Alternative energy research papers example

Environment, Water

Sun plays crucial role in the life of the Earth. The entire organic world of our planet is obliged to the Sun for its existence. It is not only the source of light and heat, but also the original source of many other types of energy (oil, coal, water, wind). Since people appeared on the Earth, they began using the sun's energy. According to archaeological data, it is known that housing preference was given to quiet places, closed from the cold winds and open to the sun's rays.

Perhaps the earliest known solar system can be considered the statue of Amenhotep III, dated XV century BC A system of air and water chambers was located inside the statue, which under the sunlight set in motion a hidden musical instrument. Ancient Greece worshiped Helios. The name of this god today became the basis of many of the terms associated with solar energy. The problem of providing electrical energy to many sectors of the world economy, the ever-growing needs of the world's population is now becoming more and more essential.

Our Sun is a huge glowing ball of gas, in which complex processes occur and the resulting energy is released continuously. Solar energy is the source of life on our planet. The sun heats the atmosphere and the earth surface. Thanks to solar winds are blowing, water cycle takes place in nature, the oceans are heated, plants develop, and animals have food. It is thanks to solar radiation on the Earth that fossil fuels exist. Solar energy can be converted into heat or cold, driving force and electricity.

The sun evaporates water from the oceans, seas, from the earth's surface. It turns this moisture into water droplets, forming clouds and fog, and then makes it again fall to Earth as rain, snow, dew or frost, thus creating a giant

circulation of moisture in the atmosphere.

Solar energy is the source of the general circulation of the atmosphere and ocean. It creates a gigantic system of water and air heating of our planet, redistributing heat on the earth's surface.

Sunlight falling on plants, causes their photosynthesis process, determining their growth and development; when falling on the ground, it is converted into heat, warms it, forming soil climate, thus giving vitality to seeds in the soil, microorganisms, and populating it with living beings, which would otherwise have remained in suspended animation (sleep) without the heat.

The sun radiates huge amounts of energy – approximately 1. 1x1020 kWh per second. Kilowatt-hour is the amount of energy required to operate the incandescent bulbs of 100 watts for 10 hours. The outer layers of the Earth's atmosphere intercept about one millionth of the energy radiated by the Sun, or about 1500 quadrillion (1. 5 x 1018) kilowatt-hours annually. However, only 47% of the total energy, or about 700 quadrillion (7 x 1017) kilowatt-hours, reach the earth's surface. The remaining 30% of solar energy are reflected back into space; roughly 23% evaporate water, 1% of the energy falls on the waves and currents, and 0. 01% - on the process of photosynthesis in nature.

Investigation of Solar Energy

Why does the Sun shine and not cools down for billions of years? What is the " fuel" that gives it such power? Scientists have searched for answers to these questions for centuries, and only in the early XX century, there came the correct solution. We now know that, like other stars, it shines due to thermonuclear reactions flowing in its bowels.

If the nuclei of the atoms of light elements merge in an atom's nucleus of a heavier element, the mass of the new one will be less than the total mass of those, of which it was formed. The residue mass is converted into energy, which carries the particles released during the reaction. This energy is almost completely converted into heat. Such a fusion reaction of nuclei can occur only at very high pressures and temperatures in excess of 10 million degrees. Therefore, it is called thermonuclear.

Basic substance constituting the Sun is hydrogen, accounting for about 71% of its total mass. Almost 27% belong to helium, and the remaining 2% - to the heavier elements, such as carbon, nitrogen, oxygen and metals. The main " fuel" of the Sun is hydrogen. Of the four hydrogen atoms in the resulting chain of transformations a single helium atom forms. From each gram of hydrogen involved in the reaction 6x1011 Joules of energy are formed! On the Earth, such amount of energy would be sufficient to heat 1000 m3 of water to a temperature of the boiling point from 0ºC (Karaipekli & Sarı, 2009).

The Potential of Solar Energy

The sun provides us with 10 000 times more free energy than there is actually used worldwide. Just in the global commercial market, there are bought and sold a little less than 85 trillion (8. 5 x 1013) kilowatt-hours of energy per year. Since it is impossible to trace the entire process as a whole, we cannot say with certainty how many people consume non-commercial energy (such as wood and fertilizer collected and burned, how much water is used to produce mechanical or electrical energy). Some experts believe that this non-profit energy is one fifth of the total energy used. However, even if

this is so, then the total energy consumed by humanity during the year is only about one seven thousandth part of the solar energy reaching the Earth's surface in the same period.

In developed countries such as the U. S., energy consumption is approximately 25 trillion (2. 5 x 1013) kilowatt-hours per year, which corresponds to more than 260 kWh per person per day. This figure is equivalent to the daily work of more than one hundred incandescent bulbs with 100 watts for the whole day. The average U. S. citizen consumes 33 times more energy than a resident of India, 13 times more than the Chinese, two and a half times more than the Japanese, and twice as much as the Swede (Lewis, 2007).

