

PAPER • OPEN ACCESS

Concept design of solar cell satellite dish

To cite this article: Steven Teja *et al* 2020 *IOP Conf. Ser.: Mater. Sci. Eng.* **852** 012088

View the [article online](#) for updates and enhancements.



The banner for the PRiME 2020 Joint International Meeting features a blue and white design with a globe in the background. It includes logos for ECS, The Electrochemical Society, and The Korean Electrochemical Society. The text "Joint International Meeting" is at the top, "PRiME 2020" is in large blue letters, "October 4-9, 2020" is below it, and "Attendees register at NO COST!" is in a blue box. The PRiME logo is on the right with the text "PACIFIC RIM MEETING ON ELECTROCHEMICAL AND SOLID STATE SCIENCE" and "2020". A "REGISTER NOW" button is at the bottom right.

Concept design of solar cell satellite dish

Steven Teja^{1*}, Nicholas Travis Adrianto², Louis Martin JM³, Nicholas Kurniawan⁴, Agustinus Purna Irawan⁵

^{1,2,3,4}Industrial Engineering, Universitas Tarumanagara

⁵Faculty of Engineering, Universitas Tarumanagara

*steven.545180010@stu.untar.ac.id

Abstract. Solar panels are devices that consist of solar cells that convert light into electricity. They are called solar on the Sun or "sol" because the Sun is the strongest light source that can be utilized. Solar panels are often called photovoltaic cells, photovoltaic can be interpreted as "light-electricity". Solar cells or PV cells depend on the photovoltaic effect to absorb the Sun's energy and cause currents to flow between two opposing charged layers. The purpose of this study is to analyze the satellite dish using solar panels, so this tool is a signal search tool that uses solar energy to run to carry out its functions. As we know that many places or areas that are still often experiencing power outages so that it can hamper and interfere with community activities. Therefore, this research wants to facilitate the public, especially the current generation who need electricity every day so that when there is a power outage, the satellite dish will utilize solar energy as its main source. This research uses a satellite dish as an intermediary to produce electrical energy with the help of solar energy and is collected into a high-voltage battery in the form of electricity, so that it becomes a source of electricity. **Keywords:** concept design, solar cell satellite dish.

1. Introduction

There are problems too in many places because the electricity is not stable too because of the unstable of the distribution of the electric tower. Common activities people do when the light is out can be seen in Figure 1 below. These conditions are unfavorable, uncomfortable, disrupting activities, damaging electronic equipment and economically degrading. The efforts are needed to ensure the availability of electricity to the wider community, so that activities can run well. Utilization of Indonesia's abundant natural energy potential such as solar energy, is one of the solutions to overcome the problem of electricity needs. On a household scale or in use with needs that are not too large, it is necessary to design a power plant that is small and medium scale economically [1], [2], [3], [4].



Figure 1. Activities when the lights go out become troublesome



Content from this work may be used under the terms of the [Creative Commons Attribution 3.0 licence](#). Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.

To provide comfort to the electricity user community, we made a power plant design using solar panel as an energy source. This design adopts the design of a satellite dish. Basically, a satellite dish is a high-range device that is used for radio, television, data communications, and for radiolocation, in the UHF and SHF portion of the spectrum of electromagnetic waves emitted through satellites free to air [5], [6], [7]. The function of a satellite dish that is commonly known to the public is as a tool for receiving satellite television broadcasts. Therefore, a satellite dish using solar panels will make people more efficient, efficient, and have optimal standards in the use of electricity. This satellite dish with solar panels has a much lower cost than using a satellite dish that can only be turned on if there is electricity from PLN [8], [9]. With this tool, we will more easily use electricity because it only requires one tool to run electricity when there is a power outage, plus, this tool uses remote control technology to carry out its functions [6], [7], [10]. Solar panels capture energy from sunlight and convert it into backup electricity that will be stored by batteries connected to satellite dishes and solar panels. Energy stored in batteries will be a backup energy source that is useful for running electronic devices in the home. When a solar panel receives light, and is converted to electricity, through cables made of steel wire, energy will be stored in a high-voltage battery as a backup of electric power. With this product that we are inventing, many problems including electrical problems can be solved in mean of time, so we are hoping that this product can be useful to everyone [11].

