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Recent trends and issues in energy conservation technologies

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Abstract

Energy efficiency is a set of measures to prevent the loss of energy in gas, steam, air, and electricity, to reduce energy demand by recycling and evaluating various wastes, or to reduce production by advanced technology, more efficient energy resources, advanced industrial processes, and energy recovery. The International Energy Agency announced that world energy consumption increased by 45% since 1980 and would be 70% higher by 2030 [1]. The energy policy of the future will be on saving, energy efficiency, and renewable energy trilogy. Today, with the industrial revolution, the environmental problems and the damages caused by the world we live in today have reached the dimensions that threaten human health and ecological balance. Considering that the energy consumed in the world is in buildings, every measure that reduces energy consumption is very important in terms of improving living conditions. For this purpose, the importance of renewable energy sources in the design of energy architecture principles in energy efficiency and sustainable environments is stated.

Keywords: Energy Conservation, Energy Efficiency, Renewable and Sustainable Energy Sources

1. Introduction

Energy conservation is a concept that complements national strategic targets such as ensuring supply security in energy, reducing risks arising from external dependency, making energy costs sustainable, increasing the efficiency of combating climate change, and protecting the environment. In today's world where the importance of sustainable development is increasingly understood, the value of efforts for energy efficiency increases at the same rate. Our standard of living is to do the same amount of work using less energy without reducing the quality and quantity of production. Energy losses in gas, steam, heat, air and electricity are prevented by energy efficiency, wastes are evaluated, or energy demand is reduced without reducing production by using advanced technologies. Energy conservation represents the use of more efficient energy sources, as well as improved industrial processes and energy recovery measures [1]. Architecture is defined as the organization of the physical environment to accommodate human needs. From the past to the present, man uses and shapes the endless possibilities that the environment offers him. This situation has been developed, differentiated and survived to the present day since the existence of man. However, the human being has attempted to change the environment and ecological values with its existence [2]. Building forms, street widths, building materials used without considering environmental data, have resulted in almost identical structures. However, our planet which has different climatic zones, produces more cold micro-climates in warmer climates. Thus, serious energy losses are experienced in the designs, because about 35% of the energy consumed is used in buildings [3].

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2. Sustainable and renewable energy concepts

Research on elective normal vitality hotspots for fossil and atomic fills has likewise raised the ideas of manageable and sustainable power source. It isn't sufficient to have assets inexhaustible for vitality. Despite the fact that a few sources are inexhaustible, their belongings counteract life to be practical. For environmental harmony, assets should be inexhaustible as well as reasonable. The congruity of vitality assets does not show that it is economical. Sustainability is just conceivable in the event that it is economical. Along these lines, sustainable power sources should be practical [2]. Sustainable power source is characterized as its very own vitality source that can be available in the idea of its own development, in the following brief time frame. Petroleum products, which are generally utilized today, are vitality sources that are singed and not reestablished. Be that as it may, regular assets, for example, water driven, sunlight based, wind and geothermal vitality are sustainable and clean vitality sources [4].

3. Wind power

The broadest meaning of wind turbines is as per the following: Propeller cutting edges, propeller centers and propellers are called rotors or turbines. The impeller shaft is associated with the gearbox. The pole interfacing the gearbox to the generator is additionally called the generator shaft. They are altogether conveyed by the pinnacle. The ground association with the pinnacle is likewise given through the base.

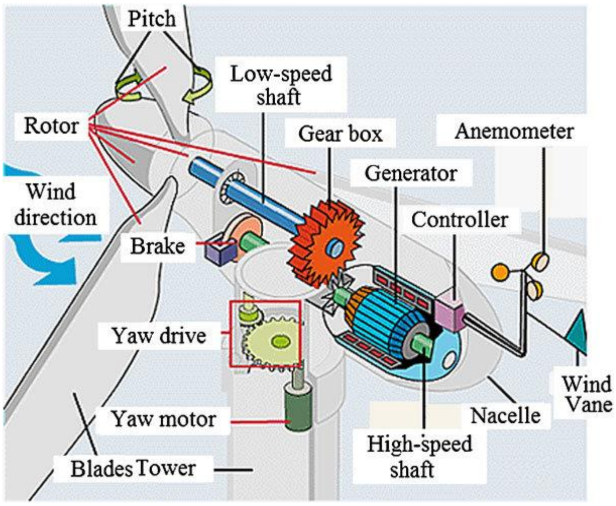

Figure 1. Internal structure of wind turbine [8]

