



An Assessment of Power Sources for Improved Energy Supply in University of Maiduguri

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Abstract

University of Maiduguri makes use of Electricity supply from the National grid and diesel-powered generators along site solar supply. This assessment was prompted by disruptions in electricity supply, exacerbated by rising diesel prices and commercialized electricity tariffs. The study aims to evaluate the impact of electricity costs and reasons behind the choice of alternative power sources for the University, focusing on the comparative costs over a projected ten-year period. In order to effectively carry out the assessment, this work compares the design of the combined analysis of solar and diesel power plants to the national grid commercial supply. A methodological approach was adopted, combining quantitative data analysis with interviews to gather insights. Data was analyzed using Excel for forecast projections. The findings indicate that over ten years, the total projected costs for electricity supply are ₦90.82 billion for the national grid, ₦34.02 billion for diesel generators, and ₦21.38 billion for solar energy. While electricity from the national grid incur the highest costs, the solar system offers the most economical solution. Interviews revealed that the high costs of energy are influenced not only by direct pricing from the national grid and diesel but also by consumer behavior. Increasing awareness and educating users about energy conservation could significantly alleviate energy expenses within the university. Given these findings, it is recommended to pursue a complete installation of solar power systems at the University of Maiduguri. Furthermore, investigating hybrid power solutions, such as combining solar with wind energy, is suggested for enhanced efficiency and effectiveness in electricity supply.

Keywords: Assessment, power sources, electricity supply, University of Maiduguri.

1.0 Introduction

The main purpose of a power generating machine is to provide electricity for human comfort, which also extends to agricultural and animal benefits. Application areas of power generating systems include: marine, aero plane, domestic appliances (air conditioning system), industrial and agricultural implements. Figure 1 show a typical industrial diesel power system with the capacity of generating 400 kW electric energy, which could also be used for domestic consumption. Insufficient and unstable power supply to consumers limits socio-economic development in a society. Therefore, providing consumers with adequate and stable electric energy, is a critical component to the development of local communities, typical of University of Maiduguri.

The Federal Government of Nigeria (FGN) approved a National Energy Policy (NEP) in 2003, which encourages optimum utilization of the country's energy sources that also include renewable energies for sustainable national development [1]. The NEP program is also designed to include active participation of the private sector, whereby some aggressive techniques to pursue and integrate the application of solar energy into the Nation's energy mix were incorporated and adopted. This present work, promotes the actualization of the NEP program, hence the requirement to carry out the assessment of power sources by firstly considering University of Maiduguri (UNIMAID) electricity consumption rates. The power sources considered includes: electricity supplied from National grid via Yola Electricity Distribution Company (YEDC), diesel power generators (DPG) and solar power system (SPS).

The UNIMAID substation, is responsible for the distribution of electricity in the University, while the installed generators and solar system situated at different and strategic locations served as backup to the supply from YEDC, which this present work concentrates on assessing. The University is presently having challenges ranging from YEDC high-energy charges to the current high cost of diesel. These prompted the University to introduce and apply the YEDC prepaid meters at the residential and commercial areas as ways of conserving and controlling electricity usage. As sourced from UNIMAID substation (or national grid) in 2022, the University has also planned and strategized at the academic sites, ways of shading and sharing the daily supply: from 11 am to 4 pm for the Faculties/Directorate and 6 pm to 6 am for Student/Staff residence and Security outlets. This work also asses merit/demerit of the University's efforts and advice further.

