


Assessment of Alternative Energy Sources for Local Government Service Commission, Alagbaka, Akure, Ondo State

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Received: 21 Feb 2026 | Received Revised Version: 13 Mar 2026 | Accepted: 18 Apr 2026 | Published: 07 May 2026

Volume 08 Issue 05 2026 | Crossref DOI: 10.37547/tajet/Volume08Issue05-03

Abstract

Department of Electrical and Electronics Engineering, Federal University of Technology, Akure, This research assessed persistent unavailability electrical energy problem of Local Government Service Commission (LGSC) Alagbaka in Akure, Ondo State, Data were collected from Benin Electricity Distribution Company (BEDC), Akure and LGSC log books Alagbaka. Frequency and duration of electricity supply were obtained from the BEDC and LGSC log books. Results revealed that the existing public utility and existing generators sources feed the LGSC; the LVP and associated CBs of the LGSC network are functioning very well; the average public supply is averagely 4hrs per each working day as against the required 8hrs per day amounting to 50% availability through the year; total connected load is 113.4 kVA. Conclusively, a proposed generator or inverter capacity is designed to 79.4 kVA considering appropriate standards of demand load, diversity factor and future expansion; solar inverter is recommended for the LGSC operation due to its overall benefits existing literature established in this research; and 80 kVA solar inverter is recommended for the LGSC operation. Load survey should be carried out before sizing of a generator/Inverter for any edifice. Appropriate standards should be considered in sizing a power supply unit source.

Keywords: Local Government Service Commission, electrical energy, load survey, design standards, Inverter.

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Cite This Article: Adesida, G. A., & Oyeleye, M. O. (2026). Assessment of Alternative Energy Sources for Local Government Service Commission, Alagbaka, Akure, Ondo State. The American Journal of Engineering and Technology, 8(05), 18–40. <https://doi.org/10.37547/tajet/Volume08Issue05-03>

1 Introduction

1.1 Background of the study

The field of this research is the Alagbaka, Akure, where the administrative headquarters of Akure South Local

Government Area of Ondo State in Nigeria is situated. In particular, the research is concerned with the Local Government Service Commission (LGSC) which is situated

in the Alagbaka government secretariat complex. Ondo state lies between the longitudes a 4030' E and 60 E of the east of Greenwich Meridian, figure 1 and 2 (1). This commission is responsible for overseeing the

recruitment, training, promotion, and discipline of staff in the 18 local government areas of the state. LGSC complex is presented in figure 3.



Figure 1: Alagbaka (Ondo State Map, 2026)



Figure 1: Alagbaka (Ondo State Map, 2026)



Figure 3: LSGC Buildings, Abuja and Lagos (Ondo State Map, 2026)

The Benin electricity distribution company (BEDC) controls the electricity supply in Alagbaka, Akure, Ondo State. Nevertheless, power outages are frequent in the locality among people and organizations. although the timing of electricity supply does not have a set schedule, reports show that most residents access power supply in the range of seven hours a day. This limited supply is mainly caused by the lack of power allocation by the Transmission Company of Nigeria (TCN) and this has been a long-term problem on power reliability of the region (2). In the case of organizations such as the local government service commission (LGSC) in Alagbaka, the sporadic power supply presents a big challenge in its operation. Most offices are dependent on backup generators to continue with their productivity in times of power outages.

An enterprise that offers a basic service to the populace, like electricity, gas, water, transportation, or telecommunications, and is regulated by the government to provide reasonable prices, access, and service quality,

is a public utility (3) The main issue around infrastructural development is the betterment and

quality of life enhancement but the repeated and alarming failure has multiple impacts on infrastructural development (4). Public utility electricity failure is a term used to denote any kind of interruption or disruption in the supply of electricity to satisfy the needs of the people. This can impact the economy, social, and environmental in a great way (5). Dependable supply and distribution of electricity are paramount to the propelling of industrial economies and improving the welfare of the society. It has been found out that there is a correlation between higher rates of national electricity consumption and rates of economic growth in countries of low, middle, and high incomes. It is worth noting that the correlation may be mediated by other variables such as higher household income and better infrastructure, which also affect electricity consumption patterns, the electricity supply system in any country consists of the main elements generation, transmission, and distribution (6).

The public utility electricity failure can be caused by infrastructure; aging infrastructure, inadequate maintenance, and lack of upgrades can lead to electricity failures (7), natural disasters: natural disasters like storms, floods, and droughts can damage electricity infrastructure (5 and human error: human mistakes, such as operational errors or inadequate planning, can also cause electricity failures (8). the consequences of such a public utility electricity outage can be defined as: economic; electricity outages can cause lower economic productivity, higher costs to businesses, and reduced competitiveness (5) socially, the risk of electricity outages to access to healthcare, education, and other vital services, especially in vulnerable populations (9), and environmental; electricity outages can also have an environmental). Electricity failures in public utilities can have significant impacts on local government service commissions, affecting administrative efficiency, service delivery, and economic activities. In Ondo state, particularly in Alagbaka, Akure, challenges related to electricity distribution have been a concern. studies have examined the administration of public utilities in Nigeria, highlighting inefficiencies in electricity distribution and the reliance on self-generated power due to inconsistent supply (10). However, local government service commissions still face operational difficulties due to power outages, which can hinder governance and public service effectiveness mitigation strategies include

2.2 Determine the period of power failures

determine the frequency and duration of electricity failures in lgsc data was obtained from the bedc obtained from the lgsc and bedc log books. this was achieved by obtaining the power supply hour and minutes for each time the power is available and converted to hours. the frequency and supply duration were obtained per day and month obtained from the log books , T_{sd} and T_m respectively. using equation 1, and 2.

$$T_{sd} = OP_{sh} - OP_{ch} \quad \text{hr} \tag{1}$$

where OP_{sh} is operational starting hour and OP_{ch} is operational closing hour for the day.

the summation of available supply per day was achieved using equation 2.

$$T_{sd} = [OP_{sh} - OP_{ch}] \times a \quad \text{hr} \tag{2}$$

where a is number of hours in a day; a is number of hours in a day.

