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[Business](#), [Industries](#)



Introduction: - Energy from the sun travels to the earth in the form of electromagnetic radiation similar to radio waves, but in a different frequency range. Available solar energy is often expressed as energy per time per unit area, Joules per second per square meter, or watts per square meter (W/m^2). The amount of energy available from the sun outside the Earth's atmosphere is approximately $1400 \text{ W}/\text{m}^2$; that's nearly the same as a high power hair drier for every square meter of sunlight! Some of the solar energy is absorbed as it passes through the Earth's atmosphere. As a result, on a clear day the amount of solar energy available at the Earth's surface in the direction of the sun depend of the angle of elevation and is typically only about $400 \text{ W}/\text{m}^2$ in Canada. At any particular time, the available solar energy is primarily dependent upon how high the sun is in the sky and current cloud conditions.

On a monthly or annual basis, the amount of solar energy available also depends upon the location. Furthermore, useable solar energy depends upon available solar energy, other weather conditions, the technology used, and the application involved. There are many ways that solar energy can be used effectively. Applications of solar energy use can be grouped into there are three primary categories: 1. Heating/cooling, 2.

Electricity production 3. Chemical processes. The most widely used applications are for water and space heating. Ventilation solar air heating is also growing in popularity. Uptake of electricity producing solar technologies is increasing for the applications photovoltaics (primarily) and concentrating solar thermal-electric technologies. Due to recent advances in

solar detoxification technologies for cleaning water and air, these applications hold promise to be competitive with conventional technologies.

Fig. 1: The energy budget of the Earth History using Solar Energy & description in working: - Fig. 2: The French chemist Lavoisier experimented with concentrating solar energy using a large parabolic mirror. Combustion, generated by focusing sunlight over flammable materials using lenses, experiment conducted by Lavoisier circa 1770s. Fig.

3: In 1866, Auguste Mouchout used a parabolic trough to produce steam for the first solar steam engine. Auguste Mouchout, inventor of the first active solar motor, questioned the widespread belief that the fossil fuels powering the Industrial Revolution in the 19th century would never run out.

Prophetically he said: Eventually industry will no longer find in Europe the resources to satisfy its prodigious expansion. Coal will undoubtedly be used up. What will industry do then? In 1861, Mouchout developed a steam engine powered entirely by the sun. But its high costs coupled with the falling price of English coal doomed his invention to become a footnote in energy history. Nevertheless, solar energy continued to intrigue and attract European scientists through the 19th century.

Scientists developed large cone-shaped collectors that could boil ammonia to perform work like locomotion and refrigeration. France and England briefly hoped that solar energy could power their growing operations in the sunny colonies of Africa and East Asia. Fig. 4: 1901 "solar motor" in operation in California. The solar furnace in Mont Louis, built in 1949 by Professor Félix

Trombe, was the first solar furnace in the world. This dual reflection solar furnace has been in steady evolution over the past 50 years and in 1993, was taken over by the limited liability company “ Solar Furnace Development” who, along with continued scientific research, is the first company to use a solar furnace for industrial and manufactured products such as the firing of ceramics, and bronze and aluminum products.

Professor Trombelater (1969-1971) directed the design and the construction of the largest solar furnace in the world that we will discuss in detail. Fig. 5: The solar furnace in Mont Louis. Sun power in the Pyrenees: - In 1972 Time magazine’s Science section described the world’s largest solar furnace in sufficient technical detail to allow the setting for an investigation that involves a great deal of students’ knowledge of physics and, with some guidance, can lead to her asking a series of questions that lead to problems and experimentation that go beyond the textbook.

These questions eventually lead to the discussion radiation, optics, wave motion, thermodynamics, solar energy, quantum mechanics and thermonuclear reactions. It should also be mentioned that the Mont-Louis solar furnace in the Pyrenees is still the largest in the world. Fig. 8: The Solar Furnace of Odeillo in the French Pyrenees.(This is the largest solar furnace in the world) Perched high in the Pyrenees, France’s powerful new solar furnace (1970) harnesses the almost limitless energy of the sun.

