wind direction to vent building air, especially in hot climate in south of country, two-sided ventilation would be required to air enter and exit.

Today, some researches are performed in the world to use wind energy and its relation to architecture with title of aerodynamic that is modern technology.

3.6. Architecture and water energy

Comparing to all materials in the earth, water special temperature and thermal capacity are more than other types. Due to this point, water can serve higher temperatures, comparing to other materials with average capacity. Generally water basin balances air temperatures, therefore, among river and sea coasts, the difference between day and night temperatures are lower than remote locations from coasts.

As existence of water resources can balance regional temperature, it can decrease building temperature based on smaller scale. One of the reasons to use water basins and trees in desert margin buildings is the increase of humidity to achieve moderate temperature. Sprinkling water in the yard helps to evaporation and decrease of temperature and may be used as tradition.

To produce electricity, we can use water energy by various methods; also this energy may be used to heating or cooling buildings.

6.4. Architecture and geothermal energy:

To response energy requirement and heating buildings during winter, we can use geothermal energy as directly. To perform this, geothermal pumps are applied. These pumps could be used to heat building, water therapy and swimming in warm waters, green houses, fish breeding and drying various types of fruits. There are regions in our country to use geothermal energy to heat buildings as Sabalan and Boshli in Ardebil.

7. Conclusion

As noted, using new energy resources is necessary of fossil resources because of limitations and quality of fossil energy and environment problems. Future energy systems should be based on fundamental and structural changes to cover energy resources without

carbon as sun, wind, geothermal energies and neutral carbon as biomass energy. in fact, renewal energies are very important to new energy systems due to technology simplicity and lack of atomic wastes comparing to energies.

Therefore development of new energies is very slow due to various reasons as primary and total costs, lack of enough investment to localization and improvement of efficiency of related technology, lack of protection policies in the global, region and local level.

	Electricity generation	Heating temperature supply	Cooling temperature supply	Supplementary to building facilities	Moderate temperature	Natural ventilation
Solar Energy	By solar plant, photovoltaic cells in Southern façade and ceil	Direct receive from walls, floor, ceil and other parts – indirect receive by tromb and water walls in Southern part of building, reserve ceils – separate receive by solarium, green house, connected atrium to Southern façade of building, using thermo Siphon system	Direct method of cooling environment through building construction to absorb temperature – indirect method by nightly heating from ceil – separated cooling system by underground cooling pipes	Supply consumable hot water by solar collectors in southern façade and solar water heating system in ceil		
Wind Energy	By wind turbine	Consumable water supply by wind pump				1. Air drugh and decrease of humidity by two sided windows in building façade 2. Cooling building based on capacity and thermal resistance and temperature tolerance of external surfaces, walls and color
Geothermal Energy	By geothermal plants	1. Special radiators, piping and heating from floor – using thermal pumps 2. using geothermal during winter directly	Using thermal pumps – using earth coldness during summer as directly			
Water and wave energy	By water plant			1. Using thermal capacity of water 2. Using water basin in building yard		
Biomass energy	By biomass plant	Using as clean fuel				
Hydrogen Energy	By fuel-cell	Using as clean fuel				

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