2.3 Determination of causes of power failures to the commission

the cause of electricity supply base on supply of electricity to the commission and inability of the commission to hook up to the supply by the utility company was established. this was achieved by determining whether the low voltage panel

infrastructure upgrades; investing in modernizing and upgrading electricity infrastructure improve reliability (11). and reduce the likelihood of failures (12). integration of renewable energy sources, such as solar and wind power, can reduce dependence on traditional fossil fuels and improve energy security (13) and the use of smart grids; implementing smart grid technologies can improve the efficiency and reliability of electricity distribution and reduce the likelihood of failures (14). These researches specifically evaluate public local government service commission, Alagbaka, Ondo state with the intention of solving electrical power supply inadequate availability in the commission which disrupt operations, impact productivity.

2. Methodology

This methodology outlines the methodological approach adopted in this research. Useful and required data were collected from the local government service commission (LGSC), Alagbaka, Ondo state (15) and Benin electricity distribution commission (BEDC) (2). The steps taken to achieve the work are underneath.

2.1 Identification of existing energy sources

Identification of existing energy sources currently use by the LGSC, Alagbaka, Akure, Ondo state was carried. This was achieved by checking physically the source of supply to all electrical appliances in the LGSC.

(LVP) energised or not? this was done through testing of the input and output of the lvp panel and the associate circuit breakers using voltmeter. this is to establish if supply utility supply power to the commission or not. also, to establish if lgsc hook up to the supply.

2.4 Monetary determination of impact of power failures to the commission

Impact of electricity failure to the commission, E_F , was evaluated using equation 3.

$$E_F = ((E_{Ed} - E_{Ad})S_T) \quad (16) \tag{3}$$

where E_{Ed} is expected electrical energy per day, E_{Ad} is available energy per day and S_T is salaries of total numbers of workers in the commission. compilation was done using micro soft excel for accuracy and clarity.

2.5 Load survey of the lgsc complex, alagbaka

load survey was computed in order to determine the required complex connected loads. rating of each equipment wase taken and computed using excel computational method. 0.8 power factor was applied where necessary (oyeeye, 2019; oyeeye and ale, 2019).

comparism of generator and hybrid inverter, and selection of which one is cheaper, reliable, and efficient to carry the demanded load of the commission was established.

if the existing utility supply cannot meet up with the operational or working hours of the lgsc. re-sizing of the existing generator to adequate capacity is necessary.

2.6 Propose strategies for alternative energy source for lgsc

2.6.1 Sizing generator and inverter capacity LGSC office

generator/ inverter capacity was sized using equation 4.

$$G = [L_c \times D_m \times D_F \times FE] \quad \text{va} \quad \text{single phase} \quad (\text{bahloul and khadem 2024}) \tag{4}$$

where L_c is connected load; D_m is demand factor (0.7, iec 60439-2), D_F is diversity factor, of 0.8 (20); FE is a future expansion multiplying factor or otherwise factor of safety (17; 16).

2.6.2 Choice of generator or solar inverter

The methodology considered and employed here is the overall compare analysis of existing literature and substantial advantages of inverter over generators in modern energy systems. Firstly, they operate quietly, which makes them more suitable for office and residential environments where noise reduction is essential (21). Secondly, inverters deliver clean and stable electricity, ensuring the safety of sensitive electronic devices such as computers and communication systems (22). It can be integrated with renewable sources like solar panels, thereby reducing long-term operational costs and environmental impact (23). It does

not contribute to air pollution. it requires minimal maintenance (21). It provides instant standby backup power during outages, while generators often require manual startup and stabilization (24). This immediate response enhances reliability of critical institutions such as local government offices. Furthermore, when paired with solar photovoltaic systems, it contributes to Nigeria’s renewable energy transition goals, aligning with national energy policies (25).

Considering the advantages of inverter, it is a choice of alternative to generators for local government offices in this research work.

3 Results and Analysis

3.1 Existing distribution boards and generator in LGSC

block diagram of existing distribution boards and generators in Abuja and Lagos buildings in the LGSC is presented in figure 4 and figure 5 respectively.

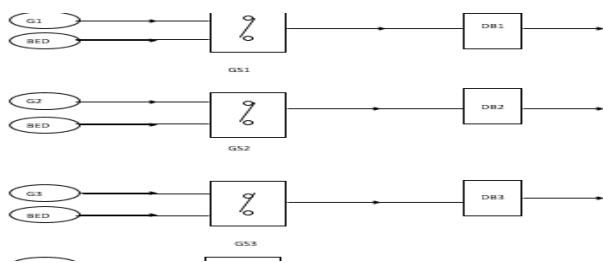


figure 4; generator and BEDC supplied

Lagos Buildings in LGSC

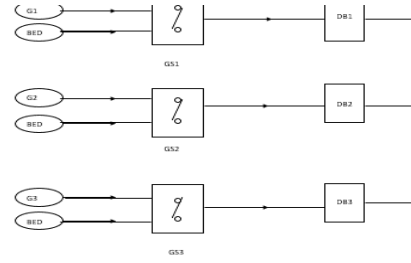


Figure 5: Generator and BEDC supplied

Abuja Building

Figures 4 and 5 imply that public utility and generator sources feed the LGSC.

3.2 Period of power failure

the frequency and duration of electricity in the lgsc is presented in table 1.

Table 1: Frequency and duration of electricity supply

| monthly public utility supply | | | | | | | |
|-------------------------------|-------------|-----------|-----------------|-----------------|-----------------|-----------------|------------------------|
| September, 2024 | | | | | | | |
| NO OF | DATE | DAYS | HR ₁ | HR ₂ | HR ₃ | TOTAL HR (T.HR) | T.HR _{AVE} /M |
| DAYS | IN MONTH(M) | IN NMONTH | | | | | [HR] |
| 1 | 2 | MON | 3.05 | 0.0 | | 3.1 | |
| 2 | 3 | TUE | 4.08 | 0.0 | | 4.1 | |
| 3 | 4 | WED | 4.33 | 1.0 | | 5.4 | |
| 4 | 5 | THUR | 5.00 | 0.0 | | 5.0 | |
| 5 | 6 | FRI | 6.30 | 0.0 | | 6.3 | |
| 6 | 9 | MON | 5.40 | 0.0 | | 5.4 | |
| 7 | 10 | TUE | 7.20 | 0.0 | | 7.2 | |
| 8 | 11 | WED | 4.67 | 0.0 | | 4.7 | |
| 9 | 12 | THUR | 4.63 | 0.0 | | 4.6 | |
| 10 | 13 | FRI | 2.43 | 2.4 | | 4.8 | |
| 11 | 16 | MON | 0.27 | 4.1 | | 4.3 | |
| 12 | 17 | TUE | 4.38 | 0.0 | | 4.4 | |

| | | | | | | | |
|----|----|------|--------------|--------------|--|-------------|-----|
| 13 | 18 | WED | 0.43 | 2.4 | | 2.8 | |
| 14 | 19 | THUR | 4.72 | 0.0 | | 4.7 | |
| 15 | 20 | FRI | 4.80 | 0.0 | | 4.8 | |
| 16 | 23 | MON | 5.45 | 0.0 | | 5.5 | |
| 17 | 24 | TUE | 0.00 | 0.0 | | 0.0 | |
| 18 | 25 | WED | 1.48 | 0.2 | | 1.7 | |
| 19 | 26 | THUR | 5.93 | 0.0 | | 5.9 | |
| 20 | 27 | FRI | 3.52 | 0.0 | | 3.5 | |
| 21 | 30 | MON | 6.25 | 0.0 | | 6.3 | |
| | | | 84.33 | 10.03 | | 94.4 | 4.5 |