Eight stories tall, the furnace’s gleaming reflector dwarfs the ancient buildings nearby and turns the surrounding hillsides topsy-turvy on its

curved surface. Lined up in tiers on a pasture in front of the big reflector stand 63 smaller mobile mirrors. These heliostats, as they are called, can be individually adjusted so that each one reflects the sun's rays directly into the big parabola, thereby creating striking flare-ups of light. Focusing these rays at the oven building only a short distance from its base, the giant mirror concentrates the sun's radiation on the small target area. The converged beams, which are no wider than a foot at their target, can create temperatures as high as 6, 300° F (3500 °C.) Fig.

9: Three commonly used reflecting schemes for concentrating solar energy to attain high temperatures.

The description of this context is based on an article in Time magazine's Science section that appeared in the May 18, 1970 issue. The Time article describes the world's largest (1970) solar furnace in sufficient detail for an investigation that involves a great deal of the young physics student's knowledge of physics. The situations described below move from the practical aspects of the furnace to a discussion of geometric optics, radiation, quantum theory, and thermonuclear reactions.

The following is the content of the article as it was given in Time magazine.

A simple magnifying glass, focusing the sun's rays, can scorch a piece of wood or set a scrap of paper on fire. Solar radiation can also be concentrated on a much more awesome scale. It can burn a hole through thick steel plate, for example, or simulate the thermal shock of a nuclear blast. It can, that is, with the aid of a super reflector of the sort that has been set up by French scientists high in the Pyrenees. Ten years in the building, the world's largest solar furnace is a complex of nearly 20, 000

mirrors and can concentrate enough sunlight to create temperatures in excess of 6, 000° F, or 3500°C.

Harnessing solar energy is hardly a new accomplishment. Nearly 22 centuries ago, the Greek mathematician Archimedes is said to have temporarily saved Syracuse from Roman conquest by setting the invading fleet aflame with numerous large mirrors. In the 18th century, the pioneer French chemist Lavoisier produced enough heat with 52-inch-wide lenses to power his experiments.

Though Lavoisier's work was cut short by the French Revolution (he was guillotined in 1794)), his history has not discouraged contemporary French scientists—notably Physical Chemist Felix Trombe, a research director of France's National Center for Scientific Research and its premier experimenter with the sun's energy. For more than 20 years, Trombe has championed solar furnaces as an ideal source of intensive heat for both industrial uses and scientific experimentation. In 1946 he fashioned his first sun stove out of a captured German anti-aircraft searchlight mirror at an observatory near Paris. Moving to the old Pyrenean citadel town of Mont-Louis where the sun shines as many as 200 days a year, he has since built five larger solar furnaces. Now, in masterly style, he has created his *pièce de résistance* on a hillside in the nearby ski resort of Odeillo. Compared with similar devices in several other countries, such as the U.

S. Army's 30-kilowatt stove at Natick, Mass., Odeillo's 1, 000-kilowatt structure is easily the Mount Palomar of solar furnaces.

Fig.

10: The Solar Furnace of Odeillo; The parabolic shape of the giant solar collector is evident here. Fig. 11: The array of mirrors is controlled by a computer and turn with the sun. Rays come from reflectors

Fig. 12: The geometry of reflection depend on the law of reflectivity Fig. 13:

The furnace is located at the focus of the parabolic mirror Fig. 14: The array of solar collector and the mirrors in perspective.

Only recently, however, have we developed the ability to harness the sun's awesome power. The resulting technologies have promising implications for the future of renewable energy and sustainability. Below, we've given a brief on solar power, how it works, and what may be in store for the future of solar. What is Solar Power? Solar power is a form of energy harnessed from the power and heat of the sun's rays. It is renewable, and therefore a "green" source of energy. How Does It Work? The most common way of harnessing energy from the sun is through photovoltaic (PV) panels - those large, mirror-like panels you've likely seen on rooftops, handheld solar devices, and even spacecraft's. These panels operate as conductors, taking in the sun's rays, heating up, and creating energy (and electricity).

On a larger scale, solar thermal power plants also harness the power of the sun to create energy. These plants utilize the sun's heat to boil water and, in turn, power steam turbines. These plants can supply power to thousands of

people. . How is Solar Power a “ Greener” Option? Just like wind power (link to blog), solar power is a virtually unlimited and inexhaustible resource (unlike power produced from expendable fossil fuels).

