Jurnal Scientia
Volume 13, Number 04, 2024, DOI 10.58471/ scientia.v13i04
ESSN 2723-7486 (Online)
https://infor.seaninstitute.org/index.php/pendidikan

# Analysis of Solar Panel Design as a Power Source For CCTV at PT. Link NET, TBK

**Asrul Andi[1], Zuraidah Tharo[2], Dicky Lesmana[3]**
[1,2,3]Universitas Pembangunan Panca Budi, Medan, North Sumatera, Indonesia

**Article Info**
**Keywords**:
Design,
Panel,
Solar,
CCTV,
Energy

**ABSTRACT**
A computer system that uses a video camera to display and record an image at the time and place where the device is installed is CCTV. However, CCTV currently relies on PLN sources. If the PLN source goes out, CCTV will not work. One solution to overcome PLN sources that often go out is to use solar energy and remember that solar energy is very environmentally friendly. This CCTV uses an Arduino Nano microcontroller as a monitoring of battery voltage as a source of electrical power assisted by SCC to regulate the incoming current from the solar panel and the output current to the load used and the battery as a storage voltage of one of the electronic devices that are often used by humans.



**Corresponding Author:**
Asrul Andi
Universitas Pembangunan Panca Budi, Medan, North Sumatera, Indonesia
asrulandi82@yahoo.com

## INTRODUCTION

Along with the rapid development of technology today, people usually monitor the location of a distant area without having to be at that location by using CCTV. However, the current obstacle to CCTV is that the source of electricity is entirely from PLN. If the electricity goes out, the CCTV will also go out, this will be a loss for the Company. The source of electricity from sunlight/solar panels is one solution. By using solar panels, solar energy can be converted into environmentally friendly electrical energy.

The increasing demand for continuous and reliable CCTV operation, particularly in remote locations, necessitates the exploration of alternative energy sources. This study aims to analyze the design of a solar panel system as a sustainable power source for CCTV at PT. Link Net, Tbk. The research focuses on determining the feasibility, efficiency, and cost-effectiveness of utilizing solar energy to ensure uninterrupted CCTV operation.

The methodology involves calculating the energy requirements of the CCTV system, designing a solar panel system that meets these demands, and evaluating its performance under different environmental conditions. Key components such as solar panels, batteries, inverters, and charge controllers are selected based on their specifications and compatibility with the system.

The findings indicate that a properly designed solar panel system can supply sufficient energy to power the CCTV system, even during low sunlight conditions, by incorporating adequate energy storage solutions. Furthermore, the analysis reveals that

Jurnal Scientia
Volume 13, Number 04, 2024, DOI 10.58471/ scientia.v13i04
ESSN 2723-7486 (Online)
https://infor.seaninstitute.org/index.php/pendidikan

the initial investment in solar energy is offset by reduced operational costs over time, making it a viable and eco-friendly alternative to traditional power sources.This study concludes that implementing a solar-powered CCTV system at PT. Link Net, Tbk enhances energy sustainability, reduces dependence on the conventional power grid, and contributes to the company's environmental goals. Future recommendations include continuous monitoring of the system's performance and exploring advanced technologies to further optimize energy efficiency.

Therefore, the author wants to apply solar panel energy as the main energy source in the design of this CCTV, because solar power is an environmentally friendly power plant and never produces waste and pollution, so it is very feasible to be developed. The environmental security system is an effort by the company and the environment to create conducive conditions, but in reality various efforts have been made such as night patrols to guarding with security guards, only the results are still less than optimal. CCTV is one solution for certain companies and the surrounding environment because of its real-time nature, capable of storing various events, and at the same time providing a warning to individuals who want to commit crimes in the area. The implementation of this research application was carried out at PT. Link Net.Tbk, Medan.

## Literature Review

### Previous Research.

The author digs up information from previous research as a comparative material. In additionThe author also digs up information from books and other reports in order to obtain previously existing information about theories related to the title used to obtain a scientific theoretical basis. This research is used to optimize the conversion of light into electrical energy as much as possible and can be combined into series or parallel to produce the desired voltage and current for use by local companies to increase the company's power load

The research that will be conducted is the analysis of solar panel design as an energy source on CCTV. This design will monitor the use of power on CCTV used on the main source in the company and will automatically switch to PLN electricity if there is no more sunlight and if the power goes out it will switch to the inverter power source from the solar panel energy storage battery so that power savings in the future.