October 2024

| NO OF DAYS | DATE IN MONTH | DAYS IN MONTH | HR ₁ | HR ₂ | HR ₃ | TOTAL HR (T.HR) | T.HR _{AVE} /MONTH |
|------------|---------------|---------------|-----------------|-----------------|-----------------|-----------------|----------------------------|
| | | | | | | | [HR] |
| 1 | 1 | TUES | 0.3 | 0.0 | 0.0 | 0.3 | |
| 2 | 2 | WED | 4.8 | 0.0 | 0.0 | 4.8 | |
| 3 | 3 | THUR | 4.7 | 0.0 | 0.0 | 4.7 | |
| 4 | 4 | FRI | 6.5 | 1.5 | 0.0 | 7.9 | |
| 5 | 7 | MON | 4.8 | 0.0 | 0.0 | 4.8 | |
| 6 | 8 | TUES | 4.7 | 0.0 | 0.0 | 4.7 | |
| 7 | 9 | WED | 5.6 | 0.0 | 0.0 | 5.6 | |
| 8 | 10 | THUR | 0.1 | 0.1 | 0.0 | 0.2 | |
| 9 | 11 | FRI | 1.7 | 0.0 | 0.0 | 1.7 | |
| 10 | 14 | MON | 0.0 | 0.0 | 0.0 | 0.0 | |
| 11 | 15 | TUES | 0.0 | 0.0 | 0.0 | 0.0 | |
| 12 | 16 | WED | 2.4 | 0.0 | 0.0 | 2.4 | |
| 13 | 17 | THUR | 1.4 | 0.0 | 0.0 | 1.4 | |
| 14 | 18 | FRI | 5.9 | 0.0 | 0.0 | 5.9 | |
| 15 | 21 | MON | 1.3 | 0.0 | 0.0 | 1.3 | |
| 16 | 22 | TUES | 1.3 | 0.0 | 0.0 | 1.3 | |
| 17 | 23 | WED | 4.8 | 0.0 | 0.0 | 4.8 | |

| 18 | 24 | THUR | 4.6 | 0.0 | 0.0 | 4.6 | |
|----------------------|---------------|---------------|-----------------|-----------------|-----------------|-----------------|----------------------------|
| 19 | 25 | FRI | 8.0 | 0.0 | 0.0 | 8.0 | |
| 20 | 28 | MON | 4.5 | 0.0 | 0.0 | 4.5 | |
| 21 | 29 | TUES | 4.9 | 0.0 | 0.0 | 4.9 | |
| 22 | 30 | WED | 0.2 | 0.8 | 2.8 | 3.7 | |
| 23 | 31 | THUR | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | | 72.3 | 2.3 | 2.8 | 77.4 | 3.4 |
| November 2024 | | | | | | | |
| NO OF DAYS | DATE IN MONTH | DAYS IN MONTH | HR ₁ | HR ₂ | HR ₃ | TOTAL HR (T.HR) | T.HR _{AVE} /MONTH |
| | | | | | | | [HR] |
| 1 | 1 | FRI | 2.1 | 1.87 | 0.1 | 4.1 | |
| 2 | 4 | MON | 4.8 | 0.00 | 0.0 | 4.8 | |
| 3 | 5 | TUES | 2.5 | 0.42 | 0.0 | 2.9 | |
| 4 | 6 | WED | 5.5 | 0.27 | 0.2 | 5.9 | |
| 5 | 7 | THUR | 1.3 | 8.00 | 0.0 | 9.3 | |
| 6 | 8 | FRI | 2.6 | 0.00 | 0.0 | 2.6 | |
| 7 | 11 | MON | 6.0 | 0.00 | 0.0 | 6.0 | |
| 8 | 12 | TUES | 4.9 | 0.00 | 0.0 | 4.9 | |
| 9 | 13 | WED | 0.2 | 0.97 | 2.0 | 3.1 | |
| 10 | 14 | THUR | 0.0 | 0.00 | 0.0 | 0.0 | |
| 11 | 15 | FRI | 0.8 | 0.78 | 0.0 | 1.6 | |
| 12 | 18 | MON | 4.7 | 0.00 | 0.0 | 4.7 | |
| 13 | 19 | TUES | 1.0 | 0.00 | 0.0 | 1.0 | |
| 14 | 20 | WED | 4.0 | 0.00 | 0.0 | 4.0 | |
| 15 | 21 | THUR | 5.8 | 0.00 | 0.0 | 5.8 | |
| 16 | 22 | FRI | 2.9 | 0.00 | 0.0 | 2.9 | |
| 17 | 25 | MON | 0.0 | 0.00 | 0.0 | 0.0 | |
| 18 | 26 | TUES | 2.1 | 2.45 | 0.0 | 4.6 | |
| 19 | 27 | WED | 0.0 | 0.00 | 0.0 | 0.0 | |
| 20 | 28 | THUR | 5.4 | 0.00 | 0.0 | 5.4 | |