2. Method

The satellite dish system is designed to use a solar panel system to obtain such strong power stored in a high-voltage battery [12]. With the presence of solar panels, heat from the sun is captured and then used as electric power that can be utilized by the sun/solar, making photons that produce electric current. A solar panel produces approximately 0.5-volt voltage. So, a 12 V solar panel consists of approximately 36 cells (to produce a maximum 17 V [13], [14]).

a. Solar cell method

Solar Cell 50 WP means the solar cell has 50 W peak (power when the sun is blazing) [14]. Peak 1 day is assumed to be 4.5 hours (safe count is 4 hours) so,

$$50 \text{ WP} \times 4.5 \text{ hour} = 225 \text{ W hour/day}$$

Where,

WP: watt Peak (power when the sun is blazing)

Watthour/day: the number of watts per hour unit added in 1 day

b. Electric power method

The battery used must be a high voltage which is in the form of AH electric power must be converted to WH. So, you can find out the total capacity of the existing battery [13], [14].

$$P = I \times V$$

Where,

P: Power (WH)

I: Strong current per hour (AH)

V: Battery voltage (V)

c. Battery Efficiency Method

$$Efficiency = \frac{W_{useful}}{W_{total}} \times 100\%$$

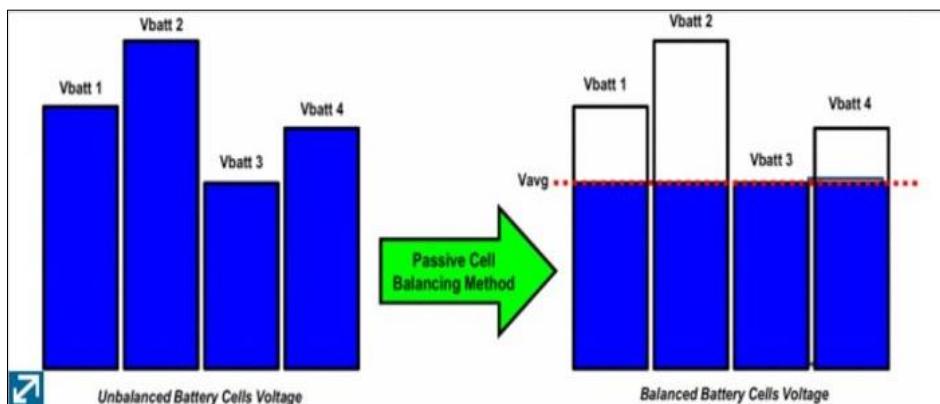


Figure 2. Balanced battery voltage

Where,

$W_{useful} = F \times s$

$W_{total} = P \times t$

F: battery load (N)

s: height (m)

P: Power

T: Time (s)

Calculation of available methods:

- Assume the sun's power is the same every day at 4.5 hours so that battery charging can be carried out continuously without leakage.
- Calculate the loss of battery power that has been converted through a fiber cable.
- Calculate how much power the high voltage battery can hold.
- Perform the above procedure repeatedly so that the power generated by the battery from the satellite dish can be transmitted to the electric current in the house.

3. Result and Discussion

The specifications for making solar panels are based on materials that can provide long-term durability. The purpose of this long-term means that the device that was created has more resistance to extreme weather such as continuous rain, and prolonged summer. Therefore, to overcome this problem we have chosen several materials that will be used for the products that we will make. For the satellite dish itself, choosing fiber as the material used because it has good heat and rain resistance.

