DESIGN AND ANALYSIS OF BUILDING CONSTRUCTION WITH EQUIPMENT GREEN ENERGY POWER PLANT BY HOMER METHOD

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ABSTRAK
Technology has been able to make a power generation system by utilizing solar radiation into electrical energy in the form of PLTS (Solar Power Plant). This article aims to design an off grid PLTS Building and Equipment’s with a capacity of 88 kWp to meet the electricity needs of the people of Kogholifano Village, Pasir Putih District, Muna Regency. Analysis of the performance of 88 kWp off grid solar power plant in kogholifano village was simulated using Software HOMER. The design of the PLTS begins by analyzing the existing 40 kWp PLTS of Kogholifano village. The technical and financial performance of the 88 kWp off-grid solar system was simulated via HOMER. The results of the analysis show that this system will provide electrical energy supply with an operating time of 24 hours / day.

Keywords: Building Design, HOMER, Kogholifano, Solar Power Plant

INTRODUCTION
The Indonesian government intends to construct a power plant utilizing 23% EBT in 2025, while NRE plants will contribute 75% of the 92.2 MTOE or 45.2 GW in 2050. Some remote and rural areas are unable to utilize all forms of renewable energy. Solar, wind, bioenergy, and hydropower are all excellent renewable energy sources for rural areas.

Indonesia electrifies using solar power 207.9 GW of EBT, 6.5 GW of new renewable energy in 2025, and 45 GW in 2050 at 22% of potential. Indonesia constructs 15,000 village PLTS. PLTS generates power in Kogholifano Village, Pasir Putih District, Muna Regency, Southeast Sulawesi.

THEORETICAL FOUNDATION
1. Solar Power Plant (PLTS)
According to SNI 8395:2017 Solar Power Plant (PLTS) is a power plant that Convert energy on modules Solar photovoltaics into electrical energy. [1] Photovoltaic systems convert solar radiation into electrical energy. The more intense coverage of the solar module system can produce maximum electrical energy.
PLTS powers small to large electrical loads in isolated and hybrid systems.

2. Main Components of Solar Power Plant
   a. Photovoltaic (PV) Modules

   Photovoltaic modules work when the sun begins to shine on solar cells. Chaya absorbed in the junction zone between type n and type p will produce free electrons. When the light has enough electron energy, it will pass through the electric field at the junction then move to silicon and then enter the external circuit. Electrical energy will be generated at the sometime it will pass through the external circuit. Intensity of solar radiation that reaches the surface of the PV module will determine the amount of electrical energy generated by the photovoltaic module.

   The number of PV modules required is obtained from dividing the hood of a PV capacity that must be met by the nominal power of one PV module (Pmax).

   \[ N_{\text{modu}} = \frac{\text{PV Capacity}}{P_{\text{max}}} \]

   The number of PV strings and PV modules in series per string must meet some criteria of the PV modules and inverters used. First, create a safe and recommended range of PV modules in series per string by creating the lower and upper bounds of the range and then, creating the maximum string limit per inverter.

   calculate the lower limit of PV modules in series (Min. N seri)

   The first lower limit is obtained from dividing the minimum PV voltage needed to produce MPP (with the PV voltage at maximum power (Wmp), \( V_{\text{PV-min}} \))

   \[ \text{Min.} \ N_{\text{seri}}(1) = \frac{V_{\text{PV-min}}}{V_{\text{mp}}} \]

   The second lower limit is obtained from dividing the minimum PV voltage needed so that the inverter can take PV power by the PV voltage at maximum power (Vmp). (\( V_{\text{PV-start}} \))

   \[ \text{Min.} \ N_{\text{seri}}(2) = \frac{V_{\text{PV-start}}}{V_{\text{mp}}} \]

   The third lower limit is obtained from dividing the minimum PV voltage required for the inverter to produce nominal power at MPP by the PV voltage at maximum power (Vmp). (\( V_{\text{PV-range}} \))

   \[ \text{Min.} \ N_{\text{seri}}(3) = \frac{\text{Min.} \ V_{\text{PV-range}}}{V_{\text{mp}}} \]

   Calculating the upper limit of PV modules in series (Max. N ser)

   The first upper limit is obtained from dividing the maximum voltage of the PV system by the open-circuit voltage of the PV module (Voc). (\( V_{\text{system-max}} \))

   \[ \text{Max.} \ N_{\text{seri}}(1) = \frac{\text{Max.} \ V_{\text{system-max}}}{\text{Voc}} \]