3.1. Factors affecting wind

Turbulence is a non-regular wind flow. Buildings, trees and uneven and rough terrain obstacles create too much turbulence. Turbulence reduces energy production efficiency in the wind turbine and leads to wear and damage to the turbine. Therefore, low turbulence density allows longer life of wind turbines.

The speed of the wind passes through buildings and narrow passages between mountains. This is called a tunnel effect. If the wind speed is 6 m / s in open areas, it can be as high as 9 m / s when passing through such places. If the hills are very hard and uneven, the turbulence in the area is very high, as the direction changes too much. Continuously changing winds can cause damage in the turbines, such as tearing and cracking.

To make better use of the wind speed, the most suitable places are the hills. Wind speeds are higher in the hills than in the environment. However, in the smooth and rough hills, an increase in wind speed is an advantage, but turbulence is completely eliminated [9].

The wind is affected by the surface roughness up to 1 km high. The greater the roughness, the higher the wind speed. The water surface is the smoothest surface that affects the wind in the least. The energy efficiency of the wind turbine is also of great importance for the coefficients of roughness depending on the terrain to assess the appropriate wind conditions.

3.2. Environmental impact of wind turbines

The bird potential in the vicinity of the turbines in operation can be damaged by the turbulence caused by the air flow of the wings. For this reason, especially wind farm implementation should not be established near the national park and the places frequented by birds. However, it was found in the study that the l kW high voltage line was 10 times less than the waste. The noise generated by the turbines leads to various problems and is taken into account in limiting the distance between the settlements in the turbines. Mechanical and aerodynamic parts form acoustic radiation. My broadcast depends on the wind speed. This problem should be taken into account in the determination of the turbine potential that can be established as it occurs in the areas where the turbines are placed frequently.

3.3. Wind power plant management

There is a need for a certain amount of energy in the production and installation of the material used when the turbines are constructed. This energy investment has to be repaid during the life of the turbine. The reimbursement time in the analyzes ranged from a few months to two years [10].
Unlike nuclear power plants or thermal power plants, there is no need to stock the resources needed for production and use them as much as desired. For this reason, you need to use the resource you have most effectively as long as this resource exists.

Table 1. Distribution of installed wind energy in the world by country

Country	Total Capacity(MW)	Percentage (%)
Germany	20622	27.8
Spain	11615	15.6
USA	11603	15.6
India	6270	8.4
Denmark	3136	4.2
China	2604	2.9
Italy	2123	2.9
England	1963	2.6
Portugal	1716	2.3
France	1567	2.1
Firts 10 Total	63217	85.2
Other Countries	11004	14.8
World Total	74221	

4. Solar energy

Solar energy is a renewable energy source with a constant intensity of 1370 W / m^2 and a surface area ranging between 0- 1100 W / m^2. It can be used as control in heating and heating. In order to benefit from this energy, in addition to passive methods that shape the architecture of buildings and settlements for this purpose, there are two active methods that are still in practice. The first is to convert the energy of the sun's rays into heat. The heat collectors, which are covered with a material that absorbs the sun's rays, heat the water passing through them, and this water supports the hot water requirement of the houses and workplaces. The unit energy cost varies between 2-13 cent / kws depending on the number of sunny days in a year. In order to obtain steam by this method, it is necessary to intensify the rays in order to obtain the required temperatures. The parabolic mirrors which perform this and automatically monitor the position of the sun with the help of the computer, reduce the rays they collect on the pipes with absorbent surfaces passing through them.

