

Role of Solar Energy for Sustainable Development

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Abstract

Sustainable development is that which beat the need of present without compromising the ability of future generation to meet their own needs. With the help of such a development we reduced the pollution and make it eco-friendly environments. In the World most of electricity generated with the help of coal and natural gases. Those resources are limited and create more air pollution which effect on human and environmental eco-system and produces greenhouse gas emission.so now days it is very essential need to find out clean, environmental friendly and pollution free energy resources. Solar energy is one of them. Solar energy is very prominent source for generation of electricity. Solar energy is clean source of energy it is pollution free and eco-friendly. In this paper written about, what is solar energy, how solar panel work and there mechanism. also discussing about role of solar energy for sustainable development.

Key words: - Sustainable development, environmental, eco-friendly, greenhouse gas emission, solar energy

Introduction

Sustainable development is the way of organizing society so that it can exist in the long term. There are manly three pillar of sustainability first one is economic then environmental and social. Such a development is future centric. Example of sustainable development is renewable energy resources it is very useful energy that is collected from natural resources.it is most effective in the long term. Examples renewable resources are sunlight, wind, rain, tides, waves, biomass plants, solar cooker, and geothermal heat. Such a renewable energy creates 5 times more effective than fossil fuels, such a energy generating energy that produces no greenhouse gas emission from fossil fuels and reduces some types of air pollutions and creating economic development and jobs in installation, manufacturing and lots more. Energy is an essential need for the existence and growth of human communities. Consequently, the need for energy has increased gradually as human civilization has progressed.(Maka & Alabid, 2022) The increasing environmental disturb is about the contribution of coal-fired power generation to air emissions, mainly due to the poor quality of Indian coal with an average ash content of 40% or more. Studies have shown that power sector contributes about 40% of the total carbon emissions.(Mallah & Bansal, 2010) Progress in energy use and emissions is expected to be principally noticeable in some sectors. The sectorial contributors to progress in energy

consumption are expected to be power generation (35%), industry (15%), transport (12%) and buildings (6%) in developing countries, followed by power generation (11%) and transport (6%) in OECD countries (Kaygusuz, 2012) Additionally environmental pollution as well as global warming or climate change that caused by the resources of conventional energy can be counted as the other significant issue in the world which all are the other main reasons to find a suitable alternative energy source(Mekhilef, Faramarzi, Saidur, & Salam, 2013) One of the most important factors of today's global energy production system are Greenhouse Gas emissions from power plants around the world, which are considered to be one of the main factors leading to climate change.(Karakosta, Pappas, Marinakis, & Psarras, 2013). Most of the scientists predict that if atmospheric concentrations of greenhouse gases continue to increase, as present trends in fossil fuel consumption suggest will occur, the earth's temperature may increase in the next century by another 2⁰C and perhaps by up to 4⁰C.(Dincer, 2000) Eighty-five per cent of the world's commercial primary energy is supplied by fossil fuels. Conventional (renewable) hydro, nuclear and new renewables provide the rest as depicted. In the last few years, renewable energy technologies in India have been promoted through R&D, demonstration projects, dissemination projects/programmes supported by government subsidies and fiscal incentives(Naidu, 1996)

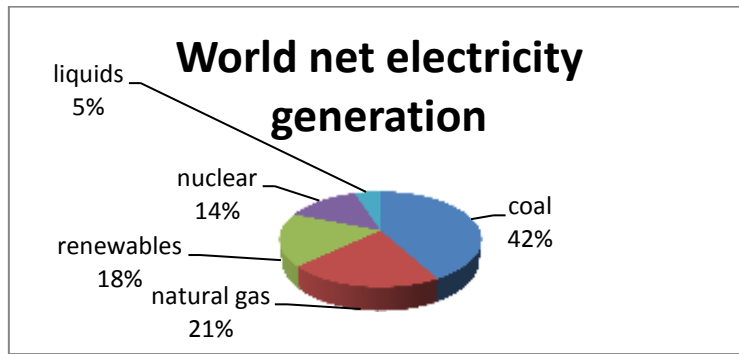


Fig.no.1 World net electricity generation by energy source, (source ref.(Karakosta et al., 2013)) When we compare the world net electricity generation it shows that most of the electricity production is generated with the help of coal and

natural gas their contribution is about 63% and rest of electricity are generated by using renewables energy resources (solar,wind,biomas etc), nuclear and liquids resources their contribution is 37%.