   The second upper limit is obtained from dividing the maximum PV voltage allowed by the inverter by the open-circuit voltage of the PV module (Voc). (\( V_{\text{PV-max}} \))

   \[ \text{Max.} \ N_{\text{seri}}(2) = \frac{\text{Max.} \ V_{\text{PV-max}}}{\text{Voc}} \]

   The third upper limit is obtained from dividing the maximum PV voltage so that the inverter produces nominal power during MPP with the open-circuit voltage of the PV module (Voc). (\( V_{\text{PV-range}} \))

   \[ \text{Max.} \ N_{\text{seri}}(3) = \frac{\text{Max.} \ V_{\text{PV-range}}}{\text{Voc}} \]

   b. Battery

   According to SNI 8395:2017, a battery is a device that converts kinetic energy into a more stable form of energy. Solar battery systems are used to store energy generated by PV modules during the day, which is then released at night or when the weather is erratic. Batteries are still used as an energy source while overcoming the difference between electricity supply and electricity demand. To determine the
The required number of batteries can be calculated using the following equation:

\[ N_{\text{batt}} = \frac{\text{Capacity battery}}{W_{\text{batt}}} \]

While the battery configuration, namely the number of parallel and series of batteries, must meet several criteria from the battery and battery inverter used, namely the range of batteries in series per parallel that is safe and recommended.

Calculating the lower limit of batteries in series (Min. \( N_{\text{batt-series}} \))

The first lower limit is obtained from dividing the minimum battery voltage allowed by the battery inverter (Min. \( V_{\text{bat-range}} \)) by the nominal voltage of the battery (\( V_{\text{batt}} \)).

\[ \text{Min. } N_{\text{batt-series}}(1) = \frac{\text{Min. batt - range}}{V_{\text{batt}}} \]

The second lower limit is obtained from one battery inverter (\( P_{\text{nom}} \)) with the multiplication between the maximum current of the inverter for charging/discharging (I_max) and the nominal voltage of the battery (V_batt).

\[ \text{Min. } N_{\text{batt-series}}(2) = \frac{P_{\text{nom}}}{I_{\text{max}} \times V_{\text{batt}}} \]

Calculates the upper limit of batteries in series (Max. \( N_{\text{batt-series}} \))

The upper limit is obtained by dividing the maximum allowable battery voltage of the battery inverter (Max. \( V_{\text{bat-range}} \)) by the nominal voltage of the battery (\( V_{\text{batt}} \)).

\[ \text{Max. } N_{\text{batt-series}} = \frac{\text{Max. } V_{\text{bat-range}}}{V_{\text{batt}}} \]

The number of parallel batteries required (\( N_{\text{parallel}} \)) is obtained by dividing the number of batteries (\( N_{\text{batt}} \)) by the number of batteries in series.

\[ N_{\text{parallel}} = \frac{N_{\text{batt}}}{N_{\text{batt-series}}} \]

Calculate the upper limit of the number of strings per inverter (Max. \( N_{\text{string-inv}} \))

The top B is first obtained from dividing the maximum short-circuit current of the PV string allowed by the inverter (\( I_{\text{SC PV-max}} \)) with short-circuit current PV module (I_{sc}).

\[ \text{Max. } N_{\text{string-inv}}(1) = \frac{I_{\text{SC PV-max}}}{I_{\text{sc}}} \]

The second upper limit is obtained from dividing the maximum current of the PV string allowed by the inverter by the current MPP of the PV module (\( I_{\text{PV-max}} \)).

\[ \text{Max. } N_{\text{string-inv}}(2) = \frac{I_{\text{PV-max}}}{I_{\text{imp}}} \]

c. Solar Charger Controller

Solar charger controller is a system of equipment that functions to control direct current entering the battery to be given to the load. This component will also control when overcharging (overcharging) and overvoltage from the PV module.

d. Inverter

Understanding inverters based on SNI 8395: 2017 is one of the compounds that functions to convert direct current (DC) into alternating current (AC). The number of battery inverters required is obtained from dividing the capacity of the battery inverter that must be met (battery capacity) by the nominal output power of one battery inverter (\( P_{\text{nom}} \)).

\[ N_{\text{inv-batt}} = \frac{\text{Kapasitas Inverter Baterai}}{P_{\text{nom}}} \]

3. Centralized Solar Power Plant Work Configuration

There are two work configurations commonly used in centralized PLTS, namely DC coupling and AC coupling.