### Components of PLTS

Solar Panel (Photovoltaic) Photovoltaic is the main component that produces electric current which will then be stored in a battery. Usually a solar cell or photovoltaic has different power and consists of 3 types based on its manufacture:

a. Monocrystal
b. Polycrystal
c. Thin Film

Of the three technologies, we can distinguish them by their level of efficiency. Monocrystal is the photovoltaic that has the highest level of efficiency today, but in terms of economy it is still very expensive compared to polycrystal.

Jurnal Scientia
Volume 13, Number 04, 2024, DOI 10.58471/ scientia.v13i04
ESSN 2723-7486 (Online)
https://infor.seaninstitute.org/index.php/pendidikan

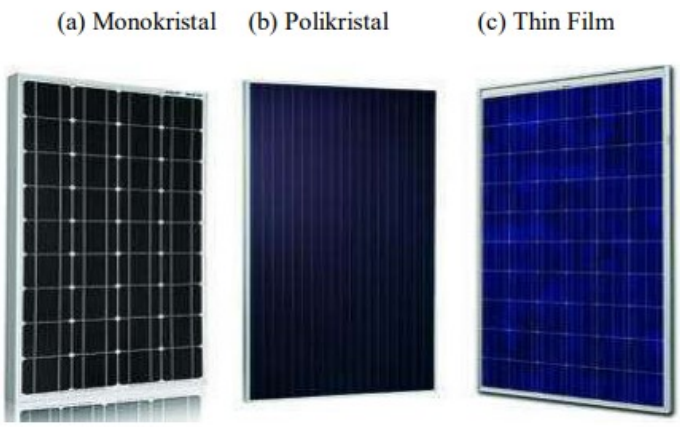



**Figure 1**. Solar Panel

MPPT Solar Charger is a component used to regulate the direct current output from the solar panel to the battery during charging. This solar charger controller also functions to avoid overcharging the battery, this tool also has the ability to convert the voltage value issued by the solar panel to match the voltage value on the battery used in this study is MPPT the task of the MPPT device checks the output of the PV module, compares it with the battery voltage, then determines the best power that the PV module can produce to charge the battery and converts it to the best voltage to get maximum current into the battery. This module can also channel power to DC loads, which are directly connected to the battery


**Figure 2.** MPPT Charger

Inverter is a supporting electronic component of PLTS that functions to change DC (direct current) into AC (alternating current) required by electrical equipment. Choosing the right inverter for a particular application depends on the load requirements and also on the system itself. The system is whether it is connected to the electricity network (grid connected) or a stand-alone system. The efficiency of the inverter during operation is around 90%. The inverter has the ability to perform the synchronization process with the network. There are many types of inverters on the market. These types have several differences ranging from those used for single modules to arrays and those used for distribution in KW or MW. There are three types of inverters that are often used, namely string inverters, central inverters, and micro inverters.

Jurnal Scientia
Volume 13, Number 04, 2024, DOI 10.58471/ scientia.v13i04
ESSN 2723-7486 (Online)
https://infor.seaninstitute.org/index.php/pendidikan


**Figure 3.** DC To AC Inverter

Battery is a power storage component to pro*vide power supply at night. Power can be stored in batteries, pump storage, or by producing* hydrogen for later use in fuel cells. Until now, batteries are the cheapest and most practical storage media. In PLTS, maintenance-free batteries are needed so that Sealed Lead-Acid Batteries are generally used, namely batteries equipped with a cover to prevent electrolytes from coming out of the battery. This type of battery has a total efficiency of around 90% for the entire charging and discharging cycle due to the resistance in the battery. With the cover, this type of battery should not be overcharged so a battery charge controller is needed. Battery capacity is expressed in ampere-hours (Ah) which means the large output current of the battery that can be flowed in one hour

**Figure 4**. Inverter Battery Pack

CCTV stands for Closed-Circuit Television, which is a visual surveillance system that uses cameras to record activities and events in a specific location. A CCTV system consists of cameras connected to a monitor or video recorder. These cameras can be installed in public or private areas, and they can record images and videos in real time or for later playback.