| | | | 56.4 | 14.75 | 2.4 | 73.5 | 3.7 |
|----------------------|----------|----------|-----------------|-----------------|-----------------|-----------------|----------------------------|
| December 2024 | | | | | | | |
| NO OF | DATE | DAYS | HR ₁ | HR ₂ | HR ₃ | TOTAL HR (T.HR) | T.HR _{AVE} /MONTH |
| DAYS | IN MONTH | IN MONTH | | | | | [HR] |
| 1 | 3 | TUES | 0.3 | 2.2 | 0.0 | 2.5 | |
| 2 | 4 | WED | 7.6 | 0.0 | 0.0 | 7.6 | |
| 3 | 5 | THUR | 3.8 | 0.0 | 0.0 | 3.8 | |
| 4 | 6 | FRI | 3.0 | 0.9 | 0.0 | 3.9 | |
| 5 | 9 | MON | 3.9 | 0.0 | 0.0 | 3.9 | |
| 6 | 10 | TUES | 1.8 | 0.6 | 0.0 | 2.4 | |
| 7 | 11 | WED | 3.1 | 0.7 | 0.0 | 3.8 | |
| 8 | 12 | THUR | 4.8 | 0.0 | 0.0 | 4.8 | |
| 9 | 13 | FRI | 1.2 | 0.8 | 0.1 | 2.1 | |
| 10 | 16 | MON | 4.7 | 1.4 | 0.0 | 6.1 | |
| 11 | 17 | TUES | 4.2 | 0.0 | 0.0 | 4.2 | |
| 12 | 18 | WED | 2.2 | 0.0 | 0.0 | 2.2 | |
| 13 | 19 | THUR | 5.6 | 0.0 | 0.0 | 5.6 | |
| 14 | 20 | FRI | 7.1 | 0.3 | 0.0 | 7.3 | |
| 15 | 23 | MON | 0.8 | 2.6 | 0.0 | 3.4 | |
| 16 | 24 | TUES | 5.0 | 0.0 | 0.0 | 5.0 | |
| 17 | 25 | WED | 8.0 | 0.0 | 0.0 | 8.0 | |
| 18 | 26 | THUR | 0.0 | 0.0 | 0.0 | 0.0 | |
| 19 | 27 | FRI | 5.0 | 0.0 | 0.0 | 5.0 | |
| 20 | 30 | MON | 3.7 | 0.0 | 0.0 | 3.7 | |
| 21 | 31 | TUES | 1.4 | 1.9 | 0.0 | 3.3 | |
| | | | 77.0 | 11.3 | 0.1 | 88.4 | 4.2 |
| January 2025 | | | | | | | |
| NO OF | DATE | DAYS | HR ₁ | HR ₂ | HR ₃ | TOTAL HR (T.HR) | T.HR _{AVE} /MONTH |
| DAYS | IN MONTH | IN MONTH | | | | | [HR] |

| 1 | 1 | WED | 0.00 | 0.0 | 0.0 | 0.0 | |
|----------------------|----------|----------|-----------------|-----------------|-----------------|-----------------|----------------------------|
| 2 | 2 | THURS | 3.03 | 0.0 | 0.0 | 3.0 | |
| 3 | 3 | FRI | 1.15 | 1.9 | 0.9 | 3.9 | |
| 4 | 6 | MON | 0.92 | 1.2 | 0.9 | 3.1 | |
| 5 | 7 | TUE | 2.87 | 1.6 | 0.0 | 4.5 | |
| 6 | 8 | WED | 0.00 | 0.9 | 0.0 | 0.9 | |
| 7 | 9 | THURS | 2.25 | 1.5 | 0.0 | 3.8 | |
| 8 | 10 | FRI | 5.53 | 0.0 | 0.0 | 5.5 | |
| 9 | 13 | MON | 2.70 | 0.0 | 0.0 | 2.7 | |
| 10 | 14 | TUE | 4.92 | 0.0 | 0.0 | 4.9 | |
| 11 | 15 | WED | 1.23 | 0.4 | 2.5 | 4.1 | |
| 12 | 16 | THURS | 4.52 | 3.2 | 0.0 | 7.7 | |
| 13 | 17 | FRI | 4.48 | 0.0 | 0.0 | 4.5 | |
| 14 | 20 | MON | 8.00 | 0.0 | 0.0 | 8.0 | |
| 15 | 21 | TUE | 5.05 | 4.1 | 0.0 | 9.2 | |
| 16 | 22 | WED | 3.53 | 0.4 | 0.0 | 3.9 | |
| 17 | 23 | THURS | 2.42 | 0.5 | 0.0 | 2.9 | |
| 18 | 24 | FRI | 4.07 | 0.9 | 0.0 | 4.9 | |
| 19 | 27 | MON | 4.45 | 0.0 | 0.0 | 4.5 | |
| 20 | 28 | TUE | 0.00 | 0.0 | 0.0 | 0.0 | |
| 21 | 29 | WED | 4.97 | 0.0 | 0.0 | 5.0 | |
| 22 | 30 | THURS | 0.63 | 1.1 | 3.1 | 4.8 | |
| 23 | 31 | FRI | 4.83 | 0.0 | 0.0 | 4.8 | |
| | | | 71.55 | 17.6 | 7.4 | 96.5 | 4.2 |
| February 2025 | | | | | | | |
| NO OF DAYS | DATE | DAYS | HR ₁ | HR ₂ | HR ₃ | TOTAL HR (T.HR) | T.HR _{AVE} /MONTH |
| | IN MONTH | IN MONTH | | | | | [HR] |
| 1 | 1 | SAT | 0.83 | 0.0 | 0.0 | 0.8 | |
| 2 | 2 | SUN | 6.83 | 0.3 | 0.0 | 7.1 | |

| | | | | | | | |
|----|----|-------|--------------|-------------|------------|-------------|------------|
| 3 | 3 | MON | 1.37 | 2.1 | 0.0 | 3.5 | |
| 4 | 4 | TUE | 8.00 | 0.0 | 0.0 | 8.0 | |
| 5 | 5 | WED | 0.40 | 2.8 | 1.5 | 4.7 | |
| 6 | 6 | THURS | 4.82 | 0.0 | 0.0 | 4.8 | |
| 7 | 7 | FRI | 0.00 | 0.0 | 0.0 | 0.0 | |
| 8 | 10 | MON | 3.58 | 0.0 | 0.0 | 3.6 | |
| 9 | 11 | TUE | 3.40 | 3.4 | 0.0 | 6.8 | |
| 10 | 12 | WED | 5.03 | 1.7 | 0.0 | 6.7 | |
| 11 | 13 | THURS | 0.00 | 0.0 | 0.0 | 0.0 | |
| 12 | 14 | FRI | 4.45 | 0.0 | 0.0 | 4.5 | |
| 13 | 17 | MON | 5.32 | 0.0 | 0.0 | 5.3 | |
| 14 | 18 | TUE | 0.00 | 4.9 | 0.0 | 4.9 | |
| 15 | 19 | WED | 2.43 | 1.4 | 0.0 | 3.8 | |
| 16 | 20 | THURS | 1.07 | 0.8 | 1.5 | 3.4 | |
| 17 | 21 | FRI | 0.00 | 4.9 | 0.0 | 4.9 | |
| 18 | 24 | MON | 1.00 | 0.3 | 0.0 | 1.3 | |
| 19 | 25 | TUE | 4.58 | 0.0 | 0.0 | 4.6 | |
| 20 | 26 | WED | 0.00 | 0.0 | 0.0 | 0.0 | |
| 21 | 27 | THURS | 4.97 | 0.0 | 0.0 | 5.0 | |
| 22 | 28 | FRI | 5.83 | 0.0 | 0.0 | 5.8 | |
| | | | 63.92 | 22.5 | 2.9 | 89.3 | 4.1 |

