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Techno-Economic Assessment and Optimization of a Standalone System in Sebira Island, Indonesia

Laili Farah[1*] **, Yus Rusdian Akhmad**[1] **, Rezky Mahardika Saryadi**[2]**, Amil Mardha**[1]**, Mudjiono**[1]**, Nuryanti**[1]**, Kurnia Anzhar**[1]**, Airine Hijrah Handayani**[3]

[1] *Research Center for Nuclear Reactor Technology, National Research and Innovation Agency, Gedung B.J. Habibie, Jl. M.H. Thamrin No. 8, Jakarta Pusat 10340, Indonesia*

[2]*Directorate of Nuclear Facility Management, National Research and Innovation Agency, Gedung B.J. Habibie, Jl. M.H. Thamrin No. 8, Jakarta Pusat 10340, Indonesia*

[3]*Research Center for Nuclear Beam Analytics Technology, National Research and Innovation Agency, Gedung B.J. Habibie, Jl. M.H. Thamrin No. 8, Jakarta Pusat 10340, Indonesia*

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A B S T R A C T

Nuclear power is known as a baseload generator in a centralized power network, but its implementation is too large for microgrid applications. Despite this challenge, nuclear power is being considered a potential source of electricity for microgrid applications due to its ability to produce emission-free energy. In order to explore the feasibility of hybrid renewable energy generation with nuclear in Sebira Island, this research discusses the techno-economic analysis and optimization of a hybrid energy system design on Sebira Island, Indonesia, using a multi-year module in HOMER Pro software. Two scenarios were created: diesel-PV-battery and nuclear-PV-battery, with the baseline system being a diesel generator (DG) only. The research results show that with the optimal use of the nuclear-PV-battery system, the levelized cost of electricity (COE) is \$0.128. This value is lower compared to the first scenario with a COE of \$0.6577. The CO_2 emissions generated in the optimal nuclear-PV-battery system are zero, making this system far more viable than other hybrid system schemes.

1. INTRODUCTION[*]

The provision of electricity for communities residing on isolated islands is one of the challenges that must be addressed. Microgrids have emerged as a solution for communities to gain access to electricity. The development of microgrids is currently on the rise, both in developed and developing countries.

Microgrids typically use fossil fuels as a source of electricity. However, with the decreasing cost of renewable energy technologies and energy storage, the options for communities are now wide open to choose low-carbon microgrid systems. However, the potential of renewable energy sources such as solar (photovoltaic / PV) and wind depends on the conditions of the location. Intermittency poses another limitation for PV and wind turbine

[*] Corresponding author.
E-mail:lail006@brin.go.id
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generation systems, so the solution is to use energy storage.

Nuclear energy, as a baseload generator in centralized grid systems, is too large for microgrid systems in remote islands. Generator Energi Mikro (GEM) is a micro-power generator that utilizes aneutronic fusion processes. Aneutronic fusion is a fusion reaction that does not produce neutrons. Neutrons are neutral particles with significant mass. Neutrons can easily penetrate materials, leading to radiation and radioactive contamination

GEM has several advantages compared to other fusion reactions, namely: (1) safer, as it does not produce neutrons, (2) easier to convert reaction energy into electrical energy, (3) more efficient, as it generates more energy per unit mass of fuel.

Aziz et al. [1] proposed a new dispatch strategy in the HOMER-MATLAB Link Controller for an isolated wind/diesel/battery hybrid energy system (HES). This is because two control strategies (load following and cycle charging) in HOMER are challenging to implement in countries with continuously fluctuating fuel prices. Shiwei Yu et al. [2] conducted a review of various papers related to decision-making optimization problems, models, and solution methods throughout the Renewable Energy Development and Utilization Chain (REDUC) process.

Babayomi et al. [3] reviewed various studies discussing mini-grids in Sub-Saharan Africa (SSA). The results show that since 2010, the rural electrification rate in SSA has increased from 17% to 28%, and there are 11 million mini-grid connections currently in operation. Lovering [4] investigated how microreactors could be implemented alongside fossil fuels and renewables in a microgrid system using HOMER. Sanni et al. [5] studied the techno-economic aspects of a hybrid energy system (HES) PV/diesel/biogas for unreliable grid electricity in Nigeria using HOMER. The results indicate that a diesel generator would not reduce the associated cost implications.

Oladigbolu et al. [6] investigated the techno-economic feasibility of a hybrid PV/wind/diesel/battery system in Northern Nigeria based on minimum net present and energy costs using HOMER. Simulation results showed that the optimal scheme had the lowest emission rate, with an Levelized Cost of Electricity (LCOE) of \$0.259/kWh. Sayeed [7] examined gaps between load profile design approaches using demand side management (DSM) and system categorization based on energy balance and performance. The author utilized HOMER supplemented by fuzzy logic.

Wicaksana et al. [8] studied the implementation of a Hybrid Energy System (HES) on Sebira Island using PV/diesel/battery with HOMER, and the results showed a PV fraction reaching 70%. Pecenak et al. [9] investigated how two approaches solve economic planning problems in designing a low-carbon and resilient future grid. The methods employed are the Forward-Looking model and the Adaptive method.

Jamnani [10] studied the techno-economic and environmental aspects of Hybrid Renewable Energy Systems (HRES) and hydrogen for three islands in Eastern Canada using HOMER. The results showed that the HRES scheme could power 50 households and 50 electric cars. Bawonda and Adefarati [11] investigated the solar energy potential in six different locations in Nigeria to reduce greenhouse gas emissions using HOMER. Simulation results indicated Sokoto as the most optimal area for solar energy-based power solutions investment in Nigeria.

Chong Li et al. [12] studied the feasibility of an HES in a village in China using HOMER with multi-year analysis. The result was the lowest LCOE obtained at \$0.378/kWh with a scheme involving a PV-wind turbine (WT)-diesel generator (DG)-battery system. Mohammadi and Gezegin [13] investigated the performance of three HRES for remote areas in Afghanistan using HOMER and then evaluated them using the Simplex algorithm.