Then for solar panel materials we choose silicon, this is because in addition to the second largest natural source on earth, silicon is also not harmful to the community. In the framework of the arrangement of other silicon material that is positively and negatively charged will produce an electric charge if given light. Battery material that is made has a high voltage so that the material chosen is lithium and lead which is cheap and environmentally friendly. Battery packaging materials use iron-chromium-nickel which can protect from the sun's heat and rainwater. In addition, it will maintain the flow of electricity in it to prevent a short circuit. In addition, solar panel size specifications are made based on the size that takes up space and is fairly light. The size of the solar panel itself has a base with a size of 150 x 150 x 10 cm, while the size of the battery has a size of 60 x 50 x 70 cm and the size of a ball disc with a diameter of 150 cm and a total weight of approximately 5-10 kg. Placement of solar panels is placed on the roof of the

house, so it does not narrow the area of the house. Design of our product can be seen in Figure 2 below.

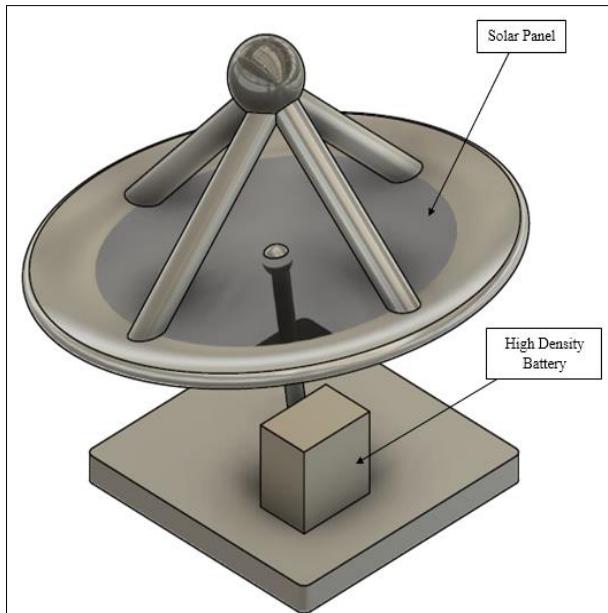


Figure 2. Description of the solar panel parabolic system

The specification of the product can be seen in Table 1 below.

Table 1. Specification of the solar panel parabolic system

No.	Specification	Description	
		Dimension	Value
1.	Base	150 x 150 x 10 cm	
	Battery	60 x 50 x 70 cm	
	Satellite Dish	Ø 150 cm	
	Total Weight	5 – 10 kg	
2.	Material	Description	
	Base	Metal Chromium Coating	
	Battery	Lithium for negative poles and Lead for positive poles. Battery packaging material uses iron-chromium-nickel material.	
	Dish	fiber (solid dish) full metal and solar cell in Silicon (Si)	
	Solar Cell	A 50 WP Solar Cell that can be used for 225 WH/day which is the peak is 4,5 hours in a day.	

4. Conclusion

Our design products are aimed at facilitating the public, especially the current generation who need electricity every day. Products that have been designed to help make work easier, safe, comfortable and environmentally friendly. This is in accordance with the needs of consumers

who want a quality product, safe and comfortable to use [15], [16], [17], [18]. So, if there is a power outage, the energy that has been stored by solar panels into a high-voltage battery that is installed into a satellite dish on the roof of the house, people can still use electricity to run the technology they need. Apart from only television, home telephones, and Wi-Fi, if we use materials and equipment that are larger or have a higher voltage, then we will be able to use electricity for one house when there is a power outage. In this tool there is a Solar Panel to collect energy from sunlight and convert it into backup electricity that will be stored by batteries connected to satellite dishes and solar panels. Energy stored in batteries, will be a useful source of energy to save electronic devices in the home.