The other method is to convert the energy of the sun's rays directly into electricity. This is done through panels consisting of photovoltaic cells. With the help of photovoltaic (PV) cells, daylight is converted directly into electricity. Photovoltaic panels can be mounted on the roofs of houses and workplaces in many countries. Systems that are suitable for larger masses are being built on a larger scale, especially in Germany and the USA. To achieve higher heat than the sun (130 ° C process heat), the incoming radiation must focus on a point or line with various reflection techniques. This is done with the help of a concentrator, focused collector. Thus, the dispersed energy source can be used to obtain a steam of 130 ° C. This can be achieved with warming. The sun seems to be in different positions in the summer and winter months from the world. In architectural designs, passive systems can be designed in summer to prevent the sun from entering the house and in winter to get in [14].

4.1. Electricity generation from the sun

Semiconductor materials are used to generate electricity from the sun. In semiconductor materials, electrons are loosely connected to their atoms. These electrons are tightly connected in the insulating material; conductive material in free circulation. The energy of the radiation from the sun consists of clusters that we call photons. The energy in the photon releases the electrons that are loosely connected in a semiconductor layer. A second semiconductor layer with the help of the difference in voltage created by the electrons moving. When you connect a cable outside the two semiconductor layers and allow the electrons to pass, you can generate electricity from this voltage. The electricity produced in this way is of the same quality as the one used in the network. With the five solar cell modules mounted on the surfaces and roof of the buildings, the electricity requirement of a house can be met.

In Europe and the US, there are several test plants with a capacity of 300-500 kw and in Japan it has 150 Mw installed power. 12-16% of the yield in the range of 20-30% while trying to remove the producers, the demand is low, and therefore due to the small volume of production costs are high argues. Thus, the Clinton administration in the US has launched a program of tax incentives for the photovoltaic roofing of 1 million houses.

4.2. Solar thermal power generation system

This is a very economical system. Very high temperatures can be reached in a tower where the solar radiation is reflected by 500 mirrors. Electricity is also generated from the steam obtained with the help of a fluid passed through this tower.

5. Geothermal energy

Geothermal Energy is a kind of energy based on hot water and geysers from the places where the earth's crust is thin. It derives its source from the heating of deep underground waters of the magma, approaching depths of 1,500-10,000m. Although the temperatures required for the production of electricity are rare, it can be used for heating. It is a reliable source and is available in approximately 97% of the time. There are currently 6,000 MW installed capacity in the world. It is said that 2,500MWbilI is in the US and this capacity can be increased to 12,000 in 2010 and to 49,000 MW in 2030. Unit production costs around 4.5-7 cent / kws. According to the last calculations, the heat in the core of our planet is unbelievably 5500 ° C [15].

In places where the underground hot water sources are close to the surface, the hot water can be pumped directly to the places where the need for heating is felt. This is a method in which warm water for heating houses and greenhouses and geothermal is used for melting snow on roads. Even where there are no easily accessible geothermal reserves, heat pumps can pump heat to the earth and buildings. It works almost everywhere. Because underground heat remains almost the same throughout the year, and this system helps in cooling the buildings during winter heating.

5.1. Geothermal energy in the world

Electricity generation from geothermal fluids was first performed in Italy in 1904 and the geothermal electricity production of 22 countries, mainly Italy, USA, Japan, Philippines and New Zealand, reached 8274 MW. The direct use of geothermal energy in the world (heating, thermal tourism, aquaculture, etc.) is 11300 MW. In the world, geothermal heating is performed above 2 million housing equivalents. Geothermal energy production costs are lower than other energy sources.

6. Biomass energy

Biomass is defined as the biological mass and the sources of organic matter resulting from the storage of green plants by converting solar energy into chemical energy by means of photosynthesis. When carbon-containing organic substances react with oxygen, they release heat. Figure 1 shows the natural biomass cycle.