Al-Khaykan et al. [14] investigated the optimal size of a grid-connected PV/battery system for residential areas in Karbala, Iraq, using HOMER. The results showed that the optimal system utilized the cycle charging control strategy. Jahangir et al. [15] studied the feasibility of HRES for supplying energy in tourism areas in Iran using HOMER, and the best scheme involved the hybrid PV/WT/battery (Bat)/DG/biogas generator (BG), and grid/PV/WT.

Wassie and Ahlgren [16] studied the long-term cost-optimal capacity expansion planning (CEP) that satisfies the required load, reliability, and other system constraints with the lowest cost using HOMER with the multi-year module. Khairurraziq et al. [17] investigated the techno-economic aspects of HRES PV/diesel for the community on Sebira Island, and the results showed that by using the PV/diesel system scheme, the cash flow can be saved up to 3.4 billion Rupiah.

Dibyendu [18] studied six different configurations of HRES to assess their techno-economic feasibility using the HOMER software. The results showed the lowest LCOE was \$0.31/kWh. Kumar et al. [19] analyzed the techno-economic aspects of various energy source scenarios, such as solar PV and a food waste-based biogas plant, with a DG as backup. The simulation, using HOMER, indicated that PV contributes the most to supplying electricity in that area.

Faraji et al. [20] investigated a novel method for the optimal design of grid-connected microgrids based on long-term load demand forecasting using Artificial Neural Networks (ANN) for time series load prediction. The method was then continued using HOMER to assess the feasibility of the microgrid in Tehran, Iran. Odetoye et al. [21] studied a multi-source standalone renewable microgrid using the multi-year module in the HOMER software. The objective was to assess the feasibility of HRES in a rural but rapidly commercializing community in Nigeria.

Chebabhi et al. [22] assesses the feasibility of three configurations of HRES microgrid at an Algerian site based on investment cost and the total power generation required using HOMER software. Putri [23] studied the use of batteries to maximize the electricity production supplied by a PV system using PVSyst software. The simulation results showed that the optimum battery size is 816 units with a total capacity of 1,632 kWh, and after optimizing the PV system, the system can reduce diesel usage on Sebira Island.

Prawitasari and Garniwa [24] studied the techno-economic feasibility of three different system configurations on seven small islands in the Thousand Islands, Indonesia. The software used was HOMER, and the simulation results showed that the most optimum configuration was PV/battery/diesel. Iweh et al. [25] investigated the optimization of HRES using HOMER and then validated it using genetic algorithm (GA) for rural areas in Cameroon. The system configuration was off-grid solar PV/hydro power. The analysis results showed that the GA method provided more hydro power generation compared to the HOMER method.

In literature reviews, it is shown that there are several studies related to techno-economic aspects using both single-year and multi-year modules in HOMER. Therefore, this study will focus on the technical, economic, and environmental optimization design of a hybrid energy system incorporating nuclear options, with a focus on Sebira Island, Indonesia.

2. DATA AND METHODS

2.1 Description of study area

Sebira Island is the outermost and northernmost island in the Kepulauan Seribu. This island (Figure 1) is located in the North Kepulauan Seribu District, precisely in Pulau Harapan Village. The island has an area of about 88,200 m^2, inhabited by 542 people with 177 households and a total of 165 residential houses. The distance from Sebira Island to the nearest point in Jakarta, Marina Ancol, is 109 km.

Fig. 1. Sebira island in Kepulauan Seribu

In Sebira island, 22% of the population are fishermen, 3.1% are entrepreneurs, 9% are employees and laborers, 0.4% are civil servants, and the remaining 65.3% are housewives, the elderly, and children. In terms of infrastructure, Sebira Island has various facilities such as the provision of clean water using Sea Water Reverse Osmosis (SWRO) and Brackish Water Reverse Osmosis (BWRO), wastewater management, coastal protection with breakwaters and embankments, as well as electricity facilities supplied by diesel generators and solar power plants.

2.2 HOMER Pro Software

One tool for planning, evaluating, and improving renewable energy systems is the HOMER Pro program. This software, which was created by HOMER Energy LLC, is intended to help users create energy systems that are both sustainable and efficient by utilizing renewable energy sources like solar, wind, hydro, and energy storage.

Some features of HOMER Pro include the ability to design renewable energy systems, economic analysis, system optimization, integration of energy storage, time-based simulation covering daily, monthly, and yearly periods, scalability adjustments from very small to large-scale energy projects, and more. This software is highly valuable for energy planners, engineers, and project developers when designing a system holistically.

2.3 Resource data analysis

The NASA Prediction of Worldwide Energy Resource (POWER) database provides monthly average solar global horizontal irradiance (GHI) and clearness index (CI) data for selected locations over a period of 22 years (July 1983 – June 2005). Monthly GHI and CI data for Sebira Island are shown in Figure 2, where the annual average GHI is

5.08 kWh/m2/day, while the annual average CI is 0.510.

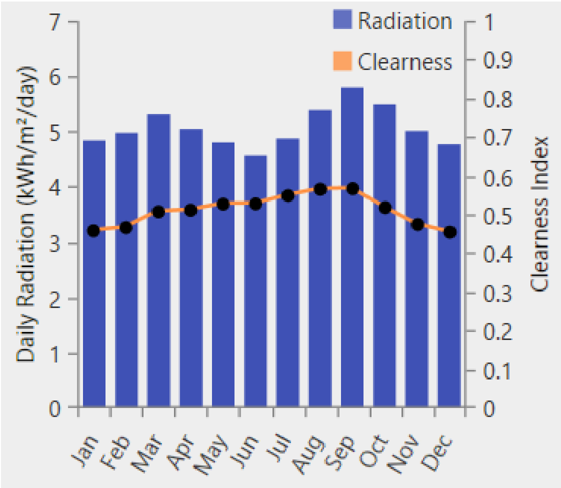


Fig. 2. Data global horizontal irradiance (GHI) and clearness index (CI)

The monthly average air temperature data for Sebira Island were obtained from the NASA POWER database over a period of 30 years (Jan 1984 – Dec 2013). Figure 3 shows that the annual average temperature on Sebira Island is 27.58 °C.

