

# Contribution of Solar Energy towards Sustainable Development: An Overview

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**Abstract:** Nature has endowed mankind with the potential of renewable and non renewable resources. Both the resources could provide energy in the form of electricity, fuel, manure, etc. with equal efficiency. However, the renewable resources are more sustainable in comparison to the non renewable resources. This paper provides the importance of conservation of nature enshrined in our religious texts. It affirms that these principles are part of the natural law and could serve a lot towards sustainable conservation of nature and its resources. The paper provides advantages and disadvantages of the solar energy, the solar appliances widely used these days in order to show case the utility of solar energy and its potential in comparison to the conventional sources of energy. It concludes that the use of solar energy in future would help in conservation of forest, wild life, mineral resources and be a long term gain to contain pollution.

**Keywords:** Laws of nature; Sustainable Development; Solar energy; Renewable energy; features

## 1. Introduction

Human has always been striving to attain better standards of living. The technology is innovated through the concepts of Science. The arrangement of information about an object according to its nature, through researches, is called SCIENCE.

Human civilization has from ancient to modern age tried to know about nature, its nearby environment. It has gained large bulk of information from natural processes. It led to development of the field called 'science'. The rules of natural law later developed the field of legal studies. These fields are undergoing change and it will undergo change. Therefore the level of knowledge, definition and scope of a topic has been widened, is widening and it will widen. But the human beings are created in the planet earth by natural cycles of evolution. Thus, humans should strive towards sustainable utilization of the resources of nature.

Natural Resources are the entities made by the Nature through the five elements viz. air, water, earth, fire and sky. These elements are the lifeline for human sustenance on earth. These resources are the basic sources of energy and are requisite for human survival. [1]

## 2. Concept of Energy

The term 'energy' is a Greek word which means 'capacity to do work'. [2] Energy can be defined as a property of matter which can be produced from or converted into mechanical work. [3]

Energy is the physical quantity, which can manifest itself as heat, as mechanical work, as motion and in the binding of matter by nuclear or chemical forces. [4] Energy is closely related to force. [5] When a force causes an object to move, energy is being transferred from the force to the kinetic energy. [6] The two laws of thermodynamics describe the behaviour of energy [7]:

The first law of thermodynamics states that-"Energy can neither be created nor be destroyed. It could be transformed from one form to another". [8]

For example –

SUN-- > Radiant energy-- > Chemical energy through photosynthesis in plants (Producers)-- > Chemical energy (in Consumers).

The second law of thermodynamics states that-"During conversion of energy from one form to another, there is always a loss of energy." [9]

The sources of energy are categorized into two parts:-

### 1) Renewable Sources

According to Oxford: Advanced Learners Dictionary, it means 'that is replaced naturally or controlled carefully and can therefore be used without the risk of finishing it all.' They are generally more sustainable than non-renewable energy sources and tend to have much lesser impact on the environment. [10]

**Example-**Water, Sun, Air, etc. These constituents of matter provide renewable sources of energy like, solar energy, wind energy, tidal energy, geothermal energy, hydro power, biomass energy, etc. [11]

Soil-it may vary in its nutrient content from place to place due to its vegetation cover, extent of water pollution, etc. But it can be renewed by use of green manures.

Nowadays, the scientists have for their Moon mission invented a mixture of chemicals which can yield a plant without soil. Thus it could be affirmed that Renewable resources are the need of the future generations.

### 2) Non-Renewable Resources

The resources that cannot be renewed are called non-renewable energy resources.

Example-firewood, coal, petroleum, natural gas, etc.

They can be said to be the conventional sources of energy since they are used traditionally.

Let us consider the Solar energy in detail, the renewable energy resource.

**Solar Energy:**

It is the energy of solar radiations that are emitted from the SUN. Sun is a huge hot mass of gaseous substances. There are various radiations emitted by the Sun. Some of these are: Visible light, Ultraviolet rays [12], Infrared rays, radio waves, X-rays and gamma rays. [13]

Of these, only visible rays are the solar radiations that are used by human beings on the land surface of earth. It is significant that, (a) according to the National Renewable Energy Laboratory, "more energy from the sun falls on the earth in one hour than is used by everyone in the world in one year." Today, we use the sun's rays in many ways—to heat homes and businesses, to warm water, and to power devices. [14] Let us inquire into the uses of solar energy.