**Figure 5**. CCTV

Jurnal Scientia
Volume 13, Number 04, 2024, DOI 10.58471/ scientia.v13i04
ESSN 2723-7486 (Online)
https://infor.seaninstitute.org/index.php/pendidikan

## RESEARCH METHODS

### Activity Plan

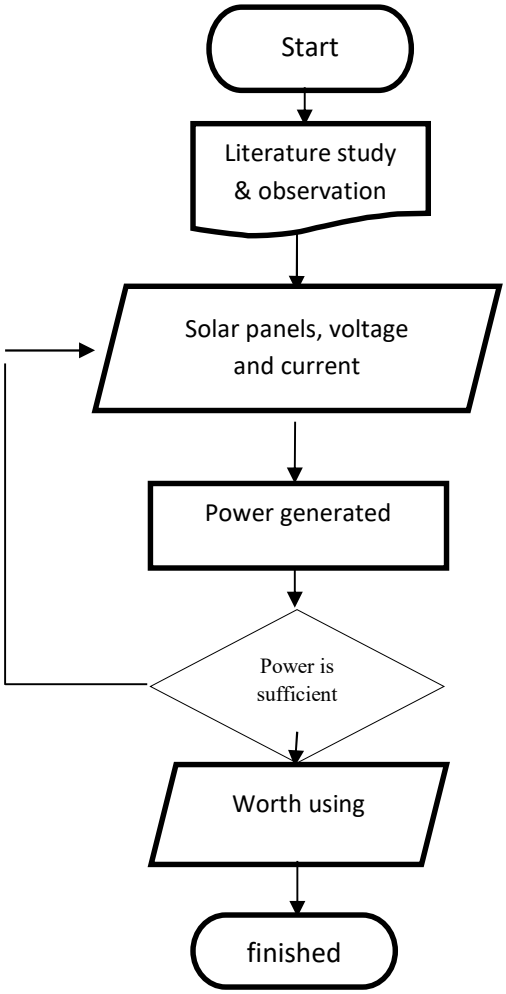



**Figure 6.** Flowchart of CCTV Camera Power Capacity Monitoring System Using Solar Panels

a. Solar Panels, Produces electrical energy from sunlight which is then forwarded to the solar charger.
b. MPPT Charger, MPPT Its function is to check the output of the solar panel, compare it with the battery voltage then fix the best power that the solar panel can produce to charge the battery and convert it to the best voltage to get maximum current to the battery.
c. Battery, The battery used is a lithium battery. This type of battery is the most common and popular type of battery used in solar panels because besides being more durable, lithium batteries have a higher level of efficiency and require minimal maintenance.
d. Inverter, The inverter in the PLTS iscomponents or tools in the solar panel system. The inverter can convert the DC current of the battery produced by the solar panel into AC electric current. Well, almost all household appliances such as AC, TV, Refrigerator, HP Charger, and so on use AC electric current.

Jurnal Scientia
Volume 13, Number 04, 2024, DOI 10.58471/ scientia.v13i04
ESSN 2723-7486 (Online)
https://infor.seaninstitute.org/index.php/pendidikan

### Data Collection and Analysis Techniques

1. Experiment, in making this thesis, it requires planning to design and make a CCTV device using solar panels.
2. Analyzing, an analysis is carried out on the design which functions to analyze the performance of the CCTV system using solar panels to obtain accurate data.
3. Conducting testing, testing of the design tools is carried out which functions to test whether the tools used work according to plan in order to obtain measurement data.
4. Conducting measurements, measurements are carried out on the device which functions to obtain data from the CCTV system using solar panels by conducting measurements on each component used to determine its performance according to plan.
5. Collecting data that has been measured will be collected as a reference for analysis using graphs and tables to find out the working system of the solar panel device of the solar cell power generation system.