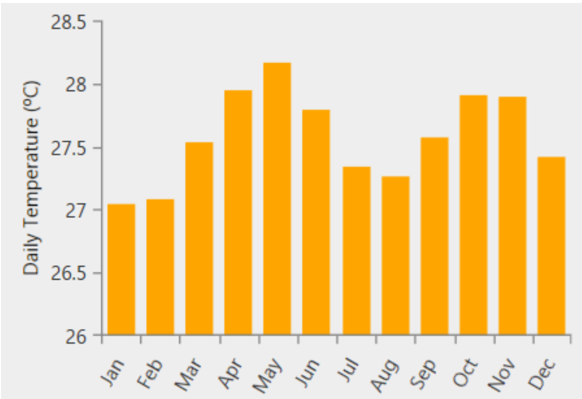


Fig. 3. The annual average temperature (°C) in Sebira island

2.4 Load data

The electrical load in this study is the electricity demand data to supply the residential needs of the residents. The electricity load data for supplying industrial and other needs are not considered in this study as they are served by specific PVs.

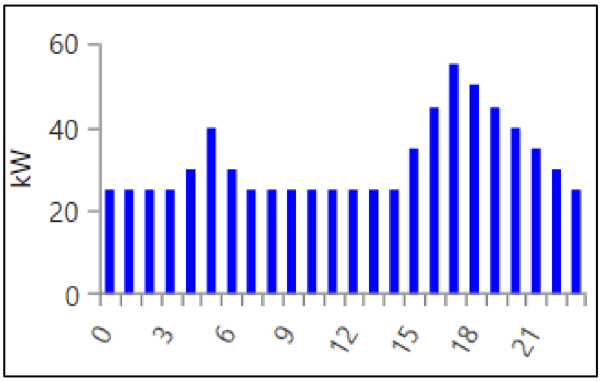


Fig. 4. Load profile in Pulau Sebira

Figure 4 shows the average annual demand on Sebira Island is 760 kWh/day, and its peak load demand is 63.93 kW. A 5% day-to-day and 3% time step random variation were used to create a realistic load profile.

2.5 Hybrid system configuration and components

2.5.1 Hybrid system configuration

This study explores the techno-economic aspects of an off-grid energy system on Sebira Island. Optimization design, technical analysis, economic evaluation, and environmental assessment were conducted using HOMER Pro software. The project lifetime in this study is 25 years, with discount rates of 6% and 8%, while the assumed inflation rates are 2.6% and 3%.

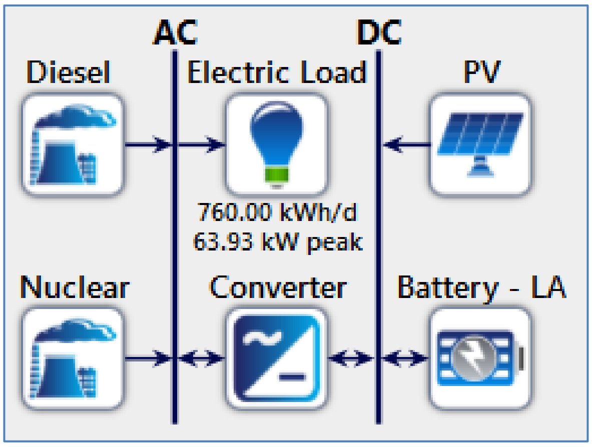


Fig. 5. The schematic of the stand alone hybrid PV-DG-nuclear-battery system

The considered stand alone hybrid PV-DG-nuclear-battery system consist of PV modules, diesel generator, nuclear reactors, batteries, and converters as shown in Figure 5. Nuclear reactors and DG are connected by an AC bus. The AC and DC bus are connected by by a directional converter.

2.5.1 Diesel generator

The standalone diesel generator system on Sebira Island currently consists of 2 x 250 kVA and 1 x 125 kVA generators. However, since 2017, the 125 kVA unit has not been operational due to the high electricity demand. In this study, it is assumed to be one generator unit because it has the same specifications and operational schedule, from 15:00 to 09:00. Detailed data on the parameters of the diesel generator components are shown in Table 1.

Table 1. Technical and cost data of the DG

Parameter Diesel	Specification
Capital cost ($/kW)	245
Replacement cost ($/kW)	245
O&M cost ($/kW.hour)	0.03
Fuel price ($/L)	0.95
Lifetime (hours)	87560

2.5.2 PV array

The electrical system on Sebira Island uses 1214 units of PV modules with a capacity of 330 Wp, divided into 2 panels. Watt peak (Wp) refers to the maximum power that can be generated by the system under optimal conditions or when sunlight or wind reaches the highest intensity. The first PV panel consists of 640 units with a total capacity of 211,200 Wp to meet residential needs. Meanwhile, the second PV panel, consisting of 574 units, is used to meet the needs of facilities such as SWRO, BWRO, and so on.

In this study, the focus is only on the load in the first cluster, which is for residential needs, so only the first PV panel is analyzed. Table 2 shows the parameter data for the PV array used.

Table 2. Technical and cost data of the PV arrays

Parameter PV	Specification
Capital cost ($/kW)	1200
Replacement cost ($/kW)	1200
O&M cost ($/kW.hour)	12
Deteriorating factor (%)	88
Lifetime (years)	25

2.5.3 Battery

This study uses lead-acid batteries with the OPzV 2V 1000Ah type. The battery has a capacity of 480 kWh, consisting of 240 units. Table 3 shows its detailed properties.