**Uses of Solar Energy**

- 1) The radiations emitted by the Sun are the only life provider in the earth for terrestrial ecosystem. These radiations are trapped by the plants through the process of photosynthesis. Photosynthesis is the process by which plants use sunlight, water, and carbon dioxide to create oxygen and energy in the form of sugar. [15] Glucose is a source of energy for metabolic activities in plants. Plants are the primary producers for all other animals in the wildlife including man. Therefore solar energy through the process of photosynthesis meets food requirement of *homo sapiens* by plants.
- 2) Solar energy is also responsible for the hydrological cycle of precipitation and sunlight. The water from the oceans and other water bodies is by evaporation converted into vapours and is condensed into the clouds which later fall on the earth by precipitation. This nurtures new seeds in the soil and leaves grown are protected by the sunlight. Sunlight is responsible for the metabolic activity in plants through the process of photosynthesis.
- 3) It is said to be a source of Vitamin D which is useful for human beings for growth and development of the body.
- 4) So, the Sun rays fulfill the needs of food and are very useful for all types of natural development purposes. It is used to generate electricity known as the solar power. Solar energy is currently being used to generate electricity using three technologies, viz. direct heating, solar photo voltaic cells/ solar panels and solar thermal power. [16]

**Solar Operated Devices:**

Let us inquire deeply about solar operated devices –

**(A) Solar Cooker:**

It is a non-polluting, perennial, cheap and best source of energy for preparation of food materials. The solar cooker is a device in which two glass sheets are placed perpendicular to each other. The sun rays are incident on the vertical glass, they are reflected on the horizontal glass then due to thickness of the horizontal glass it gets refracted into the black coloured box below it through a large angle. The principle of refraction states that when a ray of light passes from denser to a less denser medium, it gets refracted through a large angle.

The food materials are kept in the black coloured box kept inside the cooker. The box is of black colour because black is a good absorber of heat. All food products ranging from rice to cake which require heat at a constant rate can be cooked/ baked but the **exception is that no food material can be boiled in it.**

The advantages of solar cooker are-

- 1) It is a device which requires no maintenance after purchase and can work for a minimum period of 15 – 20 years.
- 2) It requires only one time expenditure.

The disadvantages of this device are-

- 1) It requires changing of direction according to the direction and intensity of Solar radiations;
- 2) It is very big to handle;
- 3) It cannot be used for boiling.
- 4) It is dependent on intensity of solar radiations.

**(B) Solar Heater:**

The solar radiations can be used for boiling water through a device called solar heater. The solar heater is a device of approximately 4 by 6 feet dimension. It is highly used in big hospitals and hotels for the purpose of boiling the water.

The advantages of a solar heater are-

- 1) It is a device which requires no maintenance after installation and can work for a minimum period of 15 – 20 years.
- 2) It requires only one time expenditure.

The disadvantages of this device are-

- 1) It can work only on the presence of solar radiations having high intensity;
- 2) It requires large area to install on the roof.

**(C) Solar Cells/ Panels:**

The next and most useful product for accomplishing the needs of modern gadgets can be by solar cells. Solar cells are the photovoltaic cells made up of silicon chip.

The advantages of solar cells or solar panels are-

- 1) It is a device which requires no maintenance after installation and can work for a minimum period of 15 – 20 years.
- 2) It requires only one time expenditure.
- 3) It is a pollution free, perennial device for transmission of electricity in the region ranging from Tropic of Cancer to Tropic of Capricorn.
- 4) It can work even on the presence of solar radiations of minimum intensity.

The disadvantages of solar cells or solar panels are-

- 1) It can work only in the presence of solar radiations;
- 2) It requires large surface area;
- 3) It is made up of Silicon chip. Silicon chip is made by an element called Silicon (Atomic no.14) which is available in limited amount.
- 4) It requires high expenditure for one-time.

### Intensity of Solar Radiations all over the Earth

The planet earth is revolving around the Sun and is simultaneously rotating at its own axis. The morning, afternoon and evening of a day respectively takes place according to the rotation of the earth with respect to the Sun. The part which comes in front of the Sun is illuminated with solar radiations and it experiences the day and the other part, the night.

Earth is ecliptical in shape. [17] During its revolution/rotation, the part which receives maximum solar radiations is the part ranging from Tropic of Cancer to Tropic of Capricorn. Therefore this region, particularly, have more bright future for solar energy.