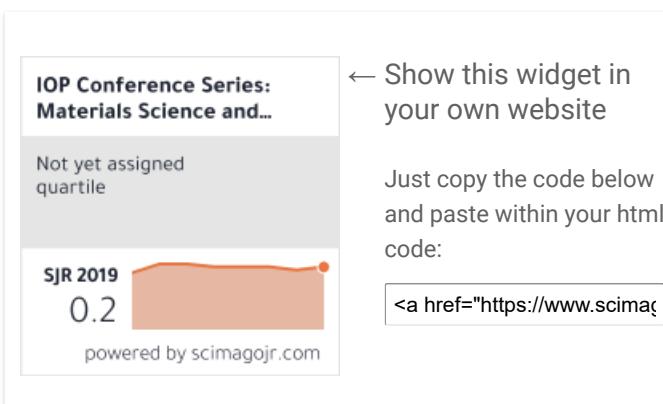
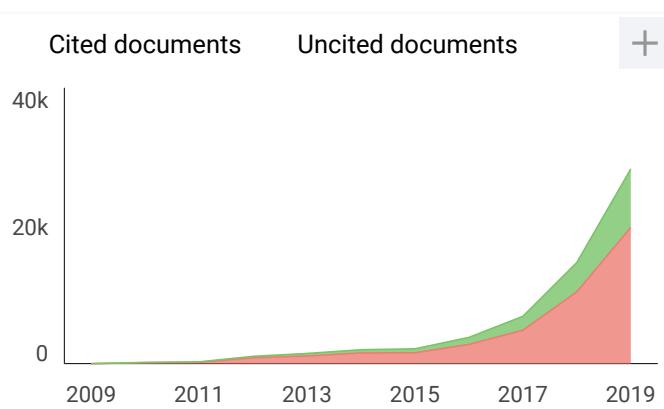
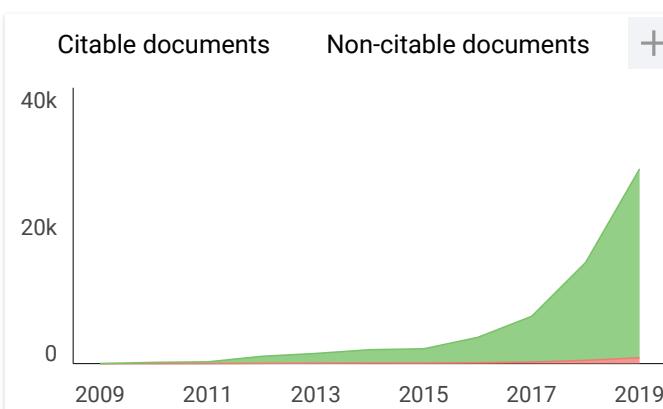
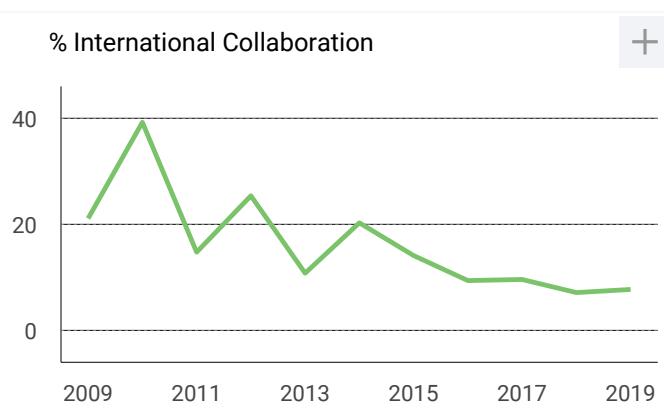
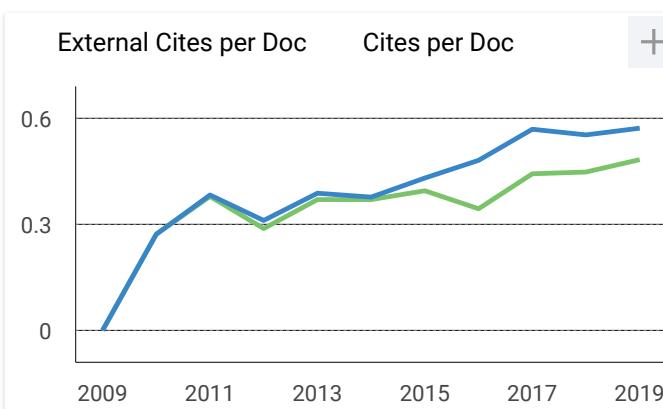
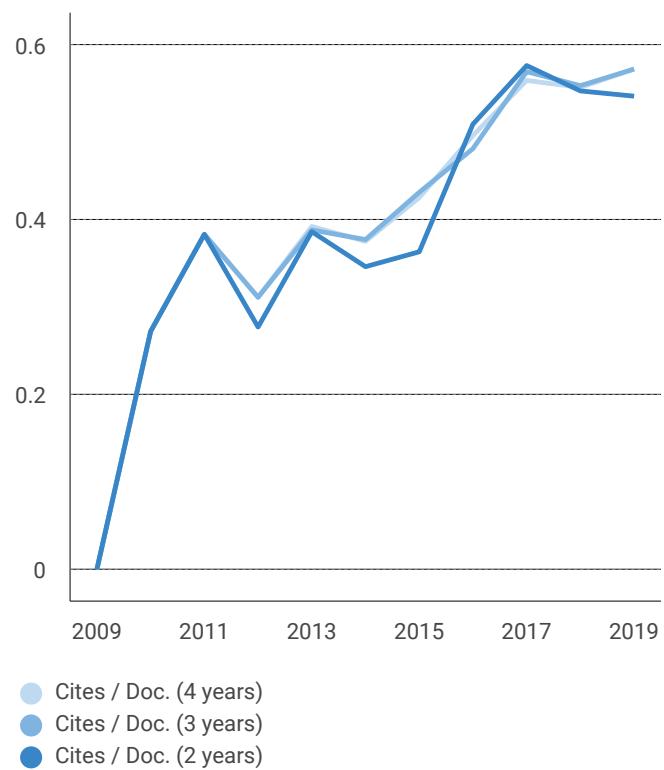
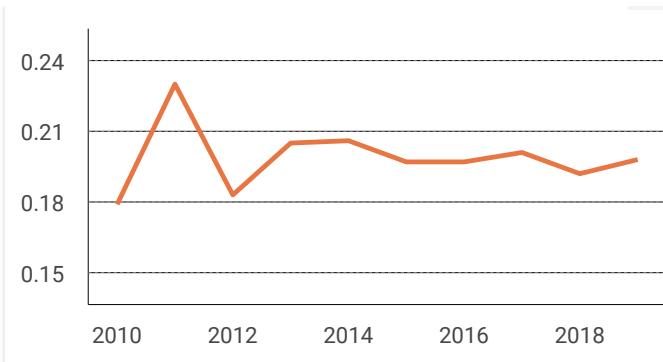
5. References