Table 3. Technical and cost data of the batteries

Parameter Battery	Specification
Capital cost ($/kW)	250
Replacement cost ($/kW)	250
O&M cost ($/kW.hour)	5
Throughput (kWh)	3,509
Lifetime (years)	25

2.5.4 Converter

A converter is required to convert direct current (DC) from PV into alternating current (AC). The efficiency of the converter (η_c) is calculated using the equation below. P_{co} is the output power of the converter (kW), and P_{ci} is the input power of the converter (kW).

$$\eta_c = \frac{P_{co}}{P_{ci}} \tag{1}$$

The capital cost is $600/kW, the replacement cost is assumed to be $600/kW, and the O&M cost is assumed to be $10/kW/year. The efficiency is 95%

2.5.5 Nuclear reactor (GEM)

Due to the absence of nuclear component options in HOMER, this study will use the generator model method. Nuclear is modeled as a diesel generator where the heating rate and fuel price need to be specified beforehand. In the GEM reactor of this study, the fuel price is assumed to be very small, so it is considered to be included in the O&M cost. The capital cost and replacement cost are assumed to be $500/kW. O&M cost is assumed to be $0.028/kW/hour. The table below shows its detailed properties.

Table 4. Technical and cost data of the reactor

Parameter Nuclear	Specification
Capital cost ($/kW)	500
Replacement cost ($/kW)	500
O&M cost ($/kW.hour)	0.028
Size (kW)	0-60, 15 interval
Lifetime (hours)	87,660

2.5.6 Evaluation model

The most crucial economic parameters in the optimization process are the total net present cost (NPC) and the LCOE. NPC reflects the present value of all costs and revenues that occur during the project's system life subtracted by the benefits obtained.

$$NPC = IC + FC + OM + \sum_{t=1}^{n} \frac{c_t}{(1+r)^t} \qquad (2)$$

LCOE is the average cost per unit of energy produced by the system. $E_{primary}$ is the total annual amount of primary load

$$LCOE = \frac{NPC_{total}}{E_{primary}} \qquad (3)$$

2.5.7 System constraints

The constraints set in this study are the annual capacity shortage, the operating reserve of a percentage of hourly loads, solar power output set to be 5%, 10%, and 25%, respectively. Operational reserve is the remaining capacity that ensures a reliable supply of electricity in the event of a sudden increase in load demand or a sudden decrease or failure of power output.

2.5.8 Multi-year module

For the multi-year module, HOMER will model and analyze performance over a longer period, unlike in the single-year module. In this study, inputs entered into the multi-year module include PV degradation of 0.5% per year, electric load growth of 0.5% per year, and assumed diesel fuel price fluctuation of 2% per year.

3. RESULTS AND DISCUSSION

Table 5 illustrates the optimization results of the hybrid energy sistem with nuclear using the multi-year module. It can be seen there are four feasible schemes including DG-PV-battery, nuclear-PV-battery, nuclear-only, and DG-only energy sytems for Sebira island. The energy system consisting solely of a diesel generator (DG) is considered the base case. The analysis of optimal mixes will be discussed in the subsequent sections.

3.1 Diesel-PV-battery

The DG-PV-battery HRES configuration using the multi-year module is optimal when composed of a 200 kW DG, 211 kW PV arrays, 240 battery units, and 100 kW converters. The optimum values for this configuration are the most economically viable, with a total NPC of $3,232,678 and COE of $0.6577. There is a $399,059 difference in NPC between the DG-PV-battery system and the DG-only system. The proposed optimal DG-PV-battery system generates an annual CO_2 emission of 261,202 kg/year, while the DG-only system, serving as the base system, produces 349,088 kg/year. Hence, there is a reduction in CO_2 emissions with the DG-PV-battery configuration.

Figure 6 illustrates the comparison of nominal cash flow between the optimal DG-PV-battery system and the base DG system. It can be observed that the DG system has fewer benefits in terms of savings and recovering expenditures compared to the optimal DG-PV-battery system. Therefore, the DG-PV-battery system is more economically viable over a 25-year period.

The NPC summary of capital, replacement, O&M, fuel, and salvage costs for the optimal DG-PV-battery system is shown in Figure 7. DG has the highest NPC of $2,336,752 because the previous load growth was assumed to be only 0.5%, and the sizing of DG in HOMER searches in the space between 0 kW and 200 kW. Therefore, HOMER only considers the DG with a size of 200 kW. The replacement cost for PV is zero because the lifetime of PV is 25 years. This value is consistent with the project lifetime in this study.

The multi-year impact module of the optimal DG-PV-battery system based on its electricity production is shown in Figure 8. Over a 25-year period, the electricity production generated by DG remains consistent throughout the year. Meanwhile, the electricity production from PV arrays experiences a decline from 318,401 kWh/year to 282,311 kWh/year due to the annual load growth and PV degradation.

Table 5. Optimum Schemes of the hybrid systems using the multi-year module

Architecture	PV (kW)	Nuclear (kW)	DG (kW)	Battery	Converter (kW)	DS	NPC ($)	COE ($/kWh)	RF (%)	CO_2 (kg/year)
DG-PV-battery	211	0	200	240	100	LF	3,232,678	0.6577	0	261,202
nuclear-PV-battery	211	30	0	240	100	LF	629,303	0.1280	49.5	0
nuclear	0	51	0	0	0	CC	279,689	0.05761	0	0
DG	0	0	200	0	0	CC	3,631,737	0.7389	0	349,088