### 3. Future Scope of Solar Energy

- 1) The solar powered equipments can take the place of all thermal power corporations (based on non renewable resources) and can serve as a major device for decreasing pollution and saving the enormous rich bio diversity of planet earth. Thermal power generation based on mineral exhaustion like coal requires complete deforestation and migration of wild life for excavation of coal and subsequently also generates pollution by burning of coal. So, it is responsible for degradation of environment in each of its steps of generation of electricity.
- 2) The solar energy could be used in the operation of aero planes and rockets since researches have shown successful journey or launching of solar operated aero planes or rockets. [18]
- 3) The National Aeronautics and Space Administration have prepared a plan to trap solar energy through the satellites and send it through radiations to the earth.
- 4) The scientists are in a search for harnessing solar energy from planet other than the earth also.
- 5) It is remarkable that Government of India has reduced tariff on solar powered equipments by more than 75%. [19] There are record 2.25 lakh installations of solar power pumps from the year 2014-2019. [20] Solar parks scheme doubled from twenty gigawatt to forty gigawatts. [21] These steps reflect India's commitment towards solar power generation.
- 6) China have discovered a light operated internet device which can be used as we use Wi-fi. This connection is named Li-fi. [22] This may be of more speed because speed of light = speed of sound = 1, 00, 000 km/ second. So, if such an enormous speed Li-fi is operated by solar radiations in future, it could save more energy.

### 4. Conclusion

The Hindu holy texts define Natural Law and the term 'nature'. It defined the utility of a human, its duty and establishes a system of rights and duties with illustration of consequences in case of deviation from the said Natural Law. Therefore human should strive for developing better standards of life in such a manner that could sustain the resources of nature. So human should do development by keeping in view the major facets of natural law and particularly adhering to it.

I conclude that the use of solar energy and all other energy resources should be done sustainably by keeping in view the need for survival of the future generations. The development of these renewable energy resources are an alternative to the ever exhausting non renewable resources. Renewable resources of energy are reported to be more sustainable but they require some essential predicaments for their use, viz., (i) that the equipments developed for operation of the renewable resources of energy are built up of non-renewable sources of energy, (ii) the reckless incessant exploitation of renewable resources could harm the environment, thus for these reasons, it is requisite that the renewable resources of energy must be used in a sustainable manner.

These principles of sustainability are enshrined in the texts of natural law and proper cognizance of these principles in exercise of the resources both renewable and nonrenewable would contribute towards sustainable development. It should be the aim of every individual of this earth to save the natural resources by utilizing it sustainably because we are experiencing this natural environment due to the good efforts of our ancestors.

### References

- [1] This is the reason that Principle 2 of the Stockholm Declaration on Human Environment 1972 propounds: "The natural resources of the earth, including the air, water, land, flora and fauna and especially representative samples of natural ecosystems, must be safeguarded for the benefit of present and future generations through careful planning or management, as appropriate. " This is the core for the concept of Sustainable development.
- [2] Dr. S. R. Myneni, *Environmental Studies* 248 (Millennium edition 2008, reprint 2013, Asia Law House).
- [3] *ibid.*
- [4] *ibid.*
- [5] *ibid.*
- [6] *ibid.*
- [7] *ibid.*
- [8] [http://www.bio.miami.edu/dana/226/226F08\\_10.html](http://www.bio.miami.edu/dana/226/226F08_10.html) (26.06.2022); <https://www.jove.com/science-education/10726/first-law-of-thermodynamics> (last visited 26.06.2022).
- [9] *ibid.*
- [10] <https://www.nrdc.org/stories/renewable-energy-clean-facts> (last visited 26.06.2022).
- [11] <https://www.edfenergy.com/for-home/energywise/renewable-energy-sources> (last visited 26.06.2022).
- [12] <https://uihc.org/health-topics/what-difference-between-uva-and-uvb-rays> (last visited 26.06.2022).
- [13] [https://gml.noaa.gov/education/info\\_activities/pdfs/LA\\_radiation.pdf](https://gml.noaa.gov/education/info_activities/pdfs/LA_radiation.pdf) (last visited 26.06.2022).
- [14] *ibid.*
- [15] <https://education.nationalgeographic.org/resource/photosynthesis> (last visited 26.06.2022). Photosynthesis, the process by which green plants and certain other organisms transform light energy into chemical energy. During photosynthesis in green plants, light energy is captured and used to convert water, carbon dioxide,

and minerals into oxygen and energy-rich organic compounds. see

<https://www.britannica.com/science/photosynthesis>  
(last visited 26.06.2022).

[16] *Supra* note 2 at 252.

[17] <http://www.geo.hunter.cuny.edu/~jochen/gtech201/lectures/lec6concepts/Datums/The%20earths%20shape%20is%20an%20ellipsoid.htm> (last visited 26.06.2022).

[18] <https://edition.cnn.com/travel/article/skydweller-solar-powered-plane-solar-impulse-climate-scen-spc-intl/index.html> (last visited 26.06.2022).

[19] <https://mnre.gov.in/> (last visited 26.06.2022).

[20] *ibid.*

[21] *ibid.*

[22] <https://www.fiercewireless.com/tech/li-fi-successfully-tested-china> (last visited 26.06.2022).