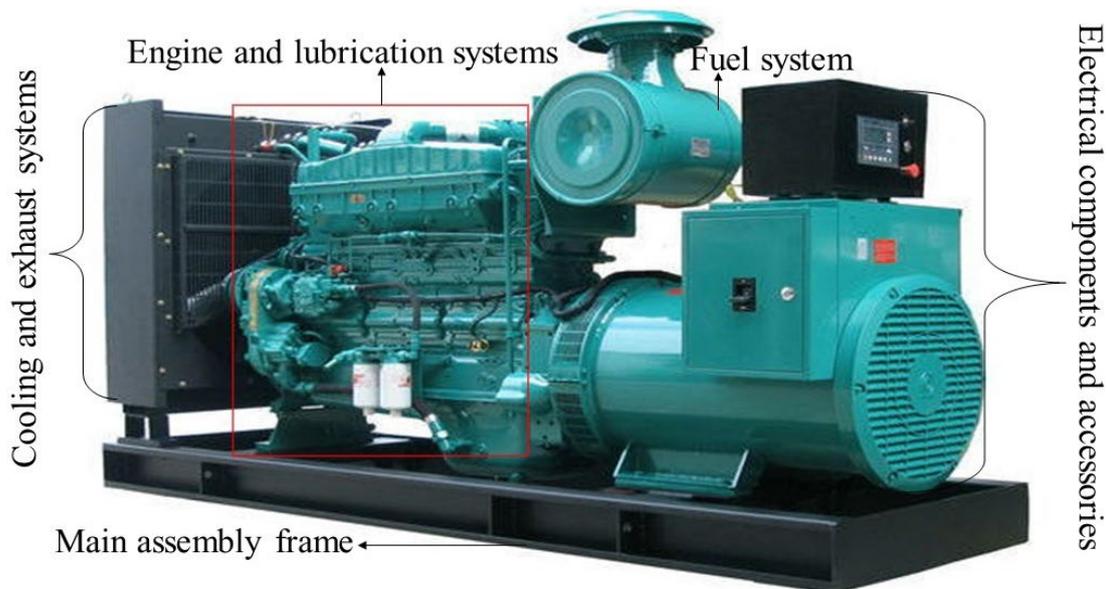


Figure 1: Diesel generator set: 400 kW capacity/1.2 m³ fuel/kWh (Linquip Report, 2021)

The power generation and distribution in Nigeria, were privatized in 2013, with the generation having twenty-three (23) and distribution having eleven (11) companies that manages the activities of each accordingly. While, the ownership of the transmission was retained by FGN, as the Transmission Company of Nigeria (TCN) [2]. This work focuses on the distribution aspect, whereby at the level of the assessment area, Yola Electricity Distribution Company (YEDC) dedicated to the North East, handles all related matters that concern the electricity distribution. The distribution by YEDC covers the regions of Adamawa, Borno, Taraba and Yobe States, whereby the Borno region that is centrally located in Maiduguri is further grouped into substations, among which is the UNIMAID substation: the study area. The UNIMAID substation that is tasked with the responsibility of providing the YEDC distributed power to University of Maiduguri, steps down the 33 kV electricity from YEDC to the transformers within the University Community. The electric energy from the UNIMAID substation and its cost are part of the work

Diesel generators, are diesel fuel consuming equipment that generates electricity based on the loads and fuel consumption. Generators for household usage range from 8 to 30 kW, whereas generators for commercial usage range from 30 kW to 2,000 kW. They are also used on large ships for additional power, which can range from lighting, fans and switches in order to provide power to the propulsion system [3]. The diesel engines are typically installed in either rural or urban areas and are utilized as a primary or backup power sources, respectively, hence, they can be configured in a variety of physical and electronic ways. Diesel generators, on average requires 0.4 liters (0.0004 m³) of fuel per kWh produced, resulting in a 25 percent efficiency ratio and the efficiency is dependent on the situation and rate of usage [3]. University of Maiduguri electricity supply, has been affected by tariff cost and interruption from main source due to failure of equipment or maintenance arrangements. This is a situation whereby the need to apply backup plan, in order to give attention to very important problems became obvious, hence the requirement to use diesel engine. This work focusses on the analytical implications of continuous use of diesel engine in the institution and compares with other sources for future development.

Solar power plants employ either photovoltaic (PV) systems or concentrated solar power (CSP) technology. PV systems convert sunlight directly into electric power using solar panels, typically crystalline silicon, producing direct current (DC) power that fluctuates with sunlight intensity [4]. Multiple solar cells connected in panels require inverters to convert DC to alternating current (AC) for practical use [4]. In some cases, especially residential PV systems, the connection are made to the grid whenever available, hence the use of energy storage (batteries) is optional or meant as back-ups. Notably, the use of both national grid and diesel sources of energy is a hindrance in University of Maiduguri, which were shown to be largely based on inadequacies in supply and financial implications. These scenario calls for apparent resort to alternative power source, hence the need for solar power system or the likes, which this work also analytically analyzed.