- [1] Irawan, A.P., Adianto, Wayan Sukania, I., 2018 *IOP Conference Series: Materials Science and Engineering* **420**-1- 012015.
- [2] Irawan, A.P., 2018 *IOP Conference Series: Materials Science and Engineering* **420**-1- 012060.
- [3] Renaldo, Irawan, A.P., Halim, A., 2019 *IOP Conference Series: Materials Science and Engineering* **508**-1- 012073.
- [4] Irawan, A.P., Soemardi, T.P., Kusumaningsih, W., Reksoprodjo, A.H.S., 2010 *Proceedings-APCHI ERGOFUTURE 2010*-1-37
- [5] Irawan, A.P., 2018 *IOP Conference Series: Materials Science and Engineering* **420**-1- 012060
- [6] Beck, A., 2019 *Journal of Engineering* **5**-203-205.
- [7] Scott, Kevin, S., Nork, S., 2018 *International Publishing* **1**-34-35.
- [8] Kuhn, T., 1998 *Theory of Transport Properties of Semiconductor Nanostructures Electronic Materials* (London: Chapman and Hall).
- [9] Brennan, M. K., Karimi, M., Almeida, F. C. L., de Lima, F. K., Ayala, P. C., Obata, D., Paschoalini, A. T., Kessissoglou, N., 2017 *Procedia Engineering* pp. 1-2
- [10] J. Liu, Z. Bao , Y. Cui , E. J. Dufek , J. B. Goodenough , P. Khalifah , Q. Li , B. Y. Liaw , P. Liu , A. Manthiram , Y. S. Meng , V. R. Subramanian , M. F. Toney , V. V. Viswanathan , M. S. Whittingham , J. Xiao , W. Xu , J. Yang , X.-Q. Yang , J.-G. Zhang, 2019 *Nat. Energy* **4**- 180 -186.
- [11] Saydam, G., 2005 *Teknologi Telekomunikasi Perkembangan dan Aplikasi* (Bandung: CV. Alfabeta).
- [12] Warsito, A., Adriono, E., Nugroho, M., Oding, O., Winardi, B., 2013 *Jurnal Ilmiah Teknik Elektro* **2**-3-499-503.
- [13] Nozik, A. J., Physica, E., 2002 *Low-dimensional Systems and Nanostructures* (Amsterdam).
- [14] Bremner, S. P., Levy, M. Y., Honsberg, C. B., 2008 *Limiting efficiency of an intermediate band solar cell*. Lett. 92, 171110.
- [15] Koko, I. N. H., Edi Laksono, E., Tapran, N., Kurniadi, K., Yuliarto, B., 2017 *4th International Conference on Electric Vehicular Technology (ICEVT)*, pp. 60.
- [16] Irawan, A.P., Daywin, F.J., Fanando, Agustino, T., 2016 *International Journal of Engineering and Technology* **8**-3-1543
- [17] Irawan, A.P., Halim, A., Kurniawan, H., 2017 *IOP Conference Series: Materials Science and Engineering* **237**-1-012006
- [18] Irawan, A.P., Utama, D.W., Affandi, E., Suteja, H., 2019 *IOP Conference Series: Materials Science and Engineering* **508**-1-012054