## ANALYSIS AND RESULTS

### Flowchart System

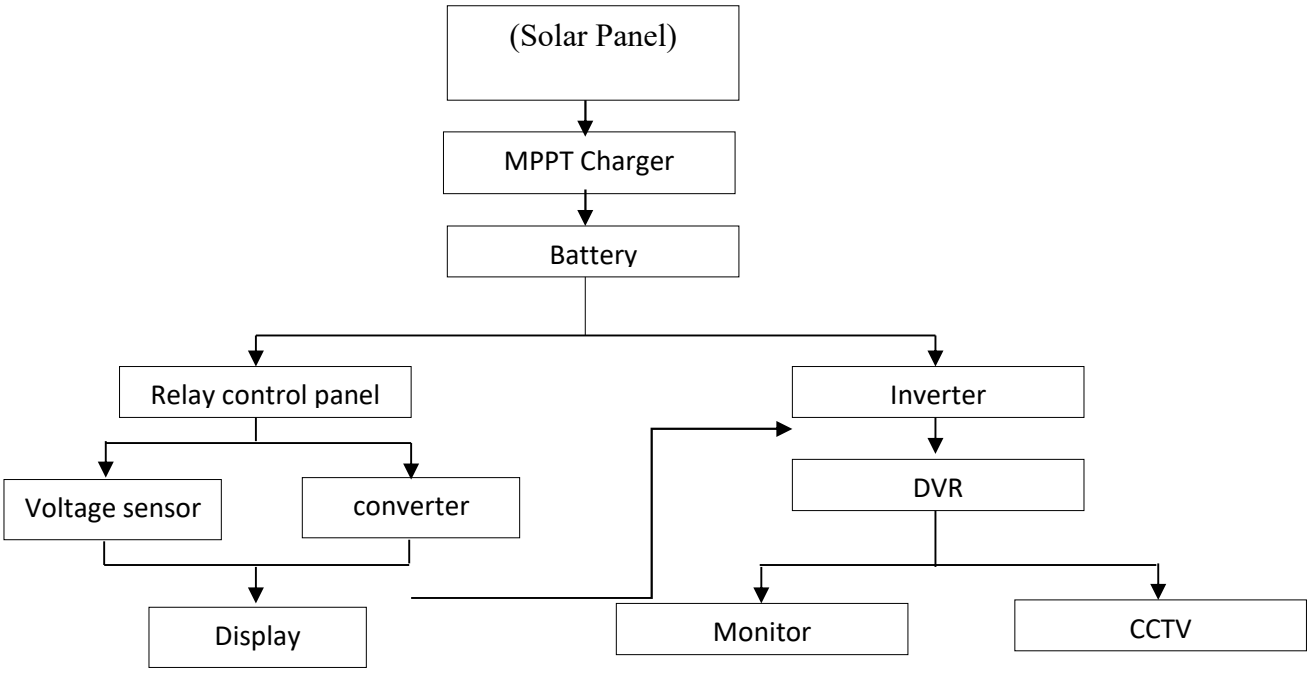



**Figure 7**. Workflow of the solar panel monitoring process as an energy source on CCTV

### Solar Panel Calculation

In this study will analyze the design of PLTS as the main energy source on centralized CCTV located at PT. Link Net.Tbk. The author by calculating the technical aspects to calculate the capacity of the PLTS system equipment used. The objectives to be achieved in this writing are:

Jurnal Scientia
Volume 13, Number 04, 2024, DOI 10.58471/ scientia.v13i04
ESSN 2723-7486 (Online)
https://infor.seaninstitute.org/index.php/pendidikan

1. Determining the capacity of CCTV system equipment and the ability of PLTS to generate energy at PT. Link Net.Tbk.
2. Calculate and analyze cost estimates

Generally, solar energy can be absorbed and converted into electrical energy 4 hours per day, How to calculate the solar cell to be used is by dividing the amount of load power by 4 hours. So that it produces the amount of Wp needed. 12 cameras require 108 Watts of power, while the DVR requires 24 Watts of power Total power = 132 Watts: 4 hours = 33 wp. So the solar cell we use is a solar cell = 100 Wp so that it does not drop when using the current source from the solar panel directly.

**Battery Calculation**

In terms of choosing the battery used, we must first know the amount of battery efficiency that we will use in building the PLTS, because the efficiency of each battery is different. In the Aki mobile battery, the efficiency is 40%, in the VLRA and Tubular batteries the efficiency is 80%, therefore we use tubular batteries which have greater efficiency. To calculate how much battery capacity will be used is by dividing the amount of power generated by the solar cell we use by the efficiency of the selected battery. Power generated = 100Wp × 4 hours = 400Wh.

$$x = \left(\frac{400}{8}\right) : 12$$
$$= 500 : 12$$
$$= 41.6 \text{ Ah}$$

**Battery Charging With Solar Panel Without Load**

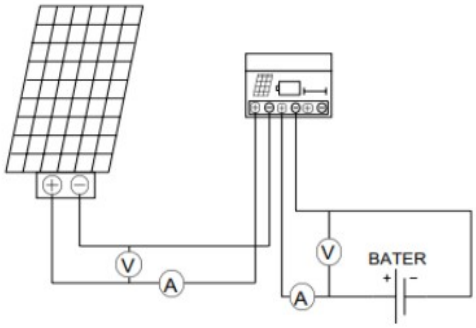
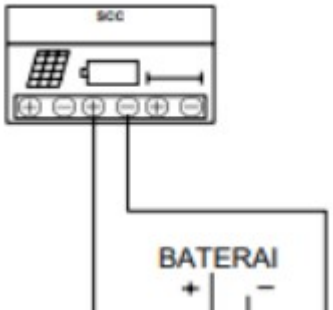