Recent studies affirm the technical and economic viability of solar PV, diesel, and hybrid systems in Nigerian contexts. For example, Omorogiuwa [5] simulated solar system performance in urban settings but did not explore hybrid system applications in institutions like universities where demand management and grid backup are complex. Bakri [6] demonstrated solar PV's economic and environmental superiority over diesel in a Nigerian college but highlighted the need for hybrid solutions without addressing the interaction with institutional grid systems and prepaid metering. Adefarati *et al.* [7] highlighted hybrid PV-diesel-battery systems' benefits for rural electrification but did not examine urban universities facing grid irregularities and tariff challenges. Similarly,

Adebisi *et al.* [8] recommended hybrid solar PV-diesel systems for Nigerian settings but did not consider demand management and prepaid metering impacts typical in university campuses.

This gap justifies the need for a tailored assessment capturing the interactions between grid supply, diesel generators, prepaid metering, and solar PV systems to guide efficient and cost-effective power solutions in academic institutions like the University of Maiduguri, which faces irregular supply, high electricity tariffs, and strategic demand management. The study is motivated by information that power supply disruptions continue to affect the entire Maiduguri community, including the University of Maiduguri, exacerbating institutional challenges [9]. Despite government interventions installing hybrid solar grids in federal universities and teaching hospitals, including a 12 MW solar grid at University of Maiduguri [10], overall supply irregularities, high diesel costs, and prepaid metering impacts remain critical issues affecting academic operations. Thus, this work is essential to assess these power sources comprehensively within this local context.

In view of the above, this study aims to assess power sources at the University of Maiduguri to devise means for improving electricity supply. The objectives are to analytically design a solar power system for the University and compare its performance with existing electricity from the UNIMAID substation alongside diesel generator supply over a five-year projection; and to determine the cost of providing electric energy by these power sources to identify the most reliable and cost-effective option. The significance lies in supporting the University's efforts to optimize electric energy use by evaluating merit and demerit trends. The findings will inform recommendations for improved and adequate electricity supply, contributing to future development. The scope is limited to analytical design and cost assessment of solar and diesel power systems compared to the installed national grid capacity, providing information for effective resource management by University authorities.

2.0 Materials and Methods

2.1 Materials

2.1.1 Assessment area

The assessment area for the present work is University of Maiduguri, an institution that was established in 1975 by the Federal Government of Nigeria (FGN). The University, is situated in the outskirts of Maiduguri, the capital of Borno State, North Eastern part of Nigeria. Although, there exists privately arranged off-campus accommodation due to increased population and demand, the University is also residential for both Staff and Students. Presently, the electric energy demand for the institution stood at 3.5 MW as at 2025 (Unimaid Substation), whereby the primary sources of electricity supply in the campus are: national grid and diesel generators, while at the secondary level is solar power. Unfortunately, due to high tariff and costs of fuel couple with Nigeria's current economic situation, the 3.5 MW is currently not feasible, hence the requirement for this present work.

2.1.2 Unimaid major sources of power

1. UNIMAID substation alongside step-down transformers: Staff quarters, Students hostels, academic areas, works/workshops/printing units, administrative/management buildings etc. Table 2.1, shows the description of major materials and costs for the installation of a 33-kV dedicated line for the University, whereby the procurement of the items satisfies the needs for adequate power supply from the substation.

Table 1: Installation requirement and cost of 33 kV dedicated line

S/No.	Description of Items	Number of Unit	Price (₦) × 10 ³	Amount (₦) × 10 ⁶
1	HT concrete pole	176	100.00	17.60
2	33 kV pot insulator	432	6.00	2.59
3	33 kV spindle	432	2.20	0.95
4	Pair of cross arm	144	3.00	0.43
5	Channel iron	176	10.00	1.76
6	190.5 mm bolt and nut/washer	176	1.00	0.18
7	31.75 mm bolt and nut/washer	288	3.50	1.01
8	Pot hole	176	3.00	0.53
9	Stay accessories	80	10.00	0.80
10	Crane service	176	7.00	1.23
11	Stay hole	80	3.00	0.24
12	Disc insulator	270	3.50	0.95
13	J – hook	270	2.00	0.54
14	Six bolt champ	270	4.00	1.08
15	Adapter socket clevis	270	2.00	0.54
Total				30.43

Source: JMG Nig (2025) [11].