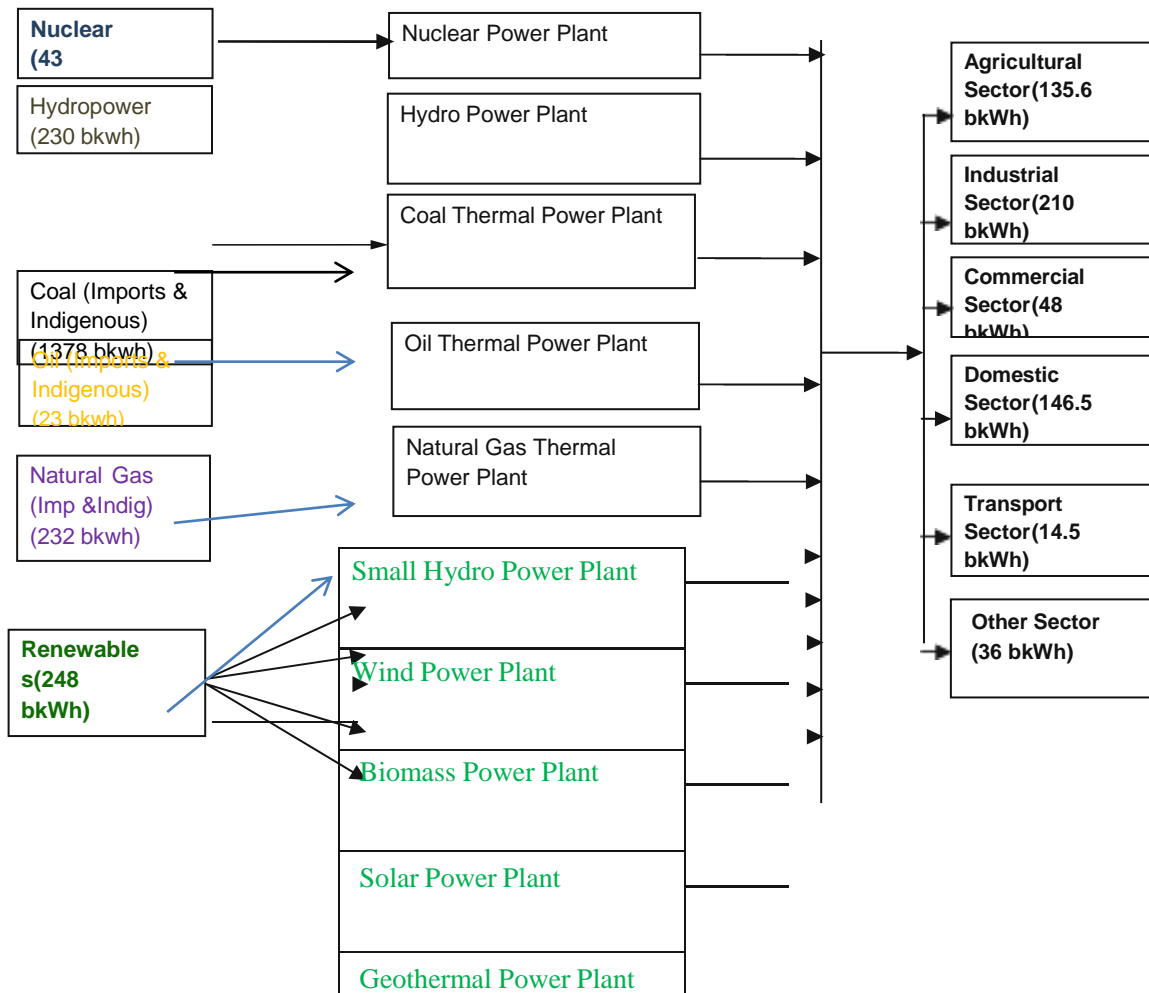


Fig no 2 (renewable and non-renewable energy resources. Source ref. (Mallah & Bansal, 2010))

Above chart shows that different types energy resources renewable and non-renewable such as coal ,oil, natural gas ,hydropower and nuclear by using this power plant most of electricity are generated

and which are provided in various sectors such as agriculture, industries, commercial ,domestics ,transports and other sectors. but contribution of renewable resources is not so much such a resources

such as wind, biomass, solar, geothermal and small hydro. Present days it is very essential need of increasing contribution of renewable resources.

Solar energy

Solar energy is radiant energy from the sun that is capable of producing heat causing chemical reactions that generate electricity. Solar energy can be located on any surfaces of earth. The word solar means sun and solar energy means the energy from the sun. in each and every day the earth received a huge amount of solar energy directly from the sun by using special scientific method we can utilised the solar energy. It mean to say that solar energy can be converted into other form of energy for ex. Solar energy converted into electrical energy ,electrical energy converted into heat energy, kinetic energy, potential energy etc. solar energy is a cheap

source of energy which can be easily converted into other useful form of energy. So question arises is that how solar energy reaches from the earth? As we know that the light travel in the form of waves solar energy reaches the earth in the form of sun light .1 meter square area of atmosphere which obtained 1.4 kw/m² energy which is also known as the solar constant it means solar energy absorption of earth atmosphere is 1.4 kw/m² .when it is passing to the atmosphere the total solar energy is reduced due to various reasons. as we know that the atmosphere is collection of different gasses and the solar energy absorb by the gas particles, water vapours , dust particles and reflections such a factors are reduced intensity of solar energy reaching from the earth is about 1 kw/m² and this energy can be converted into heat and electricity.

Mechanism of Solar Energy

What is Solar Energy System?