The Use of Solar Energy

Energy is the driving force of any production. The fact that at the disposal of people there appeared a large amount of relatively cheap energy is largely contributed to the industrialization and development of the society.

Passive Use of Solar Energy

Solar thermal power plant. Passive solar buildings are those, the project of which is designed with maximum regard for local climatic conditions, and where the relevant technologies and materials are applicable for heating, cooling and lighting of the building that work on the energy of the sun. These include the traditional building techniques and materials, such as insulation, massive floors, windows facing south. Such accommodations can be built in some cases at no additional cost. In other cases, arising in the construction additional costs can be compensated by decrease in energy consumption.

Passive solar buildings are environmentally friendly, they help to create energy independence and energy-balanced future.

In passive solar system, the building design itself acts as a collector of solar radiation. This definition is consistent with the majority of the simplest systems, where heat is stored in the building due to its walls, ceilings or floors. There is also a system where specific elements are designed to heat buildup mounted in the structure of the building (e. g., boxes with stones or water-filled cans or bottles). Such systems are also classified as passive solar ones.

The Active Use of Solar Energy

Active use of solar energy is done through solar collectors and solar systems.

Solar collectors and their types. At the heart of many solar energy systems, there is the use of solar collectors. The collector absorbs the light energy from the sun and converts it into heat, which is transferred to the coolant (liquid or air) and then uses to heat buildings, water heating, electricity production, drying of agricultural products or food preparation. Solar panels can be used in almost all processes using heat (Peng & Lee, 2008).

Technology for manufacturing solar collectors has reached almost the current level in 1908, when William Bailey of the U. S. " Carnegie Steel Company" invented a collector with an insulated housing and copper pipes. This collector is much alike a modern thermosiphon system. By the end of the First World War, Bailey sold 4000 of these collectors, and businessman from Florida, who bought his patent in 1941 sold nearly 60, 000 collectors .

A typical solar collector collects solar energy when installed on the roof of

the building modules and tubes of metal plates, painted black for maximum absorption of radiation. They are enclosed in a glass or plastic body and inclined to the south to capture maximum sunlight. Thus, the collector is a miniature greenhouse; heat is accumulated under the glass panel. As solar radiation is distributed over the surface of the collector must have a large area.

There are solar panels of different sizes and designs depending on their application. They can provide hot water for household laundry, washing and cooking, or be used to preheat water for the existing heaters. Currently, the market offers a variety of reservoir models (Yang & Garimella, 2010). Integrated collector. The simplest form of solar collector - a " capacitive" or " thermosiphon collector" who received this name because the collector is simultaneously and retaining tank, which is heated and kept " disposable" portion of water. Such collectors are used to preheat water, which is then heated to the desired temperature in conventional systems, such as in gas column. In terms of household pre-heated water enters the storage tank. This reduces energy consumption by subsequent heating it. This collector is an inexpensive alternative active solar water heating system that does not use moving parts (pumps), requiring minimal maintenance, with zero maintenance.

Flat-plate collectors. Flat-plate collectors are the most common type of solar collectors used for domestic water heating and heating systems. Usually this is a collector insulated metal box with a glass or plastic lid, which placed black painted absorber plate (absorber). Glazing can be transparent or opaque (Beard et al., 2010). In flat-plate collectors typically used frosted only

light transmissive glass with a low iron content (it transmits a significant part of the incoming sunlight collector). Sunlight falls on warmth receiving plate, and thanks glazing reduces heat loss. The bottom and sidewalls of the collector coated with a heat insulating material, which further reduces heat loss. Flat-plate collectors are divided into liquid and air. Both types of collectors are glazed or unglazed.

Solar evacuated tube collectors. Traditional simple flat solar collectors have been designed for use in regions with warm, sunny climate. They are rapidly losing effectiveness in adverse days - in cold, cloudy and windy. Moreover, due to weather conditions, moisture condensation and lead to premature deterioration of interior materials, and this, in turn, - a deterioration of the system performance characteristics and breakage. These drawbacks are eliminated by using the evacuated collectors (Lewis & Nocera, 2006). Evacuated collectors heat water for domestic use where needed water to a higher temperature. Solar radiation passes through the outer glass tube is put into a tube absorber and converted into heat. It is transmitted to the fluid flowing through the tube. The collector consists of several rows of parallel glass tubes, each of which is fastened the tubular absorber (instead of the absorber plate in a flat collector) with a selective coating. The heated fluid is circulated through a heat exchanger and gives off heat the water contained in the storage tank.

Vacuum glass tube - the best possible thermal insulation for the collector - reduces heat loss and protects the absorber and the heat removal from the tube adverse external influences. The result - a great performance surpassing any other type of solar collector.

Focusing collectors. Focusing collectors (concentrators) use mirrored surfaces to concentrate solar energy absorber, which is also called " heat sink". Achieved their temperature is much higher than in the flat-plate collectors, but they can only concentrate direct solar radiation, which leads to poor performance in foggy or cloudy weather. Mirrored surface focuses sunlight reflected from a large surface on the lower surface of the absorber, thereby achieving a high temperature (Cook et al., 2010). In some models of solar radiation concentrated in the focal point, whereas the other rays of the sun are concentrated along the focal line thin. The receiver is located at the focal point or focal line along. Heat transfer fluid passes through and absorbs heat sink. Such collectors Hubs are most suitable for regions with high insolation - close to the equator and in the desert areas.