2. Diesel generators (numbering 69 as at 2025) allocated to academic and non-academic areas
3. Solar plants situated (largely donate) at strategic places.

2.2 Methods

2.2.1 Data collection

Survey Method was used for the data collection based on which quantitative analysis was applied in this work. The survey method applied here is the personal interview techniques and the quantitative data analysis was used in analyzing the data collected from the survey, whereby Microsoft Excel forecast tool was used to interpret the data.

2.2.2 Data analysis

The estimated peak power requirement of University of Maiduguri is 3.5 MW as at 2025 ending, but the energy demand of University of Maiduguri increases by 0.5 % per annum [12, 13]. The presentations below are the data analysis for three power sources:

a. National Grid

The University of Maiduguri supply line is measured to be 8 km from the supply source, 176 number of concrete poles were provided and for every two poles mounted is a 50 m interval and after every 10 poles is a high-tension (HT) pole also mounted. The detailed requirement and cost analysis is given in table 1 and 2.

Table 2: Connection cable (conductor) requirement

Item	Price (₦)
150 mm steel reinforced ASC (8000m)	10.4×10^6
Connection labor	3.6×10^6
33 kV to 11 kV step-down transformer	7.5×10^7
Annual maintenance	5.2×10^5

Source: JMG Nig. (2025).

Table 3: Annual energy charges for a 10-year projection

Year	Tariff Cost (₦/kWh)
2025	209.00
2026	215.27
2027	221.73
2028	228.37
2029	235.21
2030	242.25
2031	249.50
2032	256.97
2033	264.67
2034	272.61

Source: YEDC, (2025) [12]

Projection is based on an average annual tariff increase rate of about 3% which is a moderate inflation and sector adjustment estimate consistent with Nigeria's gradual transition to cost-reflective tariffs and expected policy adjustments through 2035. The 2025 starting point of ₦209/kWh matches recent regulatory updates for premium supply Band A customers. Lower band tariffs remain significantly lower but are omitted here for clarity.

b. Diesel Powered Generator

Power consumption demand for the University of Maiduguri is estimated at 3500 kW.

$$\text{Load demand in kVA} = \frac{\text{Load in kW}}{\text{power factor}} \quad (1)$$

To design a 5×10^3 kVA capacity, the equivalent of 4375 kVA as calculated using Equation 1, Table 2.3 show the required items and procurement costs for an optimum diesel power system.

Table 4: Requirements for diesel power plant for 5×10^3 kVA and their prices

S/N	Items	Number of Unit	Price (₦) $\times 10^6$	Amount (₦) $\times 10^6$
1	1500 kVA diesel generator	3	140.0	420.0
2	1000 kVA diesel generator	1	95.0	95.0
3	Installation of generator	5	0.60	3.0
4	Synchronizing control panel	1	5.0	5.0
5	Maintenance of 1500 kVA gen	3	0.25	0.75
6	Maintenance of 1000 kVA gen	1	0.22	0.22
Total				523.97

Source: (Tikweld, 2022) [14]

Diesel fuel prices vary as driven by market forces, delivery costs for diesel are based on written quotes, so accuracy of +/- 15 % can be taken [15].

c. Design of Photovoltaic Solar Power Plant

Design of solar photovoltaic power plant consist of PV module sizing, inverter sizing, battery sizing and module circuit design. The design methodology and technical specifications of the PV power plant are discussed in the below sections

- 1. Load:** Power consumption demand for University of Maiduguri is given as 3500 kW in 2025. The load demand by the University increases by 0.5 % maximum every year [12]
- 2. Battery Sizing:**

$$\text{Total daily watt hour per day} = \text{Load demand} \times 24 = \text{Wh/day} \quad (2)$$

$$\text{Daily energy requirement} = \text{Total daily watt hour per day} \times \text{power factor} = \text{Wh/day} \quad (3)$$