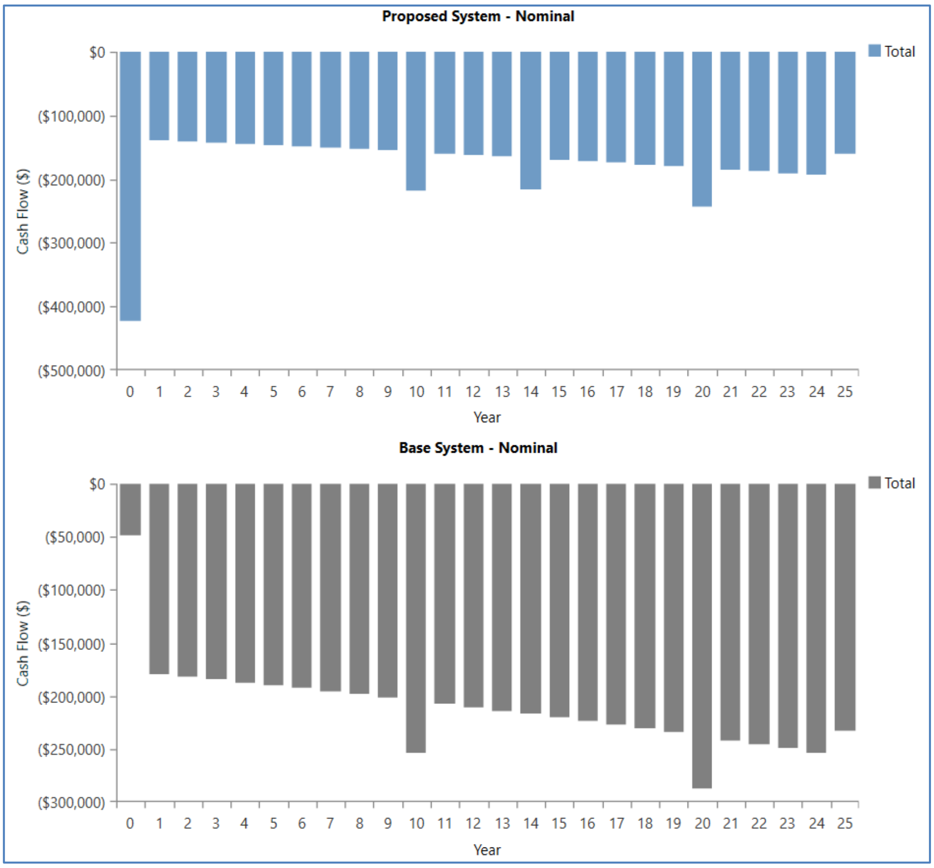
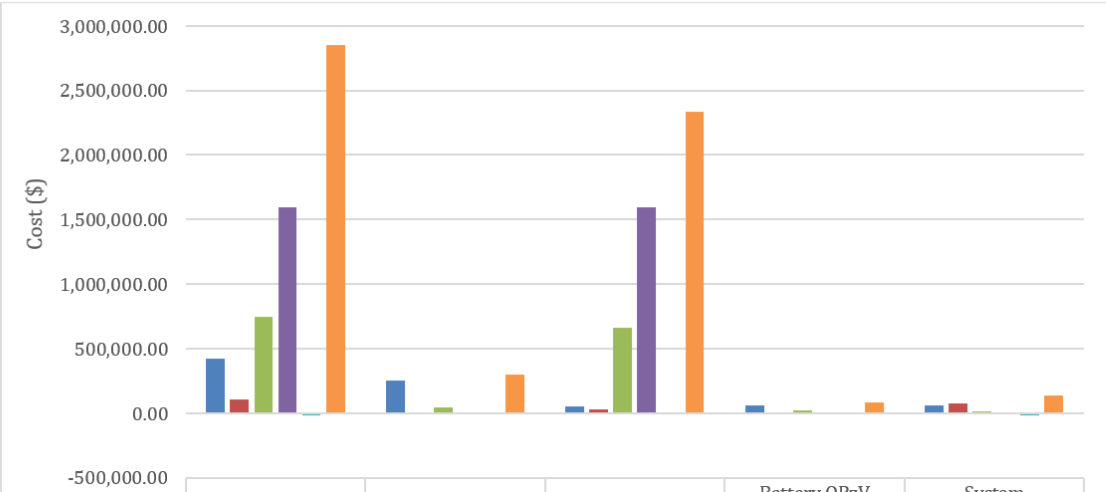


Fig. 6. A comparison of the annual nominal cash flow between the DG-PV-battery and the base system



	System	PV	Diesel	Battery OPzV 1000	System Converter
Capital	422,440.00	253,440.00	49,000.00	60,000.00	60,000.00
Replacement	106,299.59	0	31,732.35	0	74,567.25
O&M	742,657.83	42,627.51	663,027.28	20,183.48	16,819.57
Fuel	1,595,685.66	0	1,595,685.66	0	0
Salvage	-15,971.30	0	-2,692.51	0	-13,278.79
Total	2,851,111.78	296,067.51	2,336,752.78	80,183.48	138,108.02