IOP Conference Series: Materials Science and Engineering

Country	United Kingdom -  SIR Ranking of United Kingdom	<big>31</big>
Subject Area and Category	Engineering Engineering (miscellaneous)	
	Materials Science Materials Science (miscellaneous)	
Publisher	IOP Publishing Ltd.	H Index
Publication type	Conferences and Proceedings	
ISSN	17578981, 1757899X	
Coverage	2009-2020	
Scope	The open access IOP Conference Series provides a fast, versatile and cost-effective proceedings publication service for your conference. Key publishing subject areas include: physics, materials science, environmental science, bioscience, engineering, computational science and mathematics.	
	 Homepage	
	How to publish in this journal	
	Contact	
	 Join the conversation about this journal	





Source details

IOP Conference Series: Materials Science and Engineering

CiteScore 2019
0.6

ⓘ

Scopus coverage years: from 2009 to Present

ISSN: 1757-8981 E-ISSN: 1757-899X

Subject area: Engineering: General Engineering Materials Science: General Materials ScienceSJR 2019
0.198

ⓘ

[View all documents >](#)[Set document alert](#)[Save to source list](#) [Journal Homepage](#)SNIP 2019
0.543

ⓘ

[CiteScore](#) [CiteScore rank & trend](#) [Scopus content coverage](#)

i Improved CiteScore methodology

X

CiteScore 2019 counts the citations received in 2016-2019 to articles, reviews, conference papers, book chapters and data papers published in 2016-2019, and divides this by the number of publications published in 2016-2019. [Learn more >](#)

CiteScore 2019

0.6 = $\frac{28,183 \text{ Citations 2016 - 2019}}{47,300 \text{ Documents 2016 - 2019}}$

Calculated on 06 May, 2020

CiteScoreTracker 2020

0.6 = $\frac{34,911 \text{ Citations to date}}{57,266 \text{ Documents to date}}$

Last updated on 07 September, 2020 • Updated monthly

CiteScore rank 2019

Category	Rank	Percentile
----------	------	------------

Engineering
General Engineering

#222/299 25th

Materials Science
General Materials Science

#371/460 19th

[View CiteScore methodology >](#) [CiteScore FAQ >](#) [Add CiteScore to your site >](#)

About Scopus

What is Scopus
Content coverage
Scopus blog
Scopus API
Privacy matters

Language

日本語に切り替える
切换到简体中文
切换到繁體中文
Русский язык

Customer Service

Help
Contact us