System Voltage = 360 V , power factor = 1.1, nominal Battery Voltage = 6 V , % Usage = 80 % and battery autonomy = 1 day

$$\text{Total load Ampere hour per day} = \frac{\text{Total daily load Wh/day}}{\text{System Voltage} \times \text{power factor}} \quad (4)$$

$$\text{Battery Capacity (Ah)} = \frac{\text{Ampere hour per day} \times \text{Days of Autonomy}}{\text{Percentage Usage}} \quad (5)$$

$$\text{Number of Batteries required} = \frac{\text{Battery Capacity}}{\text{Battery rating required}} \quad (6)$$

- 3. Inverter Sizing:** the size of inverter used in PV power plant depends on the total peak wattage required for University of Maiduguri. The inverter must be large enough to handle the total peak requirement at any time. The inverter should be 25 - 30 % bigger than the total wattage of the appliances and machines. [16].

$$\text{Inverter size} = \text{Load demand (W)} \times 0.25 \quad (7)$$

$$\text{Number of Inverter required} = \frac{\text{Inverter size}}{\text{Rating of an Inverter}} \quad (8)$$

- 4. Panel Generation Factor:** panel generation factor varies with the solar intensity and sunshine period of the site [16, 17].

$$\text{Panel generation factor} = \frac{\text{solar irradiance} \times \text{sunshine hours}}{\text{Solar test conditions irradiance}} \quad (9)$$

- 5. Energy Required from PV Modules:** this can be calculated by multiplying peak energy requirement in kWh/day and energy lost in the system [16].

$$\text{Energy required from PV module} = \text{Total daily load} \times \text{Power factor} = \text{Wh/day} \quad (10)$$

- 6. Total Watt Peak Rating for PV Modules:** This is calculated using the energy required to be produce by from solar PV modules and the panel generation factor [16].

$$\text{Total watt peak rating for PV modules} = \frac{\text{Energy required from PV modules}}{\text{Panel generation factor}} \quad (11)$$

7. Number of PV Modules Required

$$\text{Number of PV modules required} = \frac{\text{Total watt peak rating}}{\text{PV module maximum power}} \quad (12)$$

8. Regulator Rating Required

$$\text{Regular rating load side} = \frac{\text{Total DC wattage}}{\text{System Voltage}} \quad (13)$$

$$\text{Number of regulators used} = \frac{\text{Regulator rating}}{\text{regulator capacity}} \quad (14)$$

Equation (2) to (14) shows the design methodology and technical specifications of the PV power plant.

Table 4: Cost of the major solar plant components

S/N	Item	Description	Price (₦)
1	PV Module	Canadian Solar 340W Monocrystalline: Max power: 340 Wp, Voc: 46.2 V, Vmpp: 37.9 V, Isc: 9.48 A, Impp: 8.97 A, Efficiency: 17.49%, Max Sys Voltage: 1000 V DC	₦130,000
2	Inverter	Sunny Central 500HE-US, 500 kW commercial inverter: DC voltage 3600V, two MPPT, optional SPD, 98% efficient, IP65, 5-year warranty, made in Germany	₦90,000,000
3	Battery	Trojan SIND 06 1225 (6V 1225 Ah Deep Cycle Flooded Lead-Acid Battery): Capacity 6V 942 Ah, 1500 cycles at 80% DOD	₦1,250,000
4	Solar Charge Controller	Studurvarioshing VS-120 Dual MPPT Controller (120A 600V DC)	₦1,200,000
5	Interconnection Cable	50mm x 1 core, ideal for DC connection (Battery to Battery; Battery to Inverter)	₦5,000

Source: [Solar-Shop Nigeria](#) (2025) [18]

3.0 Results and Discussion

3.1 Results

The data obtained were computed and analyzed using Microsoft Excel application.

3.1.1 Assumption taken for the assessment

- The assessment is based on normal working condition
- The design is projected for 10 years
- The period of electricity supply per day is 24 hours

3.1.2 Analysis of Electricity Supply from National Grid

Cost of 33kV to 11 kV step-down transformer = ₦7.5 × 10⁷

Cost of installing 33 kV-dedicated line is (3.04 × 10⁷) + (10.4 × 10⁶) + (3.6 × 10⁶) + (7.5 × 10⁷) + (5.2 × 10⁵) = ₦1.19 × 10⁸