**Figure 8**. Battery Charging Process With Solar Panels

**Battery Charging With Load Without Solar Panel**



Jurnal Scientia
Volume 13, Number 04, 2024, DOI 10.58471/ scientia.v13i04
ESSN 2723-7486 (Online)
https://infor.seaninstitute.org/index.php/pendidikan

**Figure 9**. Battery Charging Process With Solar Panels

## Analysis results

After analyzing this thesis, the following conclusions can be drawn:

1. CCTV can only store recording data for 30 days, after which CCTV will start new recording data.
2. Based on the images obtained by the CCTV camera, it can produce Full HD image quality which will be clearly visible during the day and night.
3. The durability of CCTV without solar panels and with solar panels can turn on CCTV for 1 full day assuming that during the day the wasted energy is recharged after the battery is fully charged, it is directly connected to the inverter device to directly generate electrical energy, but with an initial battery capacity of 13.34 Volts if it is cloudy during the day, the battery is used as a substitute for the solar panel.
4. The voltage generated by a solar panel is directly proportional to the light intensity value obtained by the solar panel.
5. The working principle of solar cells in utilizing CCTV design using solar panels is primarily to make maximum use of sunlight captured by the module itself and stored by the battery.

## REFERENCES

Aryza, S., Pratama, S., & Ikbal, M. (2022). An Enhance System Smart Toilet Based On Recycle Green Control. *Infokum*, *10*(02), 1156-1163.

Firnandi, DF, Hakim, L., & Dyah, AI (2024). Analysis of the Use of Solar Panels as Alternative Energy (Doctoral dissertation, Majapahit Islamic University, Mojokerto)

Rivai, M., Sianturi, EV, & Iriani, J. (2021). Analysis and design of CCTV camera power capacity monitoring system using solar panels. Proceedings of the national conference on social & engineering polmed (concept), 2(1), 22-29.

Khatima, H., Arsyad, M., Hafid, A., Lateko, AAH, & Suryani, S. (2024). Design and construction of electrical power backup using solar energy. Vertex Elektro, 16(2), 7-14. Sun. Vertex Elektro, 16(2), 7-14.

Wijanarko, Y., & Faizi, MN (2024). Design of a solar power plant working system as a resource for an aeroponic plant system based on the internet of things. Teliska-journal of electrical engineering, Sriwijaya State Polytechnic, 17(II), 38-43.

Winardi, B., Nugroho, A., & Dolphina, E. (2019). Planning and Economic Analysis of Centralized Solar Power Plants (PLTS) for Independent Villages. Jurnal Tekno, 16(2), 1-11.

Tharo, Zuraidah, Siti Anisah, and Fatur Rahman. "Design of Solar-Wind Hybrid Power Plant (PLTH) as Learning Media." Multidisciplinary Synergy of Social Humanities and Science Technology 1.1 (2024): 169-182. (Panca Budi Development University)

Sembiring, Antonius. "Design and Construction of Solar Cell Module Surface Cooling System Using Water Sprinkling Method as an Effort to Increase Power Efficiency." (Panca Budi Development University)

Situmorang, George Eben Ezer. "Design of Hand Sanitizer Dispenser Using Solar Energy Source at Pancabudi Development University."

Iqbal, Muhammad. "Design and Construction of Hybrid Power Plant (Solar and Wind) as a Practical Media in the Laboratory of Pancabudi Development University."

Bambang, S. "Implementation of Automatic Sterilization Gate Using Solar Cell as Backup Power Supply at PT. Pertamina Ep Asset 1 Rantau Field Based on Microcontroller." (Panca Budi Development University)

Fernanda Purba, Dicky. "Design of Hybrid Power Supply as Energy Source in Smart Traffic Lights."(Panca Budi Development University)

Rahmat Hidayat, et al. 2017 Intekna Journal, Volume 17, No. 1 Solar Power Generation Module for Low Load Applications (600 W). ISSN 2443-1060.

Asep Muhamad Alipudin, et al. 2018 Design and Construction of an Internet of Things (IoT) Based Electricity Cost Monitoring Tool.

Vlado Damjanovski, CCTV Networking and Digital Technology, (2005). USA, Buterworth-Heineman

Retrieved December 01, 2024, from (https://jmhpower.com/product/30a-40a-50a-60a-70a-80a-100a-120a-mppt-solar-charger-controller/)

Retrieved December 01, 2024, from (https://www.qoltec.com/product/pure-sine-wave-solar-inverter-2500-40a)

Retrieved December 01, 2024, from (https://indonesian.lifepo4batterycells.com/sale-26138232-ups-lifepo4-lithium-battery-5kwh-10kwh-20kwh-grid-tied-solar-panel-system.html)