from table 1, the average public utility supply varies from 3.2 hours to 4.5 hours daily. from the same table, the average daily supply is 4 hours for the operational working hours, excluding public holidays. it means that the power utility supplies 50% of the required electricity for the Idsc work. this directly means that 50% electricity failure is recorded per day. this means that workers work for 50% of their salary.

3.3 low voltage panel (lvp) effectiveness

the result of low voltage panel (lvp) effectiveness is presented in table 2.

Table 2: Low voltage panel (LVP) effectiveness

| SUPPLY SOURCE | PANEL | INPUT VOLTS | BREAKER INPUT VOLTS | BREAKERS OUTPUT VOLTS |
|----------------------|--------------|--------------------|----------------------------|------------------------------|
|----------------------|--------------|--------------------|----------------------------|------------------------------|

| | | | |
|----------------|-----|-----|-----|
| public utility | 230 | 230 | 230 |
| lvp | | | |
| generator | 235 | 235 | 235 |

from table 2, the low voltage panel has expected input and output. the associated circuit

breakers (cbs) also have expected input and output. it follows that the lvp and the associated cbs are functioning very well. this implies that the lvp has no negative effect on the supply voltages. it therefore means that the supply sources voltages are well delivered to the supply units or needed appliances.

3.4 Load survey of the LGSC

The load survey of the LGSC comprising of abuja and lagos building is presented in table 3.

Table 3: LGSC building load survey

| LGSC building load survey | | | | | | | | | | |
|----------------------------|------------------------|-----|----------------|-----|-------------------------------|------|----|------------|--------------------|--------------------|
| LAGOS building load survey | | | | | | | | | | |
| S/N | OFFICE | S/N | EQUIPMENT | QTY | RATINGS | I(A) | HP | P = | P _T (W) | L _C (W) |
| | | | | | | | | IV 0.8 (W) | | |
| 1 | head of administration | 1 | refrigerator | 2 | 220, 240V, 50HZ, 100W | | | 100 | 200 | |
| 2 | general duty | 2 | tv | 2 | 1.0W | | | 1 | 2 | |
| | | 3 | radio | 2 | 220-230V/50HZ 80W (PLOY STAR) | | | 80 | 160 | |
| | | 4 | fans | 3 | 230 & 80/60H (180W) | | | 180 | 540 | |
| | | 5 | computer set | 1 | 1.5A | 1.5 | | 288 | 288 | |
| | | 6 | dstv | 1 | 12V/5V, 1A | 1 | | 192 | 192 | |
| | | 7 | ac | 3 | 1200W, 220V 50HZ | | | 1200 | 3600 | |
| | | 8 | photocopy | 1 | 220-240V 50/60HZ 5A (1200W) | | | 1200 | 1200 | |
| | | 9 | point of light | 6 | 20W | | | 20 | 120 | |
| | | 10 | printer | 1 | 3.0A | 3 | | 576 | 576 | |

| | | | | | | | | | 6878 | 6878 |
|---|--|----|----------------|---|------------------------------|-----|-----|------|-------------|-------------|
| 3 | head of appointment and posting | 11 | refregirator | 1 | 100W | | | 100 | 100 | |
| | | 12 | tv | 1 | 100-240V, 1A | 1 | | 192 | 192 | |
| | | 13 | radio | 1 | 50/60HZ _ (1.0A) 80W | | | 80 | 80 | |
| | | 14 | fans | 2 | 230 50/60HZ (180W) | | | 180 | 360 | |
| | | 15 | computer set | 1 | 1.5A | | | 15 | 15 | |
| | | 16 | dstv | 1 | 12V/5A | 5 | | 960 | 960 | |
| | | 17 | ac | 2 | 1.5HP | | 1.5 | 1119 | 2238 | |
| | | 18 | photocopy | 1 | 220-240V, 50/60HZ (1200W) | | | 1200 | 1200 | |
| | | 19 | point of light | 3 | 18W | | | 18 | 54 | |
| | | 20 | printer | 1 | 220 - 240V 50/60HZ, 3.0A | 3 | | 576 | 576 | |
| | | | | | | | | | | |
| 4 | director of training & manpower department | 21 | tv | 1 | 100-240V 50/60HZ _ (1.0A) | 1 | | 192 | 192 | |
| | | 22 | refregirator | 1 | 100W | | | 100 | 100 | |
| | | 22 | radio | 1 | 50/60HZ _ (1.0A) 80W | | | 80 | 80 | |
| | | 23 | fan ox | 1 | 230 50/60HZ (180W) | | | 180 | 180 | |
| | | 24 | computer set | 1 | 1.5A | 1.5 | | 288 | 288 | |
| | | 25 | gotv | 1 | 12/1A | 1 | | 192 | 192 | |
| | | 26 | ac | 2 | 4.5A | 4.5 | | 864 | 1728 | |
| | | 27 | photocopy | 1 | 220-240V, 50/60HZ 5A (1200W) | | | 1200 | 1200 | |
| | | 28 | point of light | 4 | 10W | | | 18 | 72 | |
| | | 29 | printer | 1 | 3.5A | 3.5 | | 672 | 672 | |
| | | | | | | | | | 4704 | 4704 |
| 5 | director of personnel | 30 | tv | 1 | 100-240V 50/60HZ _ 1.0A | 1 | | 192 | 192 | |
| | | 31 | ref. | 1 | 100W | | | 100 | 100 | |