As technologies improve and the materials used in PV panels become “ greener,” the carbon footprint of solar power becomes smaller and smaller and the technique becomes more accessible to the masses. What’s the Holdup? Why Isn’t Solar Power More Prevalent? Similarly, to wind power, solar power is contingent upon the weather and the amount of sunshine present in a specific location. This means that geographical areas lacking in sunlight, or areas that frequently experience cloudy weather, may have difficulty utilizing solar power effectively. Additionally, solar power is an expensive endeavor. The technologies often require a large amount of land, and they can be extremely costly. Scientists are hard at work to find an affordable, efficient solution for harnessing solar power.

Did You Know?§ Every hour, the sun beats down with enough power to provide global energy for an entire year.§ It takes an average of eight minutes for energy to travel from the sun to the Earth.§ Scientists have used solar energy to power spaceships since 1958.

§ Most solar panels used today have an average life expectancy of between 20-40 years. Let the sunshine in! Interested in solar power for your home? There are a number of resources, projects, and products available online for families interested in going solar. To get the best bang for your buck, be sure to conduct thorough research before beginning any new effort. Solar

Energy Advantages: -Ø Saves you moneyØ After the initial investment has been recovered, the energy from the sun is practically free. Ø Financial incentives are available from the government that will reduce your costØ Environment friendly Ø It's not affected by the supply and demand of fuel and is therefore not subjected to the ever-increasing price of gasoline.

Ø Solar energy is clean, renewable (unlike gas, oil and coal), sustainable and helping to protect our environment. Ø As we see previously, it does not pollute air. Ø Therefore, Solar Energy does not contribute to global warming, acid rain or smog. It actively contributes to the decrease of harmful greenhouse gas emissions. By not using any fuel, solar energy does not contribute to the cost and problems of the recovery and transportation of fuel or the storage of radioactive waste. Ø Low/no maintenance.

Ø Solar Energy systems are virtually maintenance free and will last for decades. Ø Once installed, there are no recurring costs. They operate silently, have no moving parts, do not release offensive smells and do not require you to add any fuel. More solar panels can easily be added in the future when your family's needs grow. Disadvantages of Solar Energy: -Ø Initial cost: the initial cost of purchasing and installing solar panels always becomes the first disadvantage. Although subsidy programs, tax initiatives and rebate incentives are given by government to promote the use of solar panels we are still way behind in making full and efficient use of solar energy.

Ø Location: the location of solar panels is of major importance in the generation of electricity. Areas which remains mostly cloudy and foggy will produce electricity but at a reduced rate and may require more panels to generate enough electricity homes. Houses which are covered by trees, landscapes or other building may not be suitable enough to produce solar power

Ø Pollution: Most of the photovoltaic panels are made up of silicon and other toxic metal like mercury, lead and cadmium. Pollution in the environment can also degrade the quality and efficiency of photovoltaic cells.

New innovative technologies can overcome the worst of these effects. Ø

Reliability: Unlike other renewable source which can also be operated during night, solar panels prove to be useless during night which means you have to depend on the local utility grid to draw power in the night

Ø Inefficiency:

Since not all the light from the sun is absorbed by the solar panels therefore most solar panels have a %40 efficiency rate which means %60 of the sunlight gets wasted and is not harnessed. Ø Installation: For home users, a solar energy installation may not require huge space but for big companies,

a large area is required for the system to be efficient in providing a source of electricity.

Uses of Solar Energy: -§ Heaters Green houses§
Cars Water pumps§ Light
Desalination§ Satellite chilling§ Dryers Solar
ponds§ Calculators ThermalCommercial use§ On an office
building, roof areas can be covered with solar panels§ Remote building such

as school, communities can make use of solar energy. § In developing countries, this solar panels are very much useful.

§ Even on the highways, for every five Kilometers, solar telephones are used?????? ?? ?????

Better ways of usage: v Government should take measures and see that solar light are used as street light in all the areas. v We can place solar panels in the useless lands instead of keeping these solar it away uselessly. v We can also keep these solar panels in the deserts, where we can make use of this energy with the help of a rechargeable battery, v Efficiency of solar panels depends on the range of frequencies of light that strikes the surface.

So they can give higher efficiency if we spilt the light into different frequency ranges and direct the beams on to the cells tuned to these frequencies. Building a new home is the best time to design and orient the home the to take the advantage of the sun's rays