6.1. Biomass resources

It is possible to find biomass sources almost everywhere from land to sea. In addition to natural resources, studies have been started to obtain this resource in recent years. Forests, animal faeces and plant waste in nature have been the main sources of biomass used by developing countries for many years [13].
Biomass has the largest technical potential in new-renewable energy sources. Within the scope of biomass energy technology; wood (energy forests, tree residues), oilseed crops (sunflower, rapeseed, soybean, etc.), carbo-hydrate plants (potatoes, wheat, corn, beetroot, etc.), fiber plants (flax, kenaf, hemp, sorghum, etc.).), herbal residues (branches, stalks, straw, root, bark, etc.) are being evaluated. Some biomass sources include:

- High Efficiency Energy Plants
- Short Term Energy Forests
- Hydrophyte
- Animal Wastes
- City and Industrial Waste

7. Hydroelectric energy

The energy generated by the operation of the power plants in the dams is called hydroelectric energy. It is one of the renewable energy sources. Rain water or melting snow, which is mainly involved in rivers, can be converted to water energy by dams. The water left in the water collection basins flows rapidly from the upright pipes and turns the turbines and electricity is generated by the generators connected to these turbines. It is divided into two groups as large scale and small scale. However, sustainability of large-scale hydraulic plants is also controversial.

7.1. The State of hydroelectric energy in the world

Water energy is the main energy source in many European countries, especially in Scandinavia. Dams are built to create water reserves.
Norway meets 99 percent of its energy needs from hydroelectric power plants. Developed countries have almost fully developed and activated their hydroelectric potential. There is no expansion potential in this area. On the contrary, some existing dams have been removed due to the environmental changes they have caused, and the waterways are being restored. The largest expansion potential is in developing countries. But large-scale projects of some countries such as China, India, Malaysia and Turkey are also criticized in the same direction. Therefore, there is a tendency towards small dams. It can be economical in remote and small settlements where the transmission network has difficulty in reaching. 18% of the world electrical energy requirement is provided by hydroelectric power plants [16].

7.2. Advantages and disadvantages of hydroelectric energy

Hydroelectric energy is a method of obtaining energy with low cost after the dam is built. Hydroelectric plant is in a position to compete with other thermal and nuclear power plants except for natural gas power plant in terms of initial investment cost. It is economical to operate because there is no fuel cost. It does not cause environmental pollution and is not weak against fuel prices. The assessment of small waters will also lead to a significant reduction in losses in transmission networks, as they will eliminate the necessity of the network to reach the region. However, it can be criticized because of its impact on the nearby natural environment and its inhabitants. The dams are the natural sources of dam lakes, as well as the threat of destroying cultural richness is focused on [11].

8. Energy conservation in buildings

It is expressed that around 35% of the vitality expended today is utilized in structures. This demonstrates vitality utilize and effectiveness in structures is essential. Construction laws and models are a standout amongst the most imperative estimates actualized in the field of vitality productivity in different nations since the 1970s.

With the end goal to guarantee vitality productivity in structures, vitality proficient building plan controls and benchmarks in power in such manner must be agreed to. The idea of biological engineering ought to be connected with these guidelines. Biological engineering is the plan and choice of materials toward this path with the end goal to limit the vitality prerequisite of a building. While the techniques identified with natural information will be utilized in building plan, material choice and frameworks to be incorporated into the structure will be added to the generation of vitality required in the structure [12].

It is estimated that the existing buildings in European countries will consume 2/3 of the energy that Europe will use in buildings in 2050 [4]. Subsequently, with the end goal to expand the vitality execution of existing structures as of late, these benchmarks are amended as per new innovations in numerous nations. The marking work in structures is especially moved in zone and water warming; The field and water radiators assume a vital job in vitality utilization. As per the examines, a large portion of the vitality spent in individual houses in Europe and even in Southern European nations is utilized for warming and high temp water creation [5].

With the methodology of vitality productive building structure, the plan of the engineering plan toward the start of the working environment, magnificent protection, utilizing underground water, uninvolved warming or cooling from the sun, the utilization of qualified glass, twofold façade frameworks, regular ventilation and so on. In the wake of limiting the measure of vitality devoured by the building, the building tasks ought to be submitted to the establishment build for the structure of the HVAC frameworks. Once more, with regards to vitality proficiency, the establishment motor must plan the HVAC frameworks as indicated by the property of the building, protection of the establishment, proficient gadget choice, warm recuperation frameworks, speed variable gadgets, free cooling and programmed control frameworks. While these may appear to expand the underlying speculation cost, as specified above, it will give a huge vitality economy for the duration of the life of the building, taking into account that the structures will serve for somewhere around 30-40 years. Since, particularly all the cooled structures in the initial 10 years, they expend vitality as much as the principal venture cost. Consequently, it is unavoidable to structure a building that devours less vitality [6].

