

LITERATUR STUDY OF UTILIZATION OF SOLAR CELLS FOR SUPPORTING AGRICULTURE

(Studi Literatur Tentang Pemanfaatan Tenaga Surya untuk Mendukung Pertanian)

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Informasi Naskah:

Diterima: 14-12-2023
Direvisi: 16-12-2023
Disetujui terbit: 17-12-2023
Diterbitkan:
Cetak: 18-12-2023
Online: 18-12-2023

Abstract: Indonesia is known as a country whose economy depends on or is supported by the agricultural sector. But now climate change poses an increasingly greater threat. The agricultural sector is very vulnerable to climate change because of its dependence on weather. Renewable energy is expected to surpass the use of coal in electricity generation in the second half of the 2020s, and by 2050, renewable energy will account for 50% of global electricity generation. Based on the data, there is a lot of use of solar cells to support energy in the agricultural sector. There are several uses, such as irrigation, drying, spraying, fertilizing, pest control, and controlling pH and temperature. Apart from that, using solar panels also has the advantage of being environmentally friendly, economical, efficient, and can be used for a long period.

Keywords: Solar energy, Solar Panels, Renewable Energy; Agriculture

Abstrak: Indonesia dikenal sebagai negara yang perekonomiannya bergantung tau ditopang oleh sektor pertanian. Namun kini perubahan iklim menjadi ancaman yang semakin besar. Sektor pertanian sangat rentan terhadap perubahan iklim karena ketergantungannya terhadap cuaca. Energi terbarukan diperkirakan akan melampaui penggunaan batu bara dalam pembangkit Listrik pada paruh kedua tahun 2020an, sampai tahun 2050, energi terbarukan akan menyumbang 50% dari pembangkitan Listrik global. Berdasarkan data tersebut dapat disimpulkan bahwa banyak sekali pemanfaatan sel surya untuk menunjang energi di sktor pertanian. Ada beberapa kegunaan seperti irigasi, pengeringan, penyemprotan, pemupukan, pengendalian hama, serta pengendalian pH dan suhu. Selain itu penggunaan panel surya juga memiliki keunggulan yaitu ramah lingkungan, ekonomis, efisien dan dapat digunakan dalam jangka waktu lama.

Kata Kunci: Energi Surya, Panel Surya, Energi Terbarukan, Pertanian

INTRODUCTION

Climate change poses a growing threat in the 21st century. It is a challenge to all humanity, affecting all aspects of the environment and the economy while

threatening the sustainable development of society. Climate change affects the frequency and intensity of extreme weather events (extreme rainfall, floods and flash floods, erosion, storms, droughts,

heat waves, and fires). It causes gradual climate change (increase in air, soil, and water surface temperatures, sea level rise, ocean acidification, and expansion of drylands) [1]. The agricultural sector is especially vulnerable to be profound impacts of climate change because of its dependence on weather [2]. Expected impacts on the agricultural sector include changes in growing seasons of arable crops, with a focus on crops and oilseeds (e.g., corn, sugar, beets, soybeans); lower yields of all types of crops, and Greater dependence on water.

Extreme weather events such as droughts and hail led to average losses of 76 million euros per year in Croatia between 2000 and 2007, equivalent to 0.6% of the national GDP [3]. Meanwhile, in Indonesia, climate change risks causing economic losses of up to IDR 500 trillion in 2020-2024 if the government does not intervene in policy [4]. Climate changes affect the duration/length of the vegetative period of crops and lead to lower yields. Frequent droughts will lead to a higher demand for irrigation water. A longer growing season will also allow for the cultivation of some new crops and varieties. On the other hand, more frequent flooding and stagnation of surface water will reduce or eliminate yields.

Renewable energy is expected to overtake coal in electricity generation in the second half of the 2020s, and by 2050, renewable energy will account for 50% of

global electricity generation. In agriculture, solar energy can dry straw, be a source of energy for water pumps, become an electricity generator for exterminating pests, and build more efficient greenhouses. The mandatory use of energy supply measures in all sectors will increase the role of renewable energy [5, 6].