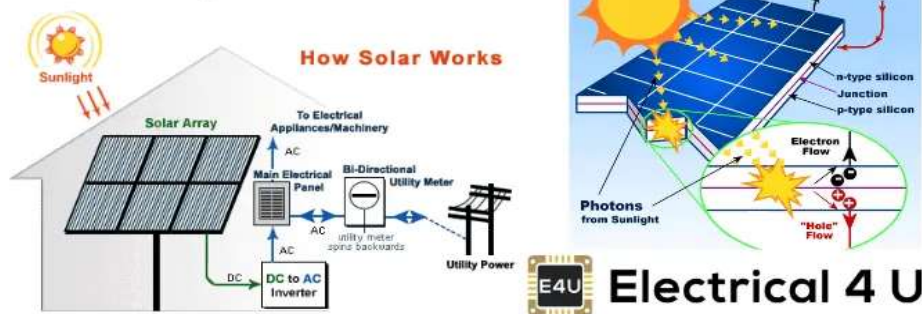


Fig.no.3

working of solar energy system (Image source by <https://www.electrical4u.com/solar-energy-system-history-of-solar-energy/>)

When sunlight incident on solar panel energy from sunlight is absorbed by the photovoltaic cell in the panel this energy creates electrical charges that move in response to an electrical field causing electricity to flow. Sunlight hits the solar panels and generates an electrical current (DC). This electric current flows to the inverter, which convert DC electricity to AC the most commonly used form of electricity. The AC electricity flows from the inverter to the breaker box which directs the current to any appliances in the building that is using electricity and unused electricity flows through a utility meter into the grid. Electricity is drawn from the grid when the building needs more energy than is produced by the solar panels.

How solar panel works

Solar panel is the combination of several solar cells connected in series to generate usable voltage. Solar panel voltage is increased by the increasing number of solar cells for example 30 solar cells connected in series to produced 15 volts of voltages. Generation of electricity on exposer of sunlight is known as photovoltaic effect. A solar cell are made by semiconductors mainly by silicon and comprises three layers. The top layer called N type layer which is comparatively thin and contain high concentration of electrons. The bottom layer is called p type layer which contain high concentration of holes and middle layer is depletion layer. when p type and n type are join to obtained p-n junction type semiconductor. On forming a p-n junction electron from n type regain try to reach the p regain creating negatively charged layer. Similarly holes of the p

type regain try to reach the n type region which creating positively charged layer. The regain between the two layers is known as depletion regain of the semiconductor. Sunlight penetrate the top thin layer easily to reach the depletion regain due to the deficiency of charged in the depletion regain it contain neutral atoms this neutral atoms are broken when the photon from sunlight strikes the depletion regain the electrons from the neutral atoms leaving behind the holes and producing free charge carrier then the electron move towards the n type layers and holes move towards the p type layers as due to the electric field present in the depletion regain on connecting an electronic circuit electrons flow through a generating an electricity to electrical devices like

Role of solar energy for sustainable development

The sustainable development importance is built based on the social, environmental, and economic perceptions. In social perception such as reducing poverty in rural areas, improving air and water quality and provides sense of security by better lightening. second is environmental which reducing the limits of greenhouse gas emission, reducing hazardous waste and change climate. third one is economic which provide economic growth and development, decreases the cost of utility bills, and create new jobs and small business for leading to public benefits. Renewable energy such as solar energy is an energy system that serves the needs of the present and such technology designed to improve energy efficiency. Solar energy technologies are clean sources of energy and that have a much lower environmental impact than conventional energy technology. On the other hand, social and economic impacts are usually not lectured in literature since solar technology is reasonably young, and its life cycle of 25 years is deliberated long. Such a energy does not produces greenhouse gas emission and also reduce air pollution. Role of solar energy for sustainable development is possible mainly in two ways, Passive and Active. Passive solar energy application collects the energy without converting the heat or light into other forms On the other hand, uses of active solar energy are that the solar energy is stored or converted for diversified applications. This in turn can be classified as two different groups Photovoltaic (PV) and Solar Thermal.(Sadhu, Chakraborty, Das, & Sadhu, 2015) It also examines that what activities will be required to happen unite long-term climate benefits, clean air and energy access targets. (Maka & Alabid, 2022) Comparing with conventional fuel, solar water

pumping system has numerous advantages, for instance, besides of no cost for fuel and maintenance, the system it has no noise and pollution for the environment. Although there are solar water pumps with high capacity (10 of kW can be used), usually the pumps that are used in remote areas are small scale one (usually less than 1500 W) (Mekhilef et al., 2013) Among one of the highest solar optical efficiency obtained was 86.2% using nanofluids. Moreover, the PV panel efficiency is generally around 15–20%. Hence, solar energy is considered as a key driver for reducing global emissions and balancing environmental, social and economic aspects. (Obaideen et al., 2021)

Conclusion

World net contribution of electricity generation is mostly depend upon non renewable resources , so now a days it is very essential need of present days to increases the contribution of renewable energy resources and in this resources solar energy is one of the best way to generate clean, environmental and eco-friendly energy. by using this energy we achieve three pillar of sustainable development which are social, environmental and economic

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