Capital Replacement O&M Fuel Salvage Total

Fig. 7. The NPC summary of the optimized diesel-PV-battery system

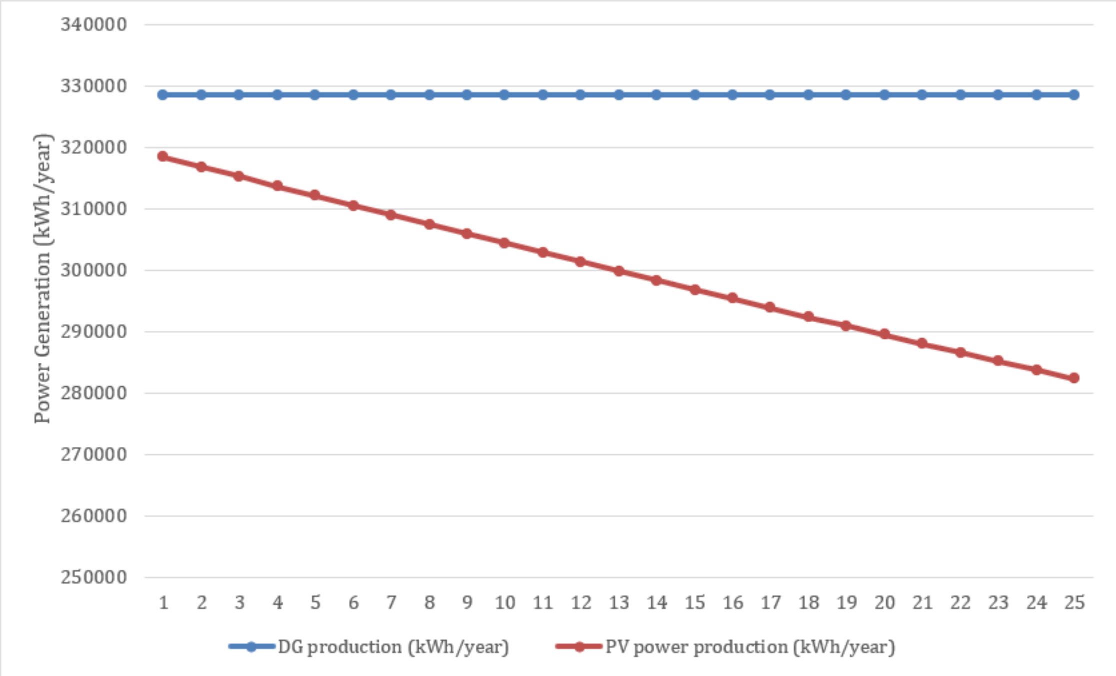


Fig. 8. Electricity production from the optimal diesel-PV-battery system

3.2 Nuclear-PV-battery

By incorporating the nuclear option into the energy system on Pulau Sebira, the optimal configuration for the nuclear-PV-battery system consists of a 211 kW PV array, 30 kW nuclear, 240-unit battery, and 100 kW converter. The total NPC for this optimal nuclear-PV-battery system configuration is $629,303, with a COE of $0.128. The difference in NPC between the optimal nuclear-PV-battery system and the base DG system is $3,002,434. This significant difference is due to the assumption of a 0.5% annual load growth, while the existing diesel generator on Pulau Sebira has a power output of 200 kW. The CO_2 emissions produced by the optimal nuclear-PV-battery system are zero, making it far more economically viable than the base DG system.

The nominal cash flow comparison between the optimal nuclear-PV-battery system and the base DG system is shown in Figure 9. The optimal nuclear-PV-battery system is far more capable of yielding greater benefits in terms of savings and recovering expenditures compared to both the base DG system and the optimal DG-PV-battery system. Therefore, the nuclear-PV-battery system is the most economically viable among the two configurations mentioned earlier

In the NPC summary graph shown in Figure 10, the nuclear capital cost is lower than the PV capital cost. Additionally, the fuel cost for the nuclear component is low because it only changes every 6 months. On the other hand, the salvage cost for the nuclear component is -$3,413, indicating decommissioning costs.

Impact module multi-year on PV and nuclear power generation over 25 years is shown in Figure 11. The electricity production from PV arrays experiences a decline over 25 years, from 318,401 $/kWh to 282,311 $/kWh due to PV degradation. Due to the increasing load served each year and to meet the demand caused by the decrease in PV production, there is an increase in nuclear production from 142,820 kWh/year to 154,783 kWh/year.

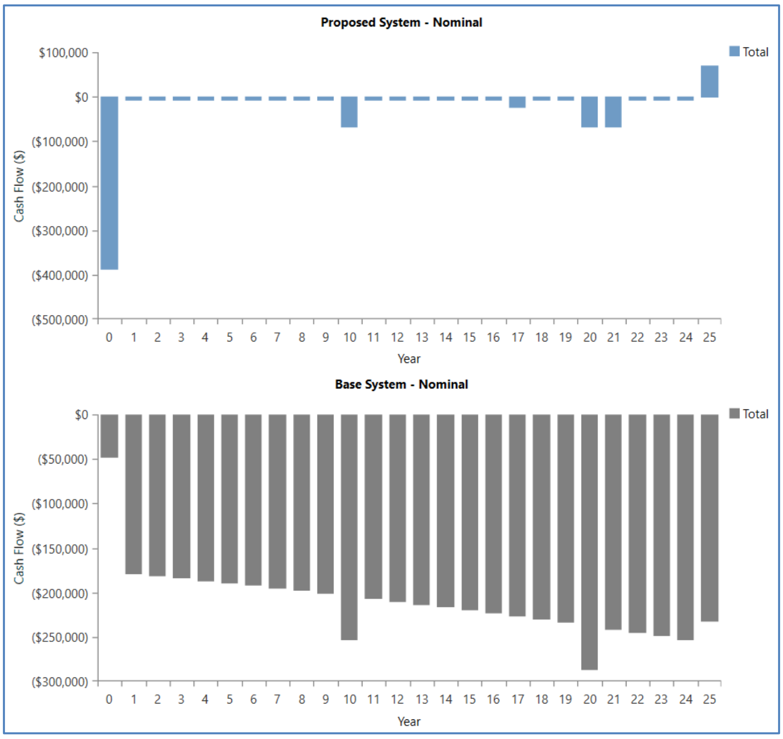
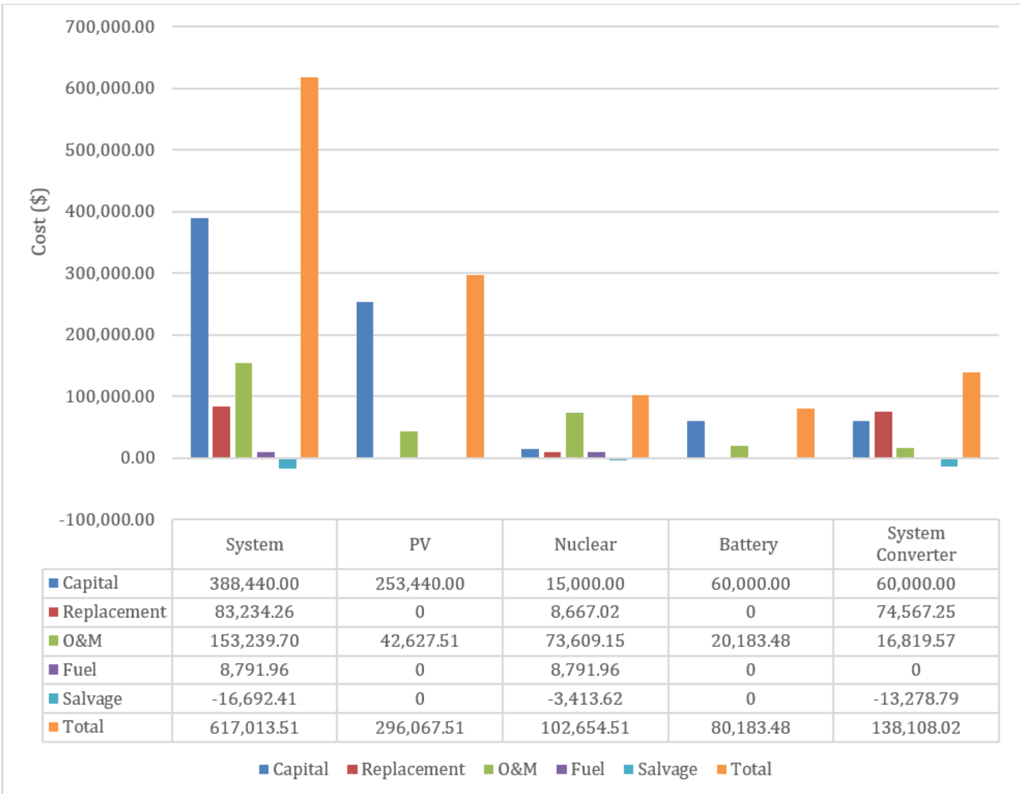