METODOLOGI PENELITIAN

The method used in this journal is a journal review. It reviews and carries out article literacy to produce data about the various potential uses of panels. Solar support energy in the agricultural sector will be the subject of discussion in the article so that it can be used as an internal ingredient in writing. The discussion will contain various types of uses for solar panels in specific fields, where each article reviewed has a wide variety of uses than solar panels so that later it will obtain utilization conclusions from the panel. Solar energy is used to help the community in agriculture.

HASIL PENELITIAN DAN PEMBAHASAN

Based on the description of the method above, six (6) scientific articles were selected as the primary articles to answer the research objectives of this paper. From this article, the author found several strategies for utilizing solar electrical energy to support community needs in the agricultural sector, as shown in Table 1.

Table 1. Research on the use of solar panels as a means of generating electricity in agriculture

Article title	Author, year	Paper Description
Pemasangan Pompa untuk Irigasi Lahan Pertanian Menggunakan Solar Panel bagi Masyarakat Cepu (Installation of Pumps for Agricultural Land Irrigation Using Solar Panels for the Cepu Community)	Susilo Handoko et.,al 2022	A solar-powered water pump is one solution for people in the Megalrejo Hamlet area, Balun Village, and Cepu-Blora District who are still experiencing difficulties irrigating agricultural land. People generally use diesel-powered or electric motors, but these pumps are expensive. Therefore, the Community Service team proposed using a pump whose power

		is supplied from solar energy using solar cells.
Agrivoltaics and Aquavoltaics: Potential of Solar Energy Use in Agriculture and Freshwater Aquaculture in Croatia	Daniel Matulić et.,al 2023	Agrivoltaics and aquavoltaics combine renewable energy production with agriculture and aquaculture. Agrivoltaics involves placing solar panels on farmland, while aquavoltaics integrates photovoltaic systems with water bodies and aquaculture. This paper examines the benefits and challenges of agrivoltaics and aquavoltaics, focusing on their potential for Croatian agriculture and freshwater aquaculture.
Pompa Air Bertenaga Hibrid Untuk Irigasi Tanaman Buah Naga <i>(Hybrid-Powered Water Pump for Dragon Fruit Irrigation)</i>	Danar Susilo Wijayanto et.,al 2016	Utilizing solar radiation as an energy source can reduce dependence on fossil fuels, reduce operational costs in the long term, and support the conservation of natural resources. This service implements the use of renewable energy sources for water pumps, which are used as a source of irrigation for fruit and vegetable plants in organic farming at the Ngasinan Agricultural Pilot Center (BPP), Beji Village, Nguntoronadi District, Wonogiri Regency.
Analysis of Optimization of Solar Cell Systems as Alternative Energy in Water Pumps to Fulfill Water Needs in Agricultural Land Analisis Optimalisasi Sistem Solar Cell sebagai Energi Alternatif pada Pompa Air sebagai Pemenuhan Kebutuhan Air di Lahan Pertanian	Lailatul Qomaria et.,al 2021	This article discusses practical ways to channel water to agricultural land, where people usually use natural flows from small rivers around the land, but this system is less effective. People then switched to modern equipment, such as diesel, to drive pumps to meet water needs. However, the use of diesel also does not solve the problem of not being environmentally friendly and requiring fossil fuels for operation, so the solution found in this article is using solar cells, which are more environmentally friendly and fuel-efficient.
Solar powered dryers in agricultural produce processing for sustainable rural development worldwide: A case study from Nayarit-Mexico	Sarah Messina et.,al 2022	Rural areas are located quite far from places where agricultural products are dried, which use diesel and ovens, which will create a relatively large carbon footprint. Moreover, using solar-powered technology will significantly reduce the carbon