| | | | | | | | | | | |
|---|----------------------|----|-------------------|---|------------------------------|-----|--|-------|---------------|-------------|
| | | 32 | radio | 1 | 80W (POLYSTAR) | | | 80 | 80 | |
| | | 33 | fan ox | 1 | 230 50/60HZ (180W) | | | 180 | 180 | |
| | | 34 | computer set | 1 | 1.5A | 1.5 | | 288 | 288 | |
| | | 35 | gotv | 1 | 12/1A | 1 | | 192 | 192 | |
| | | 35 | ac | 2 | 4.3A | 4.3 | | 825.6 | 1651.2 | |
| | | 37 | photocopy | 1 | 220-240V, 50/60HZ 5A (1200W) | | | 1200 | 1200 | |
| | | 38 | point of light | 2 | 10W | | | 10 | 20 | |
| | | 39 | printer | 1 | 3.0A | 3 | | 576 | 576 | |
| | | | | | | | | | 4479.2 | 4479.2 |
| | | | | | | | | | | |
| 6 | director of budget | 40 | tv | 1 | 100-240V 50/60HZ _ (100W) | | | 100 | 100 | |
| | | 41 | refregirator | 1 | 100W | | | 100 | 100 | |
| | | 42 | ac | 2 | 1200W | | | 1119 | 2238 | |
| | | 43 | fan (ceiling fan) | 2 | 230 50/60HZ (180W) | | | 180 | 360 | |
| | | 44 | computer set | 1 | 1.5A | 1.5 | | 288 | 288 | |
| | | 45 | dstv | 1 | 1A | 1 | | 192 | 192 | |
| | | 46 | photocopy | 1 | 220-240V, 50/60HZ 5A (1200W) | | | 1200 | 1200 | |
| | | 47 | point of light | 4 | 10W | | | 10 | 40 | |
| | | | | | | | | | | 4518 |
| | | | | | | | | | | |
| 7 | clinic health centre | 48 | point of light | 2 | 18W | | | 18 | 36 | |
| | | 49 | fan | 1 | (70W) | | | 70 | 70 | |
| | | | | | | | | | | 106 |
| | | | | | | | | | | |
| 8 | chairman's office | | tv | 2 | 100-240V 50/60HZ _ (100W) | | | 100 | 200 | |

| | | | | | | | | | | |
|---|---------------------|--|-------------------|----|------------------------------|-----|--|------|-------------|------|
| | | | ref. | 2 | 100W | | | 100 | 200 | |
| | | | radio | 2 | 80W (POLYSTAR) | | | 80 | 160 | |
| | | | fan ox | 4 | 230 50/60HZ (180W) | | | 180 | 720 | |
| | | | computer set | 1 | 1.5A | 1.5 | | 288 | 288 | |
| | | | dstv | 1 | 1.0W | 1 | | 192 | 192 | |
| | | | ac | 4 | 1200W | | | 1200 | 4800 | |
| | | | photocopy | 1 | 220-240V, 50/60HZ 5A (1200W) | | | 1200 | 1200 | |
| | | | point of light | 8 | 18W) | | | 18 | 144 | |
| | | | | | | | | | 7904 | 7904 |
| | | | | | | | | | | |
| | | | ac | 4 | 1200W | | | 1200 | 4800 | |
| 9 | conferenc e room | | tv | 1 | 100-240V 50/60HZ _ (100W) | | | 10 | 10 | |
| | | | ceiling fan | 8 | 100W | | | 180 | 1440 | |
| | | | point of light | 10 | 18W | | | 18 | 180 | |
| | | | fan binatone | 2 | (10W) 70W | | | 70 | 140 | |
| | | | | | | | | | 6570 | 6570 |
| | | | | | | | | | | |
| | | | tv | 2 | 100-240V 50/60HZ _ (100W) | | | 100 | 200 | |
| | | | ref. | 1 | 70W | | | 70 | 70 | |
| | | | radio | 2 | 100W | | | 100 | 200 | |
| | | | fan | 3 | 80W | | | 80 | 240 | |
| | | | computer set | 1 | 70W | | | 70 | 70 | |
| | | | dstv | 1 | 5A | 5 | | 960 | 960 | |
| | | | ac | 3 | 4.5A STANDING A/C | 4.5 | | 864 | 2592 | |
| | | | photocopy machine | 1 | 220-240V, 50/60HZ 5A (1200W) | | | 1200 | 1200 | |
| | | | point of light | 6 | 18W | | | 18 | 108 | |
| | | | | | | | | | 5640 | 5640 |
| | | | | | | | | | | |

| | | | | | | | | | | |
|----|----------------------|--|-------------------|---|---------------------------|-----|--|------|-------------|------|
| 11 | capturing office | | ac | 2 | 1200W | | | 1200 | 2400 | |
| | | | tv | 1 | 100-240V 50/60HZ _1.0A | 1 | | 192 | 192 | |
| | | | computer set | 2 | 70W | | | 70 | 140 | |
| | | | capturing machine | 2 | 3A | 3 | | 576 | 1152 | |
| | | | | | | | | | 3884 | 3884 |
| | | | | | | | | | | |
| 12 | commissi oner i | | tv | 2 | 1.A (A/C) | 1 | | 192 | 384 | |
| | | | radio | 2 | 80W | | | 80 | 160 | |
| | | | gotv | 1 | 5A | 5 | | 960 | 960 | |
| | | | fan ox | 1 | 80W | | | 80 | 80 | |
| | | | ceiling fan | 1 | 180W | | | 180 | 180 | |
| | | | ac | 2 | 4.5A STANDING A/C | 4.5 | | 864 | 1728 | |
| | | | | | | | | | 3492 | 3492 |
| 13 | commissi oner ii | | tv | 2 | 1.A (A/C) | 1 | | 192 | 384 | |
| | | | radio | 2 | 80W | | | 80 | 160 | |
| | | | gotv | 1 | 5A | 5 | | 960 | 960 | |
| | | | fan ox | 1 | 80W | | | 80 | 80 | |
| | | | ceiling fan | 1 | 180W | | | 180 | 180 | |
| | | | ac | 2 | 4.5A STANDING A/C | 4.5 | | 864 | 1728 | |
| | | | | | | | | | 3492 | 3492 |
| 14 | commissi oner iii | | tv | 2 | 1.A (A/C) | 1 | | 192 | 384 | |
| | | | radio | 2 | 80W | | | 80 | 160 | |
| | | | gotv | 1 | 5A | 5 | | 960 | 960 | |
| | | | fan ox | 1 | 80W | | | 80 | 80 | |
| | | | ceiling fan | 1 | 180W | | | 180 | 180 | |
| | | | ac | 2 | 4.5A STANDING A/C | 4.5 | | 864 | 1728 | |
| | | | | | | | | | | |

