


An Analysis Of Use Uninterruptible Power Supply (UPS) On Power Consumption At Iconnet Network Transmitter Stations

Asni Ati Mutia¹, Amani Darma Tarigan², Beni Satria³

^{1,2,3}Universitas Pembangunan Panca Budi, Medan, North Sumatera, Indonesia

Article Info	ABSTRACT
Keywords: UPS, Power Efficiency, Transmission Station, System Reliability	The use of Uninterruptible Power Supply (UPS) plays a crucial role in maintaining power stability, especially in ICONNET network transmission stations, which require a reliable and uninterrupted power supply. UPS functions as a backup power source that prevents sudden power disruptions, reducing the risk of equipment damage and service interruptions in telecommunication networks. This study aims to analyse the impact of UPS usage on power consumption at ICONNET transmission stations. The research methodology includes measuring power consumption before and after UPS implementation, analysing power efficiency, and evaluating the impact of UPS on system reliability. Data were collected through monitoring electrical load, UPS operation duration, and power performance during grid outages. The results indicate that UPS usage can optimize power consumption efficiency by stabilizing voltage and frequency. Additionally, UPS contributes to enhancing the operational reliability of transmission stations by preventing downtime caused by power failures from the main grid. However, UPS efficiency is highly influenced by battery capacity, power conversion efficiency, and the electrical load characteristics of the transmission station. Thus, this study provides insights for network operators in selecting and managing appropriate UPS systems to improve energy efficiency and transmission system reliability.
This is an open access article under the CC BY-NC license 	Corresponding Author: Asni Ati Mutia Universitas Pembangunan Panca Budi, Medan, North Sumatera, Indonesia asniatimutia345@gmail.com

INTRODUCTION

In the telecommunications industry, the availability of stable and reliable electrical power is a major factor in maintaining the quality of network services. ICONNET network transmitter stations, as one of the main infrastructures in providing internet services, require a continuous supply of electricity to ensure optimal operation. However, electrical disturbances such as sudden blackouts, voltage spikes, or power instability can cause system downtime, decreased service quality, and potential damage to transmission devices.

One of the solutions commonly used to overcome this problem is the Uninterruptible Power Supply (UPS). UPS functions as a power backup that can provide temporary electricity when a blackout occurs, so that network devices can continue to operate without

interruption. In addition, UPS also plays a role in stabilizing electrical voltage and frequency, which can protect electronic equipment from potential damage due to power fluctuations.

Iconneti Network Transmitter Station is a transmitter antenna for an internet network system built in certain areas to transmit telecommunications networks that optimize the use of electrical network infrastructure for telecommunications which were originally only used to meet the needs of telecommunications network services for electricity operations. Iconneti also has high speed and uses the latest reliable and stable fiber optic technology, specially designed for retail and residential areas. This Iconneti Network Transmitter Station is one of the efficient information systems, although it still uses a manual method for data collection and processing for network development on Iconnet. To anticipate power outages, an Uninterruptible Power Supply (UPS) is used which can power servers and transmitters at the network transmitter station but are turned on for some time when there is a power outage from PLN until finally the electricity is supplied by a generator (genset) or until finally the electricity is turned back on normally. Because if there is a failure or the server goes down for a moment, it can cause significant losses for the company. Therefore, in this study it is expected to be able to analyze the power capacity of the Uninterruptible Power Supply (UPS) against the loading of servers in an effort to anticipate the occurrence of failure or power outages from PLN at the Iconnet Network Transmitter Station.

Literature Review

Uninterruptible Power Supply (UPS)

One of the supporting equipment that can be used to protect various vital devices from power outages is the Uninterruptible Power Supply (UPS). This tool can function as a stabilizer against disturbances and become a backup power source in the event of a power outage from the main power supply provider. On the other hand, the performance of the Uninterruptible Power Supply (UPS) against various types of loads and various levels of loading is not necessarily the same. This performance can be seen from two conditions, namely normal conditions where the Uninterruptible Power Supply (UPS) acts as a stabilizer against disturbances and emergency conditions when there is a power outage from the main power supply provider where the Uninterruptible Power Supply (UPS) functions as a temporary backup power supply. UPS is one way for a network architect to maintain security in terms of availability. UPS itself is an abbreviation of the word Uninterruptible Power Supply which means an electronic device whose main function is as a backup power supply for computers, Data Centers, and other important things.

There are several functions of the UPS, one of which is:

- a. Can provide temporary electrical energy when there is a power outage on the main electricity
- b. Provides sufficient time to immediately turn on the generator as a replacement for the main electricity.
- c. Provides sufficient time to immediately back up data and secure the operating system (OS) by performing a shutdown according to the procedure when the main electricity goes out.