Fig. 9. A comparison of the annual nominal cash flow between the nuclear-PV-battery and the DG system



	System	PV	Nuclear	Battery	System Converter
Capital	388,440.00	253,440.00	15,000.00	60,000.00	60,000.00
Replacement	83,234.26	0	8,667.02	0	74,567.25
O&M	153,239.70	42,627.51	73,609.15	20,183.48	16,819.57
Fuel	8,791.96	0	8,791.96	0	0
Salvage	-16,692.41	0	-3,413.62	0	-13,278.79
Total	617,013.51	296,067.51	102,654.51	80,183.48	138,108.02

Fig. 10. The NPC summary of the optimized nuclear-PV-battery system

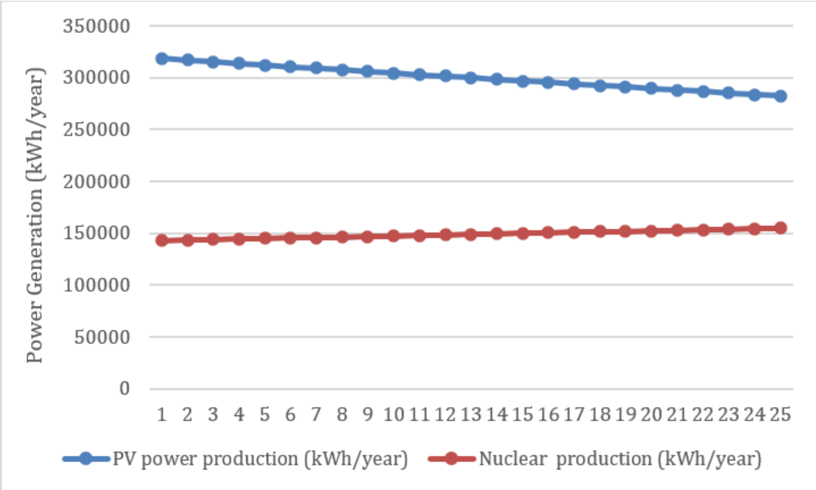


Fig. 11. Electricity production from the optimal nuclear-PV-battery system

3.3 Sensitivity analysis

Sensitivity analysis is helpful in determining how changes or variations in specific parameters can impact the performance or outcomes of the tested energy system.

The variations in NPC and COE under different nominal discount rates and expected inflation rates are shown in Figure 12. The graphical surface represents the NPC, and the COE is superimposed on the surface. When the nominal discount rate increases from 6% to 8%, the NPC value decreases while the COE increases. This indicates that the project or investment is more sensitive to changes in the discount rate. When the inflation rate increases from 2.6% to 3%, the NPC value increases while the COE decreases. This may be due to an increase in operational efficiency

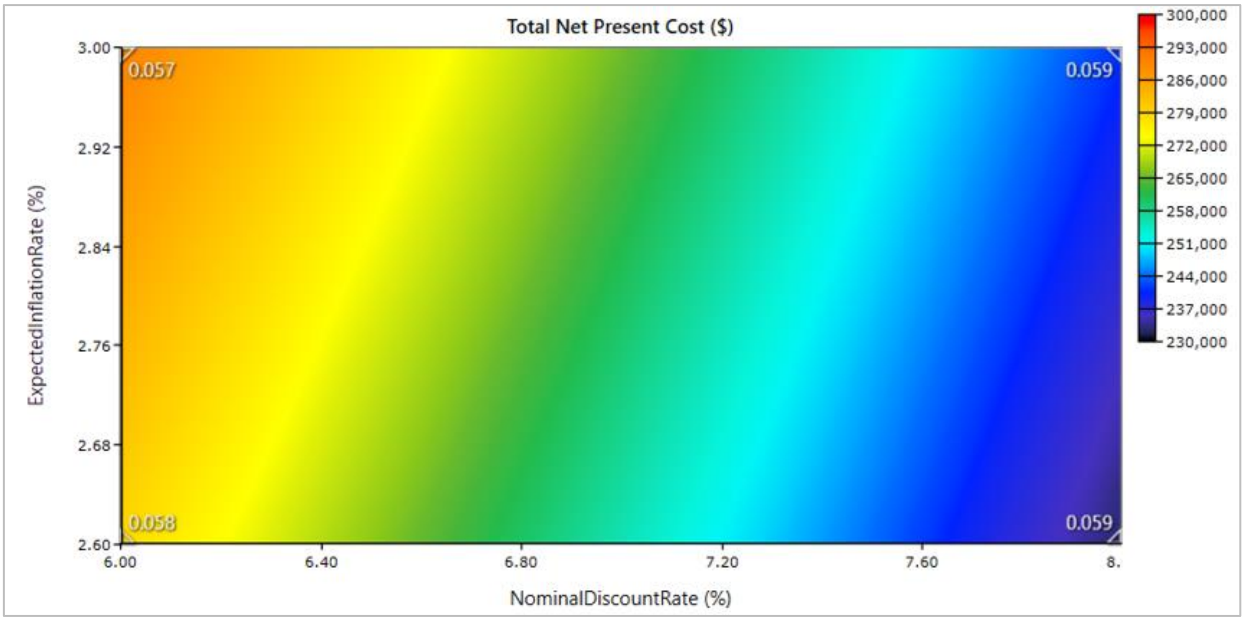


Fig. 12. The changes of nominal discount rate and inflation rate on the NPC and COE of the system