| | | | | | | | | | | |
|----|--|------------|------------------|------------|------------------------------|-------------|-----------|---------------|--------------|------------------|
| | | | | | | | | | 3492 | 3492 |
| | | | | | | | | | | |
| 15 | commissi oner iv | | tv | 2 | 1.A (A/C) | 1 | | 192 | 384 | |
| | | | radio | 2 | 80W | | | 80 | 160 | |
| | | | gotv | 1 | 5A | 5 | | 960 | 960 | |
| | | | fan ox | 1 | 80W | | | 80 | 80 | |
| | | | ceiling fan | 1 | 180W | | | 180 | 180 | |
| | | | ac | 2 | 4.5A STANDING A/C | 4.5 | | 864 | 1728 | |
| | | | | | | | | | | 3492 |
| | | | | | | | | | | |
| 16 | commissi oner v | | tv | 2 | 1.A (A/C) | 1 | | 192 | 384 | |
| | | | radio | 2 | 80W | | | 80 | 160 | |
| | | | gotv | 1 | 5A | 5 | | 960 | 960 | |
| | | | fan ox | 1 | 80W | | | 80 | 80 | |
| | | | ceiling fan | 1 | 180W | | | 180 | 180 | |
| | | | ac | 2 | 4.5A STANDING A/C | 4.5 | | 864 | 1728 | |
| | | | | | | | | | | 3492 |
| | | | | | | | | | | |
| | | | | 200 | | | | | | 66,390.20 |
| | | | | | | | | | | |
| | lagos building load survey | | | | | | | | | |
| | GROUND FLOOR | | | | | | | | | |
| | OFFICE | S/N | EQUIPMENT | QTY | RATINGS | I(A) | HP | PUQ(W) | Pr(W) | Lc(W) |
| 1 | director of local general on personnel | 1 | tv | 1 | AC 100-240V250/60HZ, 1.5A | 1.5 | | 288 | 288 | |
| | | 2 | fan | 1 | 180W | | | 180 | 180 | |
| | | | | | | | | | | 468 |
| | | | | | | | | | | |

| | | | | | | | | | | |
|---|--|------------|------------------|------------|----------------------------|-------------|-----------|---------------|---------------|---------------|
| 2 | director of tranings& man power | 3 | tv | 1 | 70W | | | 70 | 70 | |
| | | 4 | fan | 1 | 180W | | | 180 | 180 | |
| | | | | | | | | | 250 | |
| | | | | | | | | | | |
| 3 | director of post & appoint | 5 | tv | 1 | 70W | | | 70 | 70 | |
| | | 6 | fan | 1 | 180W | | | 180 | 180 | |
| | | | | | | | | | 250 | 250 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | OFFICE | S/N | EQUIPMENT | QTY | RATINGS | I(A) | HP | PuQ(W) | Pr(W) | Lc(W) |
| 1 | file room | 1 | radio | 1 | 80W | | | 80 | 80 | |
| | | 2 | fan | 2 | 230 50/60HZ POWER 180W | | | 180 | 360 | |
| | | 3 | ac | 3 | 2.0A | 2 | | 384 | 1152 | |
| | | | | | | | | | 1592 | 1592 |
| | | | | | | | | | | |
| 2 | treasury dept | 4 | radio | 1 | 80W | | | 80 | 80 | |
| | | 5 | fan ceiling | 2 | 2A | 2 | | 384 | 768 | |
| | | 6 | ac | 3 | 2.A | 2 | | 384 | 1152 | |
| | | | | | | | | | 2000 | 2000 |
| | | | | | | | | | | |
| 3 | accountan t office | 7 | radio | 1 | 80W | | | 80 | 80 | |
| | | 8 | fan | 1 | 180W | | | 180 | 180 | |
| | | 9 | ac | 1 | 4.3A STANDING A/C | 4.3 | | 825.6 | 825.6 | |
| | | 10 | comp set | 1 | 4.5A | 4.5 | | 864 | 864 | |
| | | | | | | | | | 1949.6 | 1949.6 |
| | | | | | | | | | | |
| 4 | works dept | 11 | tv | 1 | AC 100-240V-50/60HZ 70W | | | 70 | 70 | |
| | | 12 | radio | 1 | 60W | | | 60 | 60 | |
| | | 13 | ac | 1 | 2A | 2 | | 384 | 384 | |

| | | | | | | | | | | |
|---|---------------------------------|------------|------------------|------------|----------------------------|-----|-------------|-----------|---------------|--------------|
| | | 14 | fan | 1 | 180W | | | 180 | 180 | |
| | | | | | | | | | 694 | 694 |
| | | | | | | | | | | |
| 5 | general office for accountant | 15 | tv | 1 | AC 100-240V-50/60HZ 70W | | | 70 | 70 | |
| | | 16 | radio | 1 | 60W | | | 60 | 60 | |
| | | 17 | ac | 1 | 2.5A | 2.5 | | 480 | 480 | |
| | | 18 | fan | 1 | 180W | | | 180 | 180 | |
| | | | | | | | | | 790 | 790 |
| | | | | | | | | | | |
| 6 | cashier 2 | 20 | fan | 1 | 180W | | | 180 | 180 | |
| | | | | | | | | | 180 | 180 |
| | | | | | | | | | 0 | |
| | | | | | | | | | | |
| | OFFICE | S/N | EQUIPMENT | QTY | RATINGS | | I(A) | HP | PuQ(W) | Pr(W) |
| 7 | director of financing & supply | | tv | 1 | 1.0W | | | 1 | 1 | |
| | | | radio | 1 | 80W | | | 80 | 80 | |
| | | | ac | 2 | 1.0A | 1 | | 192 | 384 | |
| | | | fan | 2 | 70W | | | 70 | 140 | |
| | | | | | | | | | 605 | 605 |
| | | | | | | | | | | |
| 8 | head of local government admin. | | tv | 1 | 1.5A | 1.5 | | 288 | 288 | |
| | | | radio | 1 | 60W | | | 60 | 60 | |
| | | | ac | 2 | 1.5A | 1.5 | | 288 | 576 | |
| | | | light | 4 | 10W | | | 10 | 40 | |
| | | | fan | 2 | 70W | | | 70 | 140 | |
| | | | | | | | | | 1104 | 1104 |
| | | | | | | | | | | |