Table 5: The forecast function of the national grid is shown in table 4 below

Year	Load Demand DC (kW)	Maintenance Cost (₦) × 10 ⁵	Energy charge (₦/ kWh)	Energy charge (₦/ kWd)	Energy charge (₦/ kW year) × 10 ⁶	Energy Cost (₦) × 10 ⁹
2025	3500	8.00	209.00	5016.00	1.83	6.40
2026	3675	8.02	215.27	5166.48	1.89	6.95
2027	3850	8.04	221.73	5321.52	1.94	7.47
2028	4025	8.06	228.37	5480.88	1.95	7.85
2029	4200	8.08	235.21	5645.04	2.06	8.65
2030	4375	9.00	242.25	5814.00	2.12	9.28
2031	4550	9.02	249.50	5988.00	2.19	9.96
2032	4725	9.04	256.97	6167.28	2.25	10.63
2033	4900	9.06	264.67	6352.08	2.32	11.37
2034	5075	9.08	272.61	6542.64	2.39	12.13
		77.36				90.69

Therefore, the total cost of providing electricity from National Grid in 10 years is $(₦1.19 \times 10^8) + (₦7.74 \times 10^6) + (90.69 \times 10^9) = ₦ 90.82 \times 10^9$

3.1.3 Analysis of Electricity Supply from diesel powered generators

- Running hours of Generators in a year is
= 24 x 365
= 8,760 hours/year
Number of service in a year is
= 8760/200
= 43.8 ≈ 44 service/year

- Diesel consumption of 1500 kVA generator = 0.06 m³/hour
- Total quantity of diesel consumed by the 3 generator = 0.18m³/hr
- Diesel consumption of 1000 kVA generator = 0.045 m³/hr
- Total quantity of diesel consumed by the generator = 0.225 m³/hr
- Total quantity of diesel consumed by the generator = 5.4m³/day
- Total quantity of diesel consumed by the generator = 1971m³/year
- Cost of diesel as at the time of this research = ₦1650/0.001 m³

Table 6. The forecast function for diesel power plant

Year	Load Demand DC (kVa)	Maintenance cost 22 times(₦)×10 ⁶	Cost of Diesel (₦)	Diesel consumption (0.001m ³ /year)	Cost of Diesel consumed in a year (₦)×10 ⁹
2025	4375	50.02	1650	1971000	3.25
2026	4594	51.02	1655	1971000	3.26
2027	4813	52.02	1660	1971000	3.27
2028	5013	53.02	1665	1971000	3.28
2029	5250	54.02	1670	1971000	3.29
2030	5469	55.02	1675	1971000	3.30
2031	5688	56.02	1680	1971000	3.31
2032	5906	57.02	1685	1971000	3.32
2033	6125	58.02	1690	1971000	3.33
2034	6343	59.02	1695	1971000	3.34
	Total	545.2			32.95

The total cost of 24hrs electricity supply from diesel-powered generators is $(523.97 \times 10^6) + (545.2 \times 10^6) + (32.95 \times 10^9) = ₦ 34.02 \times 10^9$

3.1.4 Analysis of Electricity Supply from Solar Power Plant

- Inverter size = Load demand (W)x 0.25 + (W) = 3500000 × 0.25 = **875,000 + 3500000 = 4,375,000 W**

$$\text{Number of Inverter required} = \frac{4375}{500} = 8.75 \approx \mathbf{9}$$

Since you we have a fraction of an inverter, we would need 9 inverters of 500 kW to fully cover the load.

- Battery

$$\text{Total load Ampere hour per day} = \frac{\text{Total daily load Wh/day}}{\text{System Voltage} \times \text{power factor}} = \frac{84 \times 10^6}{360 \times 1.1} = \mathbf{212,121.21Ah/day}$$

$$\text{Battery Capacity (Ah)} = \frac{212,121.21 \times 1}{0.8} = \mathbf{265,151.51Ah}$$

$$\text{Number of Batteries required} = \frac{265,151.51}{942} = 284.7 \approx \mathbf{285}$$

Battery rating = 6V, 942 Ah (typical lead acid battery)

System Voltage = 48V (common for PV system)

$$\text{Series connection} = \frac{48}{12} = 4 \text{ batteries in series}$$

$$\text{Parallel connection} = \frac{265,151.51 \text{ Ah}}{942 \text{ Ah}} = 284.7 \approx 285 \text{ parallel strings}$$