**DC coupling**

**Figure 2. System DC Coupling**

A system is considered to have a DC-coupling configuration if its main components are connected on the DC bus. Electric power is generated by photovoltaic modules and used to charge batteries through a solar charge controller. SCC is a DC-DC converter to lower the voltage of the photovoltaic module to the battery voltage level which is also equipped with a maximum power point tracker (MPPT) to optimize energy capture. In the daytime, with sufficient sunlight radiation, the battery is charged to reach the state of charging (SoC, state of charge) the maximum. As the demand for electricity increases until the load exceeds the power of the connected photovoltaic array, the battery inverter will channel energy from the battery to the load and will stop operating when the battery SoC reaches the minimum limit. In daylight, with sufficient sunlight radiation, the battery is charged to achieve maximum state of charge (SoC). As electricity demand increases until the load exceeds the array power photovoltaic connected, inverter the battery will channel energy from the battery to the load and will stop operating when the battery SoC reaches the minimum limit.

AC coupling

The main component that can distinguish between AC coupling systems and DC couplings is located in the network inverter. In AC coupling models, the PV module is connected to a grid inverter where the voltage is converted from DC to AC. In this system, the power from the PV module circuit can be directly used by daytime loads and the excess electrical energy can be used for charging batteries with parallel models.

HOMER

HOMER is software that is often used to simulate various forms of new and renewable energy power plants. HOMER was invented by The National Renewable Energy Laboratory (NREL) USA in collaboration with Mistaya Engineering, where the copyright is protected by the Midwest Research Institute (MRI).

![HOMER Display Window](image)

**Figure 4. HOMER Display Window**

HOMER works based on 3 processes, namely simulation, optimization and sensitivity analysis. The three processes work sequentially and have their respective functions, so that optimal results are obtained.

SIMULATION

Simulation is the process of creating models or representations of systems, processes, or phenomena in the real-world using software or tools that produce results similar to those expected in the real world. Simulations are typically used to test theories, develop designs, or evaluate system performance without having to conduct direct trials on actual physical systems. In simulations, users can modify system parameters and conditions to see how those changes affect system results or performance. For example, simulations can be used to model the effects of climate change on agriculture or changes in traffic flow on highways. Simulation can be done using different types of software or tools, depending on the type of system you want to model. Some common types of simulations include computer simulations, physical simulations, and virtual simulations.
OPTIMIZATION

The optimization process is a method to find the best or most optimal solution of a problem or system by maximizing or minimizing certain objective functions and meeting a number of existing limitations or constraints. In the optimization process, there are one or several variables that can be modified to achieve an optimal solution. Such variables are called design variables and their goal is to achieve the best value of a predetermined objective function. For example, in production optimization, design variables can be the number of raw materials, the number of workers, and the production time used to produce a product. The optimization process involves two main stages, namely the planning stage and the implementation stage. The planning phase includes identifying design variables, objective functions, and existing constraints, as well as determining the optimization strategy to be used. The implementation phase includes testing the optimization strategy and evaluating the optimal solution found.

SENSITIVITY ANALYSIS

Sensitivity analysis is the process of evaluating how variations in the inputs or parameters of a model or system affect the results or outputs of that model or system. Sensitivity analysis helps understand the degree of uncertainty in a model or system and identify which parameters have the greatest impact on results or outputs. In sensitivity analysis, some input values or parameters of a model or system are changed within a certain range to measure their effect on results or outputs. Once input or parameter values are changed, the results or outputs of the model or system are measured and analyzed to determine the impact of changes in inputs or parameters on results or outputs.

RESEARCH METHODOLOGY

The methodology carried out in this study is to use Homer Software. The data needed in this study was obtained through direct observation and measurement at the research location of Kogholifano Village, Pasir Putih District, Muna Regency. There are also some data obtained directly via the internet such as location coordinates and solar irradiation. The data collected are as follows: Location coordinate data of Kogholifano Village, Daily electricity load data, Component specification data.

Steps to design and simulate a PLTS system using HOMER software: Determine the components of the solar system consisting of photovoltaic, batteries, converters, and control systems. Enter location coordinate data. Enter solar irradiation data.