| | | | | | | | | | |
|----|---------------------|-----------|---|------------------------|-----|-------|-------------|---------------|---------------|
| 9 | remmitter office | tv | 1 | 1.5A | 1.5 | 288 | 288 | | |
| | | radio | 1 | 60W | | 60 | 60 | | |
| | | ac | 1 | 1.5A | 1.5 | 288 | 288 | | |
| | | compt set | 6 | 4.5A | 4.5 | 864 | 5184 | | |
| | | fan | 1 | 80W | | 80 | 80 | | |
| | | | | | | | 5900 | 5900 | |
| | | | | | | | | | |
| 10 | informatio n dept | tv | 1 | 1.5A | 1.5 | 288 | 288 | | |
| | | radio | 1 | 60W | | 60 | 60 | | |
| | | ac | 1 | 1A | 1 | 192 | 192 | | |
| | | fan | 1 | 70W (BINATONE PRODUCT) | | 70 | 70 | | |
| | | dstv | 1 | 5A | 5 | 960 | 960 | | |
| | | ac | 1 | 1.5A | 1.5 | 288 | 288 | | |
| | | light | 1 | 10W | | 10 | 10 | | |
| | | | | | | | | 1868 | 1868 |
| | | | | | | | | | |
| 11 | computati on office | fan | 2 | 70W | | 70 | 140 | | |
| | | comp set | 6 | 220/240V 71AW | | 71 | 426 | | |
| | | ac | 1 | 4.3A | 4.3 | 825.6 | 825.6 | | |
| | | light | 4 | 18W | | 18 | 72 | | |
| | | | | | | | | 1463.6 | 1463.6 |
| | | | | | | | | | |
| 12 | union office | tv | 1 | 1.5A | 1.5 | 288 | 288 | | |
| | | radio | 1 | 1A | 1 | 192 | 192 | | |
| | | fan | 1 | 70W | | 70 | 70 | | |
| | | dstv | 1 | 5A | 5 | 960 | 960 | | |
| | | light | 4 | 18W | | 18 | 72 | | |
| | | | | | | | | 1582 | 1582 |
| | | | | | | | | | |

| THIRD FLOOR | | | | | | | | | | |
|-------------|----------------------------------|----------------|------------|---------|--|------|----|---------------------|--------------------|------------------|
| OFFICE | S/N | EQUIPMENT | QTY | RATINGS | | I(A) | HP | P _{UQ} (W) | P _T (W) | |
| 13 | auditor | radio | 1 | 80W | | | | 80 | 80 | |
| | | fan | 1 | 70W | | | | 70 | 70 | |
| | | ac | 1 | 4.5A | | 4.5 | | 864 | 864 | |
| | | point of light | 2 | 10W | | | | 10 | 20 | |
| | | | | | | | | | | 1034 |
| | | | | | | | | | | |
| 14 | cashier 1 | fan | 1 | 70W | | | | 70 | 70 | |
| | | point of light | 1 | 10W | | | | 10 | 10 | |
| | | | | | | | | | | 80 |
| | | | | | | | | | | |
| 15 | local govt. primary school loans | radio | 1 | 80W | | | | 80 | 80 | |
| | | fan | 2 | 70W | | | | 70 | 140 | |
| | | computer set | 2 | 15W | | | | 15 | 30 | |
| | | ac | 1 | 4.5A | | 4.5 | | 864 | 864 | |
| | | point of light | 4 | 10W | | | | 10 | 40 | |
| | | | | | | | | | | 1154 |
| | | | | | | | | | | |
| | | | 102 | | | | | | | 22,714.20 |
| | | | | | | | | final total | | 90,632.4 |

From table 3, the total load survey for the commission is 90.6 mw. it is deduced that the total connected load is 90.632.4 kw (113.4 kva).

the result of a redesigned generator or solar capacity (proposed) is presented in table 4.

Table 4: proposed generator sizing

| L _C | D _M | D _F | F _E | G _M = L _C X D _M | G _M F = L _C X D _M X D _F | G _M F-F _E = L _C X D _M X D _F X F _E |
|----------------|----------------|----------------|----------------|--|---|---|
| KVA | | | | kVA | kVA | kVA |
| 113.4 | 0.7 | 0.8 | 1.25 | 79.4 | 63.5 | 79.4 |

generator load is presented in table 5.

Table 5: Generated loads

| s/no | generator name | rating (kva) |
|------|-------------------|--------------|
| 1 | Firman fpg22800e2 | 9.9 |
| 2 | Firman eco8990cs | 8.9 |
| 3 | Firman ec08990cs | 8.9 |
| 4 | Elepaq 5v6800 | 3.5 |
| 5 | Thermocool | 3.5 |
| 6 | thermocool | 2.5 |
| 7 | Firman | 2.8 |
| | total | 40 |

From table 5, the generator load is 40 kva. it cannot carry the proposed load of 79.4 kva, table 4. it means that the existing distributed generators need to be resizing for effective lgsc operation. hence review and redesigned of a proposed generator for the commission was done,

table 4 shows redesigned of a generator using demand load, diversity factor and future expansion of appropriate standards to 79.4 kva as against the existing 40 kva. the continuous use of these distributed generators should be totally discouraged as maintenance will be very high and replacement will be often.

solar inverter is preferred to generator is supported in this research based on the existing literatures as in 3.6.2.

4. Conclusion and recommendations

4.1 Conclusion

This research work evaluated the main problem of lgsc in akure, ondo state, nigeria. the problem was critically evaluated and this research established a proposed solution suitable for the commission effective operation. the followings are conclusions from this research:

- I. the existing public utility and existing generators sources feed the lgsc;
- II. the lvp and associated cbs of the lgsc network are functioning very well;
- III. the average public supply varies 3.2hrs to 4.5hrs daily, averagely 4hrs, excluding saturdays sunday, and public holidays (50% of the required electricity);
- IV. the total connected load is 90.342 kva (113.4 kva),

- V. proposed generator or inverter capacity is 79.4 kva (designed) considering appropriate standards of demand load, diversity factor and future expansion;
- VI. solar inverter is recommended for the lgsc operation due to its overall benefits established in this research; and
- VII. a customised 80 kva solar inverter is recommended for the lgsc operation.

4.2 recommendations

it is recommended that load survey should be carried out before sizing of a generator/inverter for any edifice or office. appropriate demand, diversity and future expansion factors should be considered in sizing a power supply unit source.

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