Total number of batteries = 4 × 285 = 1140 batteries in total

- Panel generation factor = $\frac{\text{solar irradiance} \times \text{sunshine hours}}{\text{Solar test conditions irradiance}} = \mathbf{3.4}$

- Total PV panels energy needed = 84000000 × 1.3 = **109200000Wh/day**

- Total Wp of PV panel capacity needed = $\frac{109200000}{3.4} = \mathbf{32,117,647.06Wp}$

- Number of PV panels needed = $\frac{32,117,647.06}{340} = \mathbf{94464}$ modules

Actual requirement = 94464 modules

- Regular rating load side = $\frac{3500000}{360} = \mathbf{9722.22A}$

$$\text{Number of regulators used} = \frac{9722.22}{120} = \mathbf{81.01}$$

The system should be powered by at least 94464 modules of Canadian Solar 340W Monocrystalline, supported by a battery bank with a total capacity of 265,151.51Ah at 48V, requiring 1140 batteries of 12V, 924Ah each. To fully cover the load, the system will need 9 inverters with a combined capacity of 500kW. The system’s regular load rating is 9722.22A

Table 7: Forecast function for cost increment of the solar component/year.

Year	Battery Cost (₦)×10 ⁹	inverter Cost (₦)×10 ⁶	Panel Cost (₦)×10 ⁹	Regulator Cost (₦)×10 ⁶	Cable Cost (₦)×10 ⁶	Labour Cost (₦)×10 ⁵	Maintenance Cost (₦) ×10 ⁵
2025	1.43	810	12.28	97.2	80	8	8
2026	-	-	-	-	-	-	4
2027	-	-	-	-	-	-	4
2028	-	-	2.3	32.4	20	4	8
2029	0.715	270	-	-	-	3	4
2030	-	-	-	-	-	-	4
2031	-	-	2.3	32.4	20	4	8
2032	-	-	-	-	-	-	4
2033	0.715	270	-	-	-	2	6
2034	-	-	-	=	-	-	4
Total	2.86	1,350	16.88	162	120	21	93

Therefore, the total cost of electricity supply from solar power system is (2.86 × 10⁹) + (1.35 × 10⁹) + (16.88 × 10⁹) + (162 × 10⁶) + (120 × 10⁶) + (2.1 × 10⁶) + (9.3 × 10⁶) = **₦21.38 × 10⁹**

3.2 Discussion

The analysis of power sources that include: National grid, diesel generators and solar power system have been shown for five (10) years. The power supply of the national grid of the university has a 7 MVA transformer that can withstand the investigated load increases. According to the results of the study, the total cost of providing electricity from the national grid is ₦90.82 × 10⁹, which is very expensive. In order to reduce these costs, energy conservation must be promoted through the use of high-efficiency appliances, energy-saving behavior, best management practices and the use of an energy supply scheduling device must be promoted. The diesel power plant is designed to provide electricity 24 hours a day during the study period, but it is not feasible for a generator to run 24 hours without interruption. Therefore, two generator sets are used to provide 12 hours each. According to the results of this study, the total cost of electricity supply from diesel generators amounts to ₦34.02 × 10⁹ which is expensive. This high amount is due to the high cost of diesel and maintenance materials. The solar power plant has a high initial installation cost, but when planned for 10 years, it turned out to be the cheapest way to power the University. The batteries need to be replaced after 3 years and the total cost of providing electricity supply from solar power plant based on the results of this study is ₦21.38 × 10⁹. This amount is lower compared to the other sources.

The high cost of energy consumption is not only due to the energy fee and diesel costs, but also to end-user attitudes. Enlightening and educating the end users of energy on the importance of energy conservation will significantly reduce the cost of energy consumption at the University, and this cost can be used for another important aspect of the university's needs.

4.0 Conclusion

1. University of Maiduguri makes use of electricity supply by the commercial based companies, diesel generators and solar system, whereby a projection of ten (10) years is considered and assessed for the three power sources.
2. This work compares the design of the combined analysis of solar and diesel power plants to the national grid commercial supply.
3. The analysis of the three Electricity sources for the University of Maiduguri indicates that electricity supply from solar power plant has better cost effectiveness alongside maintenance cost, as is easy and cheap when compared with the other two sources.

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