

Received: 12 October 2022

Revised: 25 November 2022

Accepted: 17 December 2022

DOI: <https://doi.org/10.5281/zenodo.7528111>



Article

Solar energy in Iran

Simin Shahbazi Ahmadi¹ | Lyudmila Kuzinkova¹ |

¹Institute of Production Management
Economics and Trade
Peter the Great St.
Petersburg Polytechnic University
St. Petersburg
Russia

Correspondence
Simin Shahbazi Ahmadi
Email: sarashahbazi81@yahoo.com

ABSTRACT

Among renewable energy sources, Iran has a high solar energy potential. The amount of solar radiation in Iran is estimated to be between 1800 and 2200 kilowatt hours per square meter per year, which is higher than the world average; also, Iran has an average of more than 280 sunny days per year, which is very significant. Considering the recent advances in solar energy technologies, the widespread use of solar energy in Iran is promising. Therefore, many domestic and foreign investors are interested in investing in the development of solar energy. If we dedicate an area equal to 100x100 square kilometers of Iran's land to the construction of a photovoltaic solar power plant, the electricity produced by it will be equivalent to the entire electricity production of the country. The increase in energy demand in Iran has caused many concerns such as energy poverty and environmental pollution. Solar energy is the best answer to energy poverty and can provide great opportunities to reduce greenhouse gas emissions and air pollution.[1] Solar photovoltaic PV can be a suitable technology for renewable electricity source in Iran, especially in remote rural areas where grid development is not financially or technically feasible. In this article, according to Iran's high solar energy potential, the benefits of using solar energy and also the need of the solar industry to reduce the resources related to greenhouse gas emissions, the environmental effects of fossil fuels and renewable energies have been examined.

Keywords: Solar energy, fossil fuels, electric energy, Energy sources

Copyright: 2023 by the authors. Licensee KMF Publishers (www.kmf-publishers.com). This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

INTRODUCTION

Iran is among the best countries in the world in terms of solar energy potential. Considering the geographical position of Iran and the dispersion of villages in the country, the use of solar energy is one of the most important factors that should be considered.

Using solar energy is one of the best ways of electrification and energy production compared to other models of energy transmission to villages and remote areas in the country in terms of cost, transportation, maintenance and similar factors.

According to international standards, if the average solar radiation energy per day is higher than 3.5 kilowatt hours per square meter (3500 watts/hour), the use of solar energy models such as solar collectors or photovoltaic systems is very economical and affordable.

In many parts of Iran, the radiant energy of the sun is much higher than this international average, and in some places it has been measured even higher than 7 to 8 kilowatt hours per square meter, but on average, the solar radiant energy on the surface of Iran is about 4.5 kilowatt hours. per square meter.

So far, according to the geographical location of Iran, a large number of solar water heaters and several solar baths have been installed and launched in different parts of the country, including Khorasan province, Sistan and Baluchistan province, Yazd province, and Kerman province. [2]

Renewable energy source solar cells:

The solar cell is the main component of the solar panel. Sometimes they are called photovoltaic cells or PV cells. These cells produce electricity by absorbing sunlight. The name PV is derived from the process of converting light (photons) into electricity (voltage), which is also called the PV effect.

Solar cells are made of semiconductor materials, the most common type of which is crystalline silicon.

The second generation of solar cells are thin film cells that are made of amorphous silicon or non-silicon materials such as cadmium telluride.

In addition to silicon, the third generation of solar cells are made from a variety of new materials, including solar composites, using conventional printing technologies, solar paints, and conductive plastics.

Ancient Iranians used solar energy to reduce the consumption of wood in heating their homes in winter. They built the buildings in such a way that in the winter the sunlight shines into the living rooms, but in the hot summer days the space of the room is in the shade. Examples of such designs can be seen in most other cultures of the world. In the years between the two world wars in Europe and the United States of America, various plans were proposed and tested in the field of solar houses. Since then, there has been no special development in this field. It has been several years that architects have seriously started building solar houses, and following the development and advancement of this technology, they have also achieved useful results. For example, in the United States in 1980, around 10,000 to 20,000 solar houses were built alone. In such houses, they try to use the sun's energy for lighting - provision of sanitary hot water - cooling and heating of the building, and by using useful building materials, the loss of heat and energy is avoided.

Solar water pump:

A solar water pump can provide water to places that do not have access to electricity. Usually, these places rely on animal or human power and diesel engines for water supply. Solar water pumps can replace today's pump systems and thus have both socio-economic and other benefits. The water provided by the solar water pump can be used for irrigation, livestock water supply and drinking water.[2] A solar water pump system is actually an electric pump system that

produces electricity with several panels. Usually, a solar pump system includes a number of solar panels that provide power to an electric motor, and the motor in turn powers the surface pump. Water is usually pumped from the surface of the ground or rivers to a storage source.

Solar Water Heater:

The solar water heater takes its energy from the sun and heats the water with that energy. Today, with the advancement of technology, in order to save fuel consumption, one of the best types of water heaters can be a solar water heater and its use. These types of water heaters have a high-pressure tank that makes them withstand city water. The tanks of this type of water heaters are directly connected to the city water and the consumer can use high pressure hot water.

The connection of hot water to the water pipes of the building is unhindered, and the hot water outlet can be connected to hot water consumption, engine room preheater, or package preheater. The types of solar water heaters are very affordable from an economic point of view.

