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Study the Possibilities of Using Solar Energy

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***Abstract* —** *Recently, there has been an increase in interest in the sun as an inexhaustible source of energy. The potential possibilities of power engineering based on the use of direct solar radiation are extremely great. After all, solar radiation is also an environmentally friendly and renewable energy source.This article discusses the possibilities of using solar energy.*

Keywords — solar energy, solar installations, Solar radiation, photoelectric method.

Introduction

With its life-giving power, the Sun has always evoked feelings of worship and fear in people. Peoples closely associated with nature expected gracious gifts from him - harvest and abundance, good weather and fresh rain, or punishment - bad weather, storms, hail. Therefore, in folk art, we see the image of the Sun everywhere: above the facades of houses, on embroideries, in carvings.

Almost all energy sources, in one way or another, use the energy of the Sun: coal, oil, natural gas are nothing more than "conserved" solar energy. It has been in this fuel since time immemorial; Under the influence of solar heat and light, plants grew on Earth, accumulated energy in themselves, and then, as a result of long-term processes, turned into fuel used today. The sun will give humanity billions of tons of grain and timber every year. The energy of rivers and mountain waterfalls also comes from the Sun, which maintains the water cycle around the globe.

Materials and methods

It is known that in three days the Sun sends to the Earth as much energy as is contained in all explored reserves of fossil fuels, and in 1 s - 170 billion J. Most of this energy is dissipated or absorbed by the atmosphere, especially clouds, and only a third of it reaches the earth's surface. All the energy emitted by the Sun is 5,000,000,000 times greater than the fraction that the Earth receives. But even this "negligible" value is 1600 times the energy that all other sources put together. Solar energy falling on the surface of one lake is equivalent to the power of a large power plant.

By the beginning of the XXI century, mankind has developed and mastered a number of principles for converting thermal energy into electrical energy. They can be roughly divided into machine and non-machine methods. The latter are often referred to as the direct energy conversion method, since they lack the stage of converting thermal energy into mechanical work.

Among the machine converters, the most are steam and gas turbine plants operating at all ground-based thermal and nuclear power plants.

The schematic diagram of a closed gas turbine plant looks like this. Solar radiation, collected by the concentrator on the surface of the solar boiler, heats the working fluid - an inert gas to temperatures of the order of 1200 - 1500 Kelvin and, under the pressure created by the compressor, supplies hot gas to the blades of a gas turbine, which drives an alternating current electric generator. The exhaust gas in the turbine first enters the generator, where it heats up the working gas after the compressor. Thus, it facilitates the operation of the main heater - the solar boiler. Then the gas is cooled in a refrigerator - radiator.

In a power plant with a steam turbine converter, the solar energy collected by the concentrator heats the working fluid in the solar boiler, which turns into saturated and then into superheated steam, which expands in a turbine connected to an electric generator. After condensation in the fridge-emitter of the steam spent in the turbine, its condensate, compressed by the pump, enters the boiler again. Since the supply and removal of heat in this installation is carried out isothermally, the average temperatures of the supply and removal are higher than in a gas turbine installation, and the specific areas of the radiator and concentrator may turn out to be smaller. A similar installation, operating on an organic working fluid, has an efficiency of 15 - 20 percent at relatively low heat supply temperatures - only 600 - 650 degrees Kelvin.

According to experts, the most attractive idea regarding the conversion of solar energy is the use without machine converters: thermoelectric, thermionic and photoelectric, which directly convert the energy of solar radiation into electric current.

Discussion

Today, photovoltaic cells are common. The phenomenon of the photoelectric effect was first observed by Edmond Becquerel in 1839. This accidental discovery went unnoticed until 1873, when Willoughby Smith discovered a similar effect when exposed to light from a selenium plate. Although his first experiments were far from perfect, they marked the beginning of the history of semiconductor solar cells. In search of new energy sources, Bell's laboratory invented a silicon solar cell, which became

the forerunner of modern solar photo converters. It was only in the early 1950s that the solar cell achieved a relatively high degree of sophistication.

Consider a photoelectric method for converting energy. In solar cells, the phenomenon of an external photoeffect is used, which manifests itself at the p – n junction in a semiconductor when it is illuminated with light. A p – n junction is created by introducing an impurity base with the opposite sign of conductivity into a single-crystal semiconductor material. When solar radiation hits the p – n transition, the electrons of the valence band are excited and an electric current is formed in the external circuit. The current will depend on the intensity of the light and the size of the element, which means its surface area. An element with a size of 100 * 100 mm is 100 times larger than an element with a size of 10 * 10 mm and, therefore, with the same illumination, it will give out a current 100 times greater. The batteries can be combined in any desired combination. The simplest battery is a string of cells connected in series. You can also connect strings in parallel to form a so-called series-parallel connection.

An important point in the operation of solar cells is their temperature regime. When the element is heated by one degree above 25 ° C, it loses 0.002 V in voltage, i.e. 0.4% / degree. On a bright sunny day, the elements heat up to 60-70 ° C, losing 0.07-0.09 V each. This is the main reason for the decrease in the efficiency of solar cells, leading to a voltage drop generated by the cell.

The efficiency of modern solar panels ranges from 10 to 16%. This means that an element with a size of 100 * 100 mm under standard conditions can generate 1-1.6 watts.

For example, a solar-powered power plant near the equator with a daily output of 500 MWh (approximately the same amount of energy is generated by a fairly large hydroelectric power station) with efficiency 10% would require an effective surface area of about 500,000 m2. It is clear that such a huge amount of solar semiconductor cells can. Pay off only when their production is really cheap. The efficiency of solar power plants in other zones of the Earth would be low due to unstable atmospheric conditions, the relatively low intensity of solar radiation, which is more strongly absorbed by the atmosphere here even on sunny days, as well as fluctuations due to the alternation of day and night.

In this regard, many experts put forward the idea of placing a solar power plant in space. There will be no atmospheric interference, weightlessness will allow the creation of multi-kilometer structures, which are necessary to "collect" the energy of the Sun. Such stations have a great advantage. The transformation of one type of energy into another is inevitably accompanied by the release of heat, and its discharge into space will prevent dangerous overheating of the earth's atmosphere.

Conclusion

Although the designers began to design such power plants in the late 1960s. Any variant of the project of a solar space power plant assumes that this is a colossal structure. Even the smallest space power plant must weigh tens of thousands of tons. And this gigantic mass will need to be launched into an orbit distant from the Earth.

Show me, solar panels are used effectively in space stations and satellites.

Today, work is underway, not yet in favor of solar power plants: today these structures are still among the most complex and most expensive technical method of using solar energy.

Large-scale use of solar energy entails a gigantic increase in the need for materials and, consequently, labor resources for the extraction of raw materials, their enrichment, the production of materials, the manufacture of heliostats, collectors, and other equipment, and their transportation.

New options and technologies are needed that allow for maximum efficiency from the solar energy that hits the earth's surface, it is also necessary to achieve cheap materials and facilitate the production of heliostats. So far, no negative qualities of these stations have been found. Work in this field of energy is being carried out all over the world.

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