1. Input the daily electricity load of Kogholifano Village.
2. Bis the part of each component and parameters are specified for component input.
3. Set the value of the input parameter of economic factors.
4. Perform system simulations and calculations.
5. Get optimization results.

IV. RESULTS AND DISCUSSION

A. Location Overview
Geographically, Kogholifano Village is located on Kogholifano Island 39° 05 S and 245° 55 E with elliptical physical characteristics that extend from west to east with a land height of 2-9 meters above sea level, and the beach conditions are partly rocky.

Figure 5. Kogholifano Island
Daily Electrical Load Profile

Figure 6. Daily Electrical Load Kogholifano

In general, people in Kogholifano Village only use electricity for lighting purposes.

Determination of Solar Components

The number of PV modules required is obtained from dividing the PV capacity that must be met (PV capacity) by the nominal power of one module PV (Pmax).

\[ N_{modul} = \frac{Kapasitas PV}{P_{max}} \]

\[ = \frac{86379 \text{ Wp}}{200} = 431.89 \rightarrow 432 \text{ modul} \]

Table 1. Selected module specifications

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Maximum Power (Pmax)</td>
<td>200 Wp</td>
</tr>
<tr>
<td>Voltage at Max. Power (Vmp)</td>
<td>25.15 V</td>
</tr>
<tr>
<td>Current at Max. Power (Imp)</td>
<td>8 A</td>
</tr>
<tr>
<td>Open Circuit Voltage (Voc)</td>
<td>30 V</td>
</tr>
<tr>
<td>Short-Circuit Current (Isc)</td>
<td>8.8 A</td>
</tr>
<tr>
<td>Max. System Voltage (V_{system,max})</td>
<td>1000</td>
</tr>
</tbody>
</table>

The number of inverters needed is obtained from dividing the capacity of the battery inverter that must be met (battery capacity) by the battery energy capacity per cell (W_{batt}).

\[ N_{batt} = \frac{Kapasitas Baterai}{W_{batt}} \]

\[ = \frac{440096 \text{ W}}{2 \times 1000 \text{ Ah}} = 222.048 \rightarrow 223 \text{ sel} \]

In this case study, the energy storage system chosen is a battery OpzV 2v/1000 Ah.

Table 2. Battery Inverter Specifications

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery Voltage Range ( (V_{batt-range}) )</td>
<td>2 V</td>
</tr>
<tr>
<td>Max. Charging/Discharging Current ( (I_{max}) )</td>
<td>1000 Ah</td>
</tr>
<tr>
<td>Rated Power</td>
<td>4600 W</td>
</tr>
</tbody>
</table>

Table 3. Product Specification of OpzV 2v/1000 Ah Battery

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Voltage ( (V_{batt}) )</td>
<td>2 V</td>
</tr>
<tr>
<td>Energy ( (W_{batt}) )</td>
<td>1000 Ah</td>
</tr>
<tr>
<td>Maximum Discharge ( (A) )</td>
<td>3,800 A</td>
</tr>
</tbody>
</table>

Configuration Determination

1. PV System Configuration

The number of PV strings and PV modules in series per string must meet the criteria of the PV modules and inverters used. First, create a safe and recommended range of PV modules in series per string by creating the upper and lower bounds of the range. Then create the maximum upper limit of strings per inverter.

2. Calculating the lower limit of PV modules in series (Min. Nseri)

The first lower limit is obtained from dividing the minimum PV voltage required to produce MPP (by the PV voltage when the power is maximum \( V_{PV-min} \))(Wmp).
The second lower limit is obtained from dividing the minimum PV voltage required for the inverter to take PV power by the PV voltage when the power is maximum \((V_{PV-\text{start}})/(V_{mp})\).

\[
\text{Min. } N_{\text{seri}}(1) = \frac{V_{PV-\text{min}}}{V_{mp}} = \frac{600 \text{ V}}{25.15 \text{ V}} = 23.85 \rightarrow 24 \text{ modul}
\]

The third lower limit is obtained from dividing the minimum PV voltage required for the inverter to produce nominal power at MPP with PV voltage at maximum power \((V_{PV-\text{range}})/(V_{mp})\).

\[
\text{Min. } N_{\text{seri}}(2) = \frac{V_{PV-\text{max}}}{V_{mp}} = \frac{188}{25.15} = 7.47 \rightarrow 8 \text{ modul}
\]