		footprint and increase dry product life by 12 months.
Penerapan Penyemprot Tanaman Elektrik untuk Lahan Pertanian di Desa Kuta Dame. Application of Electric Crop Sprayers for Agricultural Land in Kuta Dame Village.	Waluyo, B. D et.,al 2021	Less use of manual sprayers is effective, so a spraying tool made of electricity sourced from solar panels can be used to support the agriculture sector and increase productivity in agriculture.
Implementasi Panel Surya Sebagai Sumber Energi pada Sistem Kendali Ph dan Level Larutan Nutrisi Tanaman Hidroponik. (Implementation of Solar Panels as an Energy Source in the Ph and Nutrient Solution Level Control System for Hydroponic Plants)	Fitria Hidayanti et.,al 2019	Hydroponics is a farming technique using media other than soil, for example, water. Water is a nutrient for plants which is circulated by a pump. Water circulation operates continuously, so it requires large amounts of electrical power, so it requires solar panels as a tool that can convert sunlight into electrical energy. Solar panels are used to power the pump and control systems for pH and nutrient solution levels.
Pemanfaatan Pompa Air Tenaga Surya Untuk Sistem Irigasi Pertanian (Utilization of Solar Water Pumps for Agricultural Irrigation Systems)	Muhammad Syahid et.,al 2022	Limited water supply makes farmers Subak leave the rice fields. Implementation of the system in cells is less effective so the use of water pumps Solar powered is an effective choice with installed panels with a maximum capacity of 52.14 kW on an area of 300 m ² .

Solar Energy

Solar energy is a solar or sun fuel generated by the sun spreading everywhere in the universe, and all solar system planets rely on it. This is also called clean, green, alternative, or sustainable energy. This is the origin of most of the energy sources on earth. The solar energy coming from the sun is in the form of radiations of a range of values. Most solar energy is captured in interstellar space, and only a tiny part of solar energy reaches the earth. However, this small quantity of solar energy reaching the earth's surface in only one hour is still higher than the energy generated by all other

available sources, including hydro, nuclear, and fossil fuels.

Solar Technologies in Agriculture

Technology at agricultural farms is changing and improving rapidly. These developments improve farm machinery and equipment, farm facilities, and buildings for crops and animals. As we all know, solar energy is the largest and cheapest energy resource on earth. Solar energy can quickly fulfill energy provision and supply at agriculture farms. Various solar energy absorbing devices and systems have been developed and are in work for agricultural applications. This

includes solar thermal and electric devices such as solar spraying machines, solar greenhouse heating, solar crop dryers, solar water pumps, ventilation for livestock, solar aeration pumps, and solar electricity.

a. Solar PV-operated water lifting/pumping system:

Solar PV pumping systems help operate the pressurized irrigation system. Specifically, solar pumps may be useful as water-lifting devices in irrigation canals and to evenly distribute water in those areas where traditional water systems could not have access, such as in elevated hilly lands.

b. Solar spraying and seed-sowing machines

The solar pesticide sprayer machine is designed to improve productivity for small farmers. They can easily carry and handle these machines with rechargeable batteries and direct solar illumination options. Pesticide spraying activity is mostly done in the daytime, so these spray machines could be used by directly capturing solar energy, which prevents the installation of batteries in these machines.

c. Solar Crop Drying

One of the applications of solar energy in agriculture is a solar drying system based on various options. Solar dryers are available in different shapes and structures. Different types of solar dryer are available for various applications, which is used for drying agricultural products like potatoes, grains, carrots, and mushrooms

d. Solar Green House Heating

Generally, greenhouses worldwide use sunlight to meet their lighting needs for photosynthesis, but they are not ready to use the sun for heat. Instead, they rely on conventional energy sources, such as oil or gas, to produce greenhouse temperatures for winter plant growth. However, solar-powered

greenhouses (SGHs) are built to use solar energy for both heating and lighting. Also, these greenhouses reduce the damage caused by excess solar energy from the ambient to the greenhouse during hot sunny periods. A controlled environment is available in these SGHs.

e. Solar Powered Tractors

Tractors are fundamental machines in agriculture, which make farming more accessible and increase yields and crop production. Tractors transform agriculture into an agro-industry by performing many functions with the help of various tools and equipment.

CONCLUSION

Based on the above data, solar cells support energy in the agricultural sector. Several uses include irrigation, drying, spraying, fertilizing, pest control, and controlling pH and temperature. Apart from that, using solar panels also has the advantage of being environmentally friendly, economical, efficient, and able to be used for an extended period.

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