- d. Secures the computer system from electrical disturbances that can interfere with the computer system, both in the form of software damage, data and hardware damage.
- e. UPS can automatically stabilize the electrical voltage when there is a change in input voltage so that the output voltage used by the computer system is a stable voltage.
- f. UPSi can perform self-diagnosis and settings, making it easier for users to anticipate if there will be a disruption to the system.
- g. User friendly and easy to understand the installation.
- h. Users can control UPSi via LAN network by adding some necessary accessories.
- i. Can be integrated with the internet network.
- j. Notification if a failure occurs by making settings on the UPS management software

Types of Uninterruptible Power Supply (UPS) Systems

- a. Standby UPS
- b. Line Interactive UPS
- c. Double Conversion Online
- d. Delta Conversion Online

Uninterruptible Power Supply (UPS) systems always work to back up or supply electrical power so that in this system the electrical power supply is always converted to DC supply and then converted back to AC power supply through an inverter.

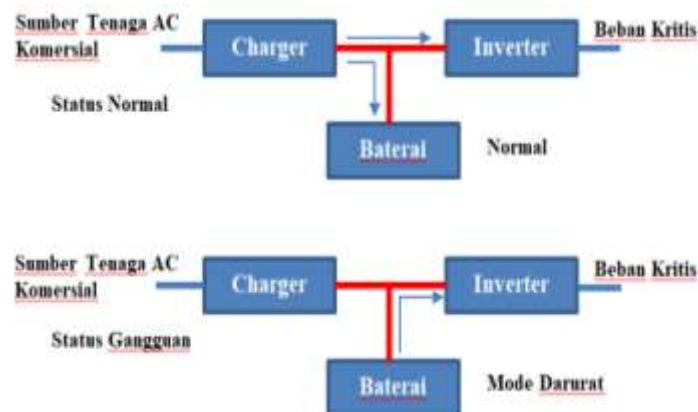


Figure 1. Continuous UPS system

This system will work to supply electrical power to the load when the sensor detects a disturbance in the electrical power supply.

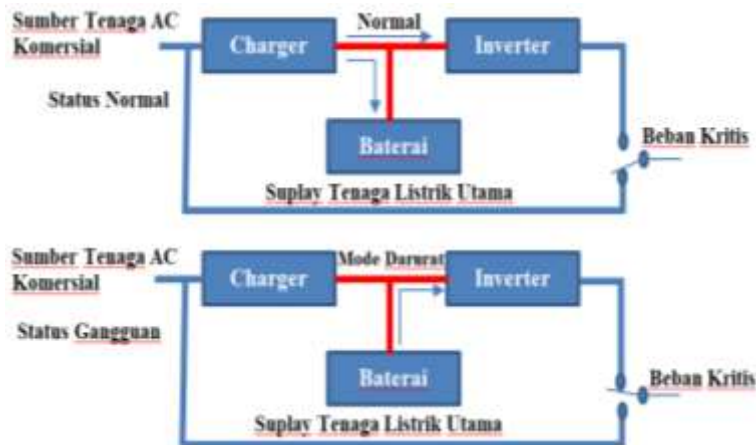


Figure 2. Forward UPS System

On system This output system UPS direct connected with burden critical However on condition disturbance certain so burden critical can diverted on source power other besides UPS.



Figure 3. Reverse UPS System

METHOD

The Uninterruptible Power Supply (UPS) system used in Iconnet Network Transmitter Stations is an Uninterruptible Power Supply (UPS) system with component number APCi BX650Li made in Germany. With flexible configurations, accessories, and available options, this system is well suited to powering capacitive loads, such as blade servers. Reliability and availability of a single power source for critical applications are guaranteed by distributed or centralized parallel connections of up to 10 units for backup power or parallel power, and by all available configurations in the MASTER MPS series.



Figure 4. UPS Emmerich APC BX650LI

There are 50 battery units used as a place to store backup power/energy to supply the transmitter engine and its supporting equipment at the Iconnet Network Transmitter Station. To accommodate electrical power, there is a transformer connected to the generator. The specifications of the transformer used are 550kVAi 3Pi 13.8kVi / 210. From here, the output voltage from the transformer is obtained which is the input voltage (AC input voltage) to the Iconnet Network Transmitter Station and the UPS of 210V. So that the output voltage from the UPS that enters the server/load at the Iconnet Network Transmitter Station is 210Vi (VL-Li 3i Phase).