There are other cheap technologically simple solar collectors narrow purpose - solar stoves (for cooking) and solar distillers which allow cheaper to get distilled water from almost any source.

Solar cookers. They are cheap and easy to manufacture. They consist of a large well- insulated boxes covered in a reflective material (e. g., foil), covered with glass and equipped with an external reflector. Casserole is black absorber, heating faster than regular cookware of aluminum or stainless steel. Solar cookers can be used for water disinfection, if bring it to a boil. There are pans and mirror (reflector) solar cookers.

Solar stills. Solar stills provide cheap distilled water, the source may be even salty or heavily contaminated water. They are based on the principle of evaporation of water from an open container. Solar still uses the sun's energy to accelerate the process. It consists of a thermally insulated

container with dark color glazing that is tilted in such a way that the condensing fresh water flowed into a special container. Solar still small - about the size of a kitchen stove - on a sunny day can produce up to ten liters of distilled water.

Solar system

Solar hot water system. Hot water - the most common form of direct use of solar energy. A typical system consists of one or more collectors, wherein the fluid heated by the sun, as well as a tank for storing hot water heated by the heat transfer fluid. Even in regions with a relatively small amount of solar radiation, such as in Northern Europe, the solar system can provide 50-70 % of the hot water. More can not be obtained, except that with the help of seasonal regulation. In Southern Europe, the solar collector can provide 70-90 % of hot water consumed. Heating water using solar energy - a very practical and economical way. While as photovoltaic systems achieve 10-15 % efficiency, thermal efficiency of the solar system show 50-90 %. In conjunction with wood burning ovens household hot water demand can be met almost all year round without the use of fossil fuels.

Thermosiphon solar systems. Called thermal siphon solar water system with natural circulation (convection) of coolant used in warm winter (no frost). In general, it is not the most efficient solar power, but they have many advantages in terms of housing. Thermosyphon circulation of coolant is due to a change in water density with the change in its temperature. Thermosyphon system is divided into three main parts: flat collector (absorber); pipelines; the storage tank for hot water (boiler).

When the water in the reservoir (usually flat) is heated, it rises through the

riser and into the storage tank, in its place in the reservoir from the bottom of the storage tank is supplied cold water. Therefore, it is necessary to have the collector below the storage tank and connecting pipes warm.

Solar Energy Innovation

As today the possibilities of getting and using solar energy are constantly developing, it is very practical to find new ways of its application. I think that today more and more portable devices appear, and every day specialists work to make them better and efficient. The issue of their charging has always been topical, and I think that solar energy should not be ignored in this relation. In order to charge mobile phones, tablets and other gadgets with the help of sun, it is necessary to develop effective solar batteries installed in them that would allow people to keep the devices charged without additional problems.

I think that it would be great not to worry about the level of your gadget charge, as every time sun is around, it charges automatically. It is necessary to make the battery sensitive so as it could reach the solar energy even through the clouds so that in cold seasons and in those countries when there is cold in general, people could also make use of it. I am sure that this innovation would have a great commercialization potential, as people use more and more such devices, and face the problems with charging every day.

References

Beard, M. C., Midgett, A. G., Hanna, M. C., Luther, J. M., Hughes, B. K., & Nozik, A. J. (2010). Comparing multiple exciton generation in quantum dots

to impact ionization in bulk semiconductors: implications for enhancement of solar energy conversion. Nano letters, 10(8), 3019-3027.

Cook, T. R., Dogutan, D. K., Reece, S. Y., Surendranath, Y., Teets, T. S., & Nocera, D. G. (2010). Solar energy supply and storage for the legacy and nonlegacy worlds. Chemical reviews, 110(11), 6474-6502.

Karaipekli, A., & Sarı, A. (2009). Capric–myristic acid/vermiculite composite as form-stable phase change material for thermal energy storage. Solar Energy, 83(3), 323-332.

Lewis, N. S., & Nocera, D. G. (2006). Powering the planet: Chemical challenges in solar energy utilization. Proceedings of the National Academy of Sciences, 103(43), 15729-15735.

Lewis, N. S. (2007). Toward cost-effective solar energy use. Science, 315(5813), 798-801.

Peng, K. Q., & Lee, S. T. (2011). Silicon nanowires for photovoltaic solar energy conversion. Advanced Materials, 23(2), 198-215.

Yang, H., Zhou, W., Lu, L., & Fang, Z. (2008). Optimal sizing method for stand-alone hybrid solar–wind system with LPSP technology by using genetic algorithm. Solar energy, 82(4), 354-367.

Yang, Z., & Garimella, S. V. (2010). Thermal analysis of solar thermal energy storage in a molten-salt thermocline. Solar Energy, 84(6), 974-985.