8.1. Design phase

Energy-efficient designs are aimed at minimizing the energy consumption without reducing the standard of the structure in a wide area from the production of the materials and components that make up the structure, the design of the structure as well as the design, maintenance, operation and direction of the air-conditioning systems. In other words, this approach aims to take measures to protect from the renewable energy sources and to preserve the energy used. Intelligent buildings, which make physical environmental control based on automation with the help of computer, are based on the development of these approaches by using advanced technology. Roughly three steps can be mentioned in energy efficient building design:

The first stage: It is aimed at the conservation of energy, heating in winter, minimizing the cooling load in the summer and designing the natural ventilation lighting to increase its efficiency. Every design decision taken in this step affects the burden of the subject matter and the design decisions, which are unsuccessful, are able to double or even triple the system dimensions of the elements such as heating, cooling, ventilation and lighting. Because as the amount of deviation from the comfort limits of the interior environment increases, the amount of energy to be used to attract the comfort limits will increase and the dimensions of the mechanical and electrical installation systems will be increased [6].

Second stage: Passive heating, mechanical cooling, ventilation, application of natural lighting techniques and use of renewable energy sources are the most appropriate for the building type and environment. In the first stage, decisions about energy conservation, which are correctly transferred to the design, seriously reduce the energy burdens. In other words, the remaining loads are slightly alleviated by passive air conditioning techniques in the second stage, which means that "optimum benefit from the heat sources and absorbers generated, ie maximizing the beneficial effects while minimizing the harmful effects". The common goal of these two phases is to extend the period in which the internal comfort conditions are ensured by natural means as long as possible [5]. The third stage: The increasing loads from the design decisions in the first two stages are the (active) air conditioning loads which must be met by mechanical installation systems. Mechanical systems under conditions of function of internal comfort or by preference of users, in conditions with high levels of comfort expectation and inability to benefit from natural environmental inputs (e.g., no need for natural ventilation due to humidification, noise, air pollution etc.). However, even in this case, the comfort conditions of the building should not be left alone to mechanical systems [6] .

9. Conclusion

The main goal of the different disciplines that contribute to the production of buildings should be to use energy efficiently while preparing the places where they will live more comfortably. For this, it seems to be necessary to have an energy engineer or energy consultant, especially in large buildings. Thus, it will be easier to design the buildings which are suitable for climate, benefit from renewable energy sources and consume less energy. To achieve these goals;

- To look at the issue in terms of ecology and energy; to know the usage, conservation, transformation requirements of existing resources and ways to allow it,
- To follow the development of technology closely, to understand the possibilities and constraints provided,
- To know how energy and technology affect different disciplines to give input to building design and to define new processes that will transfer this knowledge to design-production-operation process through team work,

Especially in the process of mechanical installation systems to the stage of the project "energy engineer" should be included in the design of an expert can say [7].

On the other hand, in the stage of meeting the air conditioning loads that are not met passively with architectural design and active air conditioning, system selection, capacity determination, operation and control strategies and important decisions for engineers are required. However, at this stage, the joint work of architects and engineers is of great importance in terms of determining the level of integration of service systems with architectural and structural components.

Passive and active solar heating systems are used in new buildings and samples with bioclimatic structure are increasing day by day.

New materials, intelligent facade and roof systems, natural artificial lighting systems, use of renewable energy sources such as photovoltaic panels, building and energy control systems are examples of these technological developments.

In order to create comfort conditions during the periods when the technology is not developed as much as today, natural and local materials have been used with energy efficiency by taking appropriate measures. However, with the development of technology, the idea that all kinds of comfort conditions can be provided by making systems causes the energy to be exhausted.

The use of renewable and efficient energy in the scope of sustainability will be possible with the implementation of the right regulations and standards, which provide correct results in the design and construction of energy efficient buildings [8].

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