3. Calculating the upper limit of PV modules in series \((\text{Max. } N_{\text{seri}})\)

The first upper limit is obtained from dividing the maximum voltage of the PV system by the open-circuit voltage of the PV module \((V_{system-\text{max}})/(V_{oc})\).

\[
\text{Max. } N_{\text{seri}}(1) = \frac{\text{Max. } V_{\text{system-\text{max}}}}{V_{oc}} = \frac{1000}{30.00} = 33.33 \rightarrow 34 \text{ modul}
\]

The second upper limit is obtained from dividing the maximum PV voltage allowed by the inverter by the current current MPP of the module \((I_{PV-\text{max}})/(I_{mp})\).

\[
\text{Max. } N_{\text{seri}}(2) = \frac{\text{Max. } V_{PV}}{V_{oc}} = \frac{33}{8} = 4 \text{ modul}
\]

Based on the calculations above, we get the range of PV modules in series and the maximum number of PV strings per inverter as follows:

\[
N_{\text{string}} = \frac{N_{\text{modul}}}{N_{\text{seri}}} = \frac{432 \text{ modul}}{22 \text{ modul}} = 20 \text{ string (22 \text{ string / inverter})}
\]

So, the PV PLTS system has 432 PV modules and 5 PV inverters with a configuration of 20 PV strings and 22 modules in series per string. Configuration of PV string on inverter:
Inverter with 20 PV string input.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Nilai</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. PV Input Voltage ($V_{PV-max}$)</td>
<td>1000 V</td>
</tr>
<tr>
<td>Min. PV Input Voltage ($V_{PV-min}$)</td>
<td>150 V</td>
</tr>
<tr>
<td>Start-up Input Voltage ($V_{PV-start}$)</td>
<td>188 V</td>
</tr>
<tr>
<td>MPP Voltage Range for Nominal Power ($V_{PV-range}$)</td>
<td>240 – 800 V</td>
</tr>
<tr>
<td>No. Of independent MPP inputs ($N_{mppt}$)</td>
<td>2</td>
</tr>
<tr>
<td>Max. Number of PV string per MPPT ($N_{string/mppt}$)</td>
<td>3</td>
</tr>
<tr>
<td>Maximum PV Input Current ($I_{PVmax}$)</td>
<td>33 A</td>
</tr>
<tr>
<td>Maximum DC Short-Circuit Current ($I_{SC PVmax}$)</td>
<td>43 A</td>
</tr>
<tr>
<td>AC output Power ($P_{inverter}$)</td>
<td>15 kW</td>
</tr>
</tbody>
</table>

Energy storage system configuration

The number of parallel and batteries in series per parallel must meet several criteria of the battery and battery inverter used, namely the safe and recommended range of batteries in series per parallel.

Calculating the lower limit of batteries in series (Min. Nbatt-seri)

The first lower limit is obtained from dividing the minimum allowable battery voltage of the battery inverter (Min. Vbat-range) by the nominal voltage of the battery (Vbatt).

$$Min. N_{batt-seri}(1) = \frac{Min. batt - range}{V_{batt}} = \frac{48}{2} = 24 \text{ baterai}$$

The second lower limit is obtained from one battery inverter (Pnom) with the multiplication between the maximum current of the inverter for charging/discharging (Imax) and the nominal voltage of the battery (Vbatt).

$$Min. N_{patt-seri}(2) = \frac{P_{nom}}{I_{max} \times V_{batt}} = \frac{6000}{110 \times 2} = 27.27 \rightarrow 28 \text{ baterai}$$

Calculates the upper limit of batteries in series (Max.Nbatt-series)

The upper limit is obtained from dividing the maximum allowable battery voltage of the battery inverter (Max. Vbatt-range) by the nominal voltage of the battery (Vbatt).

$$Max. N_{batt-seri} = \frac{Max. V_{batt-range}}{V_{batt}} = \frac{63}{2} = 31.5 \rightarrow 32 \text{ baterai}$$

The batteries in the series should be in the range of 24 – 32 batteries, however, the operating voltage of the battery should not be close to the minimum voltage. In this design, a battery operating voltage of 50 V is selected so that the number of batteries in the selected series is 25 cells. Therefore, 1 battery bank has a capacity of 2 V 1000 Ah 25 units, or equivalent to 50 kWh / bank × ×.

