

## **SOLAR ENERGY IN A SUSTAINABLE FUTURE**

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There are three key approaches to improving the sustainability of human energy use in the future. These are:

- (a) 'Cleaning-up' fossil and nuclear technologies
- (b) Switching to renewable energy sources
- (c) Using energy more efficiently

The use of renewable energy usually involves environmental impacts of some kind, but these are normally lower than those of fossil or nuclear sources.

I think, that the most important kind of renewable energy sources is solar energy.

Solar energy makes an enormous but largely unrecorded contribution to our energy needs. It is the sun's radiant energy, that maintains the Earth's surface at a temperature warm enough to support human life. But despite this enormous input of energy to our civilization, the sun is virtually ignored in national and international energy statistics, which are almost entirely concerned with consumption of commercial fuels.

The sun has a surface temperature of 6000 °C, maintained by continuous nuclear fusion reactions between hydrogen atoms within its interior. These nuclear reactions will gradually convert all of the hydrogen into heavier elements, but this is a relatively slow process and the sun should continue to supply power for another 5 billion years.

Solar energy, when it enters our buildings, warms and illuminates them to a significant extent. When buildings are specifically designed to take full advantage of the sun's radiation, their needs for additional heating and for artificial lighting can be further reduced.

Solar power can also be harnessed by using solar collectors to produce hot water for washing or space heating in buildings.

There are two common ways to convert solar energy into electricity: photovoltaic and solar-thermal technologies. Photovoltaic

systems consist of wafers made of silicon or other conductive materials. When sunlight hits the wafers, a chemical reaction occurs, resulting in the release of electricity. Solar-thermal technologies concentrate the sun's rays with mirrors or other reflective devices to heat a liquid to create steam, which is then used to turn a generator and create electricity.

The sun's energy can also be harnessed via other forms of energy that are indirect manifestations of its power. Principally, these are bioenergy and hydropower together with wind energy and wave power.

### *Environmental Impacts*

Emissions associated with generating electricity from solar technologies are negligible because no fuels are combusted.

Photovoltaic systems do not require the use of any water to create electricity. Solar-thermal technologies may tap local water resources if the liquid that is being heated to create steam is water. In this case, the water can be re-used after it has been condensed from steam back into water.

Solar technologies do not discharge any water while creating electricity.

Solar-thermal technologies do not produce any substantial amount of solid waste while creating electricity. The production of photovoltaic wafers creates very small amounts of hazardous materials that must be handled properly to avert risk to the environment or to people.

Photovoltaic systems require a negligible amount of land area because they are typically placed on existing structures. In contrast, solar-thermal technologies may require a significant amount of land, depending upon the specific solar-thermal technology used. Solar energy installations do not usually damage the land they occupy, but they prevent it from being used for other purposes. In addition, photovoltaic systems can negatively affect wildlife habitat because of the amount of land area the technology requires.