Figure 13 illustrates the changes in NPC and COE in the surface plot under different nuclear capacity, PV size, and with 240 units of battery. NPC is added to the surface plot, and COE is superimposed on the surface. As the nuclear capacity increases from 0 kW to 60 kW, the NPC value increases, and COE also increases. This can occur because, despite the relatively low fuel costs for nuclear reactors, operational and maintenance costs can be high. The increase in nuclear capacity may require more resources to operate and maintain the reactor, contributing to higher operational costs and, therefore, an increase in NPC and COE. When the size of PV increases from 0 kW to 211.2 kW, the NPC and COE values also increase. This may be due to high initial investment costs and a decreasing capacity factor.

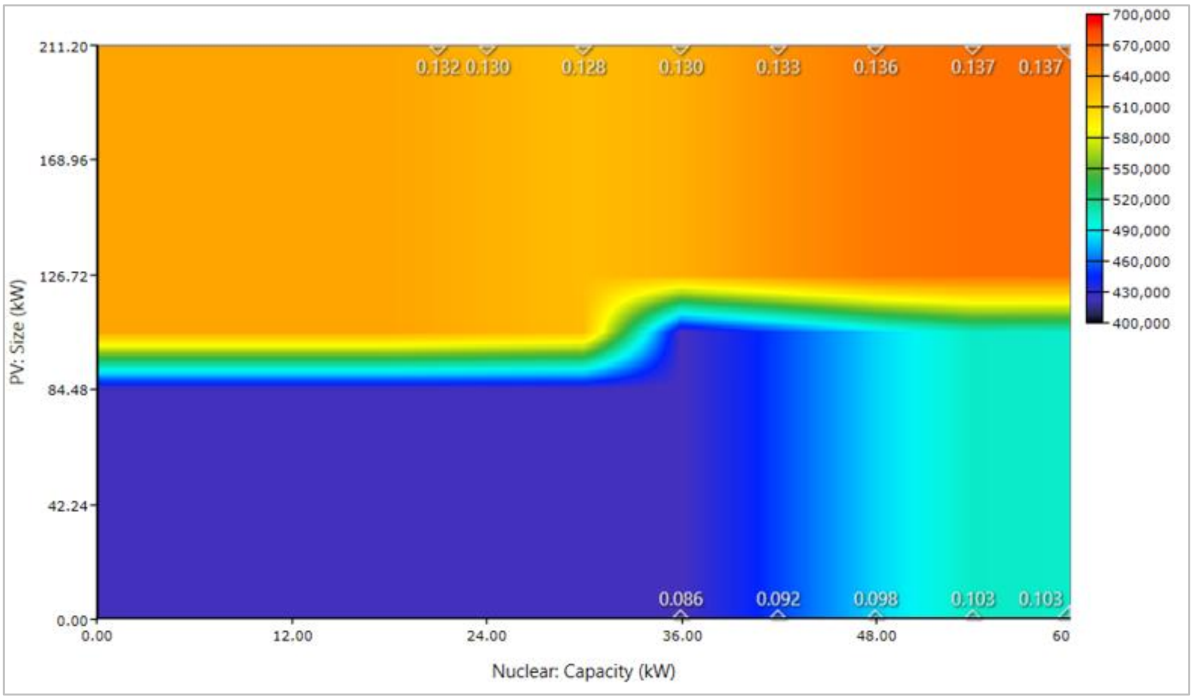


Fig. 13. The changes of PV size and nuclear capacity on the NPC and COE of the system

4. CONCLUSION

The study findings indicate that in the DG-PV-battery scenario, the optimal system includes a 200 kW DG, 211 kW PV arrays, 240-unit battery, and 100 kW converters, with a total NPC of $3,232,678 and COE of $0.6577. This system results in an annual CO_2 emission of 261,202 kg/year, outperforming the base DG system. However, the DG system exhibits fewer benefits in terms of savings and expenditure recovery compared to the optimal DG-PV-battery system. In the second scenario, introducing the nuclear option instead of the diesel generator yields the optimal nuclear-PV-battery system with a 211 kW PV array, 30 kW nuclear, 240-unit battery, and 100 kW converter. The total NPC for this system is $629,303, and its COE is $0.128. The nuclear-PV-battery system demonstrates superior capabilities in generating higher benefits, including savings and expenditure recovery, compared to both the base DG system and the optimized DG-PV-battery system. Consequently, the nuclear-PV-battery configuration emerges as the most economically feasible option between the two configurations mentioned.

The multi-year module analysis reveals that in the optimal DG-PV-battery system over 25 years, DG maintains consistent electricity production, while PV production decreases due to load growth and degradation. In the optimal nuclear-PV-battery system, there is a decline in PV output over 25 years, addressed by an increase in nuclear production to counteract the impact of load growth and PV degradation. In general, Sebira Island has the potential to install a hybrid renewable energy system by incorporating nuclear options in its energy system in the future.

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AUTHOR CONTRIBUTION

Laili Farah carried out data analysis, designed simulations, and interpreted the results. Yus Rusdian Akhmad compiled the presented ideas and developed theories. Rezky Mahardika Saryadi provided writing assistance and contributed to theory development. Amil Mardha contributed to drafting the manuscript. Mudjiono and Nuryanti assisted in data collection, while Kurnia Anzhar and Airine Hijrah Handayani contributed to manuscript preparation. All authors have read and approved the final version of this paper.

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