The number of parallel batteries required (Nparallel) is obtained by dividing the number of batteries required (Nbatt) by the number of batteries in series.

$$N_{parallel} = \frac{Nbatt}{N_{batt-seri}} = \frac{223}{25} = 8.92 \rightarrow 9 \text{ parallel}$$

Because this system uses 9 battery inverters, each inverter will be connected to 1 battery bank containing 25 battery cells.

Kogholifano Village Solar System Design

Based on the determination of the main components and the results of calculations and system configuration drawings, the following is a summary of the design of the Kogholifano Village Standalone Solar Power Plant system.
Table 5. Needs of Standalone Solar Design Components

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PV Module</strong></td>
<td></td>
</tr>
<tr>
<td>PV Module Capacity</td>
<td>200 Wp</td>
</tr>
<tr>
<td>Cell Type</td>
<td>Polycrystalline</td>
</tr>
<tr>
<td>Number of Modules per String / Total String</td>
<td>22 / 20</td>
</tr>
<tr>
<td>Total Number of Modules</td>
<td>440</td>
</tr>
<tr>
<td><strong>Inverter</strong></td>
<td></td>
</tr>
<tr>
<td>Inverter Capacity</td>
<td>15 kW</td>
</tr>
<tr>
<td>Types of Inverters</td>
<td>String PV Inverter</td>
</tr>
<tr>
<td>Number of Inverters</td>
<td>5</td>
</tr>
<tr>
<td><strong>Battery</strong></td>
<td></td>
</tr>
<tr>
<td>Battery Used</td>
<td>OpzV 2V</td>
</tr>
<tr>
<td>Battery Capacity</td>
<td>1000 Ah</td>
</tr>
<tr>
<td>Battery Type</td>
<td>Lead-Acid</td>
</tr>
<tr>
<td>Number of Series / Parallel Batteries</td>
<td>25 / 9</td>
</tr>
<tr>
<td>Total Number of Battery Modules</td>
<td>225</td>
</tr>
<tr>
<td><strong>Battery Inverter</strong></td>
<td></td>
</tr>
<tr>
<td>Battery Inverter Capacity</td>
<td>6 kW</td>
</tr>
<tr>
<td>Number of Battery Inverters</td>
<td>9</td>
</tr>
</tbody>
</table>

HOMER Analysis Results

Solar radiation data is obtained from NASA's official website using HOMER Software which has direct access to the official website of the American space agency NASA Union.

The results of the simulation of electrical energy production at HOMER, the total production of standalone 88 kWp PLTS Kogholifano Village is 128,344 kW / year with a total annual electricity load of 58,699 kW / year.

For one year PV produces a total electrical energy production of 128,344 kWh / year. the operating time of PV components is 4,423 hours/year with the maximum output produced is 75.0 kW. Where the average value of output per day is 352 kWh / day.

Figure 8. Radiasi Sun Village Kogholifano

In simulation, the nominal capacity of the battery is 632 kWh while the nominal capacity of the battery used is around 505 kWh. With 75.4 hours autonomy so that the battery can serve loads for two days without recharging.

Figure 10. PV Component Output Graph

The inverter operates with a vulnerable time of 5,046 hours / year with a maximum output of 20.4 kW.

Figure 12. Inverter Rectifier Output Graph
Operating time as a rectifier is battery charging by PV as much as 3,714 hours/year. It can also be seen that the input energy value is 33,223 kWh/year and the output energy is 31,562 kWh/year so that the loss value ranges from 1,661 kWh/year.

**Figure 13. Grafik Output Rectifier Inverter**

**V. CONCLUSION**

Standalone topology solar power generation system with 88 kW PV configuration with include inverter, 2V 1000 Ah 225 battery, 54 kW battery inverter will be able to meet 24-hour electricity needs in Kogholifano Village with an average daily load requirement of 160.82 kWh/day. The average electrical energy production of the 40 kWp Existing PLTS in Kogholifano Village per year 2021 is 35.7 kWh/day. So that it is no longer able to meet the needs of the electricity load of the people of Kogholifano Village which reaches 160.82 kWh/day. With a daily load consumption of 160.82 kW/day and an average solar radiation of 5.10 kWh/m²/day, the results of the HOMER simulation for the Standalone Solar Power Plant system in Kogholifano Village produce a total of 128,344 kWh/year of electrical energy.

**BIBLIOGRAPHY**