Solar dryer

Drying food to preserve it has been customary since ancient times, and early humans considered drying to be an art. Drying means taking part of the water in food and other products, which increases the shelf life of the product and prevents the growth of bacteria. In solar dryers, solar energy is used directly or indirectly to dry the materials, and the air flows naturally or forcibly, which accelerates the drying process of the product. Solar dryers are designed and manufactured in different sizes and designs for different products and uses.

Prominent solar power plants in Iran:

Iran is one of the countries with high potential in the field of solar energy, despite having 280 sunny days out of the total 365 days of the year in more than two-thirds of its area and an average radiation of 4.5 to 5.5

kilowatt hours per square meter per day. According to studies conducted by the German Aerospace Center (DLR), it is possible to install more than 60,000 megawatts of solar thermal power plants in an area of more than 2,000 square kilometers. [3]

According to the report of the Ministry of Energy, a summary of the activities carried out in the solar field is as follows: Previously, in 2010, Yazd Solar Combined Cycle Power Plant was known as the eighth largest solar power plant in the world. It was the first time that a power plant used the combination of solar energy and natural gas in the world. This power plant was built with the knowledge of Iranian experts and its total capacity reached 308 megawatts at the time of operation and under ISO conditions.

Importance of the topic:

The consumption of non-renewable resources such as oil, gas and coal are increasing sharply, but finally the time comes when we have to look for a renewable energy source such as solar, wind or geothermal energy. Although many countries have started using solar energy extensively, they have a long way to go before they can meet all their daily energy needs with this source. The most important benefit of solar energy is that it does not produce any pollution and is one of the cleanest sources of energy. Solar energy is a renewable source of energy, requires little maintenance and is easy to use. [2]

With the growing threat of climate change from excessive carbon emissions many countries are looking for clean energy alternatives to their traditional fossil fuels. Among all energy alternatives, solar energy has been the most expensive.

However, considering the pros and cons and the 80% drop in the price of solar panels in the last five years, solar energy has a bright future. Among the benefits of this energy, the following can be mentioned. energy due to its high potential and long-term benefits:

- Solar energy is a completely free and abundant source of energy
- Solar energy, which consists of a lot of light and heat, can be harnessed with modern technologies such as photovoltaics, artificial photosynthesis, solar architecture, etc.
- Solar technology is divided into active and passive parts. Photovoltaic panels and solar thermal collectors, which harness solar energy, are examples of active solar technology.
- Water heating systems use solar energy to heat water, so that in some parts of the world, 60 to 70% of the hot water consumed is produced by the heat of the sun.
- Electricity production is one of the most exciting applications of solar energy. In this method, the large rays of the sun are converted into smaller rays using lenses and mirrors. [3]
- Solar chemical process as a source of chemical energy replaces fossil fuels and can make solar energy storable and portable. Photosynthesis can produce different types of fuels, so hydrogen production technology is an important part of scientific research. Solar energy has no pollution or harmful effects on the environment and is completely acceptable from an environmental point of view.
- Solar energy is one of the most consumed renewable energy sources and renewable energy technology is used to convert solar energy into electricity.
- Different countries that carry out space missions use solar energy to fuel the ship.
- Solar energy is a completely reliable source.
- With the progress of scientific research, solar energy will become cheaper and more efficient in the future. It can be said that solar energy is the most important source of renewable

energy due to its high potential and long-term benefits.

Disadvantages of solar panels:

- The initial costs of setting up solar equipment are expensive and private investors need financial facilities to buy and install solar cells.
- Solar energy is an intermittent source. Access to sunlight is possible at a certain time during the day and night. It is also difficult to predict the daily weather. Therefore, solar energy is not considered as the main and primary source for the production of required electricity.
- Solar energy storage systems such as batteries help to make the electricity flow uniform and stable. But these technologies are very expensive.
- Although solar energy is definitely pollution-free, there are some problems. Some materials used in the process of making solar cells, such as nitrogen trifluoride and sulfur hexafluoride, emit greenhouse gases. The transfer and installation of solar cells can also indirectly cause pollution.
- Some special solar cells require materials that are expensive and rare in nature. This is true for thin-film solar cells based on cadmium telluride (CDTE) or copper indium gallium selenide (CIGS).

DISCUSSION AND CONCLUSION

Estimates show that the countries of the world consider solar energy as one of the main sources of energy in the future, and based on this, they have already carried out extensive planning and activities to expand the use of this energy in various uses. [4]

Studies in the field of solar energy in Iran started about 35 years ago and almost simultaneously in

Shiraz and Sharif Universities of Technology. Among the important projects of interest in these centers are the 10 Mega Wat solar power plant project in Shiraz University and the design and development and construction of photovoltaic cells in the aforementioned center. Projects in the field of solar energy are currently underway in the country by the New Energy

Organization of Iran

Fortunately, in recent years, with the installation of wind turbines and the launch of solar power plants, the use of this the type of energies has been improved. The World Bank has announced that it will not participate in non-renewable power plant projects Most of the European countries, by defining a basket of energy according to their climate, have the agenda of providing 111% of the required electricity. [3] from renewable sources until 2025 and eliminating dependence on fossil fuels on the other hand, considering the 21% share of thermal power plants in Iran, it is necessary to have a codified and strategic plan for the use of new energies according to the current conditions and the existing potential power, in order to reach the appropriate share of energy supply.

REFERENCES

1. Renewable energy and its place in energy supply; Moini Sam and Dehghan Monshadi Mohsen. (2008)
2. <https://civilica.com/doc/276930>
3. An attitude towards solar energy as a renewable energy / Saki Sara And Khorasani Ferdwani Mohammad Ismail. (2015)
4. Solar energy and its role as an alternative energy; Islamic Shura Council. (2015)