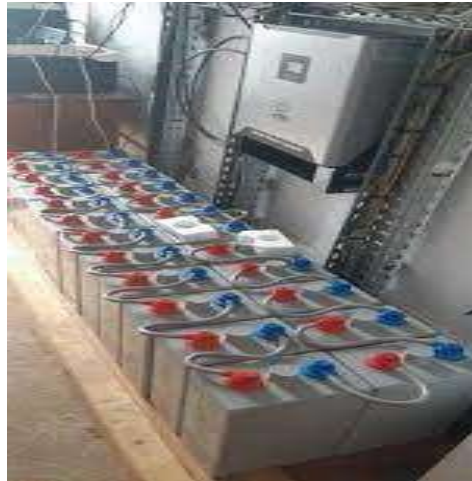


Figure 5. Unit Battery

Rating Breaker Power.

- a. For System 1 Phase $I_n = \frac{P}{V_{l-n} \cdot \cos \phi}$
- b. For System 3 Phase $I_n = \frac{P}{\sqrt{3} \cdot V_{l-n} \cdot \cos \phi}$

Power and Power Factor In the AC system, the power or electrical loads are generally distinguished:

- a. Active power

(P) is a power quantity and is also called real power or active power. The active power (P) used for 1 phase is as follows:

$$P = v \cdot i \cdot \cos \phi \text{ where as For 3 phase is } P = \sqrt{3} \cdot v \cdot i \cdot \cos \phi$$

Where:

- P = Power active (watt)
- V = Voltage line to line (volt)
- I = Current (amperes)
- Cos ϕ = Factor Power

- b. Reactive Power

The reactive power used by a circuit is:

$$(Q) = \text{Current} \times \text{component V Which upright straight to I. } Q = \sqrt{3} V \cdot I \sin \phi$$

- c. Power Complex

In form complex, Power stated as: $S = \frac{P}{\cos \phi}$

- d. Pseudo Power $S = VI$

$$S = \sqrt{3}V.L$$

e. Factor Power $(\cos\phi)$

A Factor Power $(\cos\phi)$ can stated with $\cos\phi = \frac{P}{V.I} = \frac{P}{S} = \frac{\text{Watt}}{\text{VA}}$

RESULTS AND ANALYSIS

Calculation of Uninterruptible Power Supply (UPS)

Load Uninterruptible Power Supply (UPS) load on Iconnet Network Search Station in the form of internet network transmitter and computer. It is necessary to know the voltage and current flowing/entering the load, so that the total load power can be calculated in VA (apparent power) and Watt (active power). In the power distribution from Uninterruptible Power Supply (UPS) on Iconnet Network Search Station, the output voltage from Uninterruptible Power Supply (UPS) is 119i kVA divided into several equipment, including Internet Network Search Machine = 91.5 A, Computer = 2.15A, Other Equipment = 6.7 A

Load Flow

Total load current = $I_{\text{Load}} = 91.5 + 2.15 + 6.7 = 100.35$ Ampere

Total server Which connected on UPS (status ON)

= Total Server = 5 unit

$$\text{Flat - flat current per server} = \frac{\frac{I_{\text{Load}}}{\text{Total Server}}}{5} = \frac{100,35}{5} = 20,07A$$

Power Load

For get total Power burden (total *load*) use formula Power pseudo 3 phase

$$S = \frac{P}{\cos\phi} \text{ Or}$$

$$S = \sqrt{3}.V_{L-L}.I \text{ (VA)}$$

$$V_{L-L} = \sqrt{3}.V_{L-N}$$

$$S = \sqrt{3}.\sqrt{3}.V_{L-N}.I$$

$$S = 3.V_{L-N}.I \text{ (VA)}$$

$$V_{L-N} = 119 \text{ V}$$

$$I = I_{\text{Load}} = 20.07 \text{ A}$$

$$\cos = 0.92$$

So that the total load power (total load) of all servers installed on the Uninterruptible Power Supply (UPS) at the Iconneti Network Search Station is obtained, namely:

Sothat obtained total Power burden (total *load*) all server Which installed on *Uninterru*
ptible Power Supply (UPS) in Station Transmitter Network Iconnet that is:

$$S = 3 \times V_{L-N} \times I$$

$$= 3 \times 119V \times 20.07 \text{ A}$$

$$= 7.164 \text{ VA}$$

$$P = S \times \cos\phi$$

$$= 7.164 \text{ VA} \times 0.92$$

$$= 6590.88 \text{ Watt}$$

Ideal Ratings for Uninterruptible Power Supplies (UPS)

The rating for Uninterruptible Power Supplies (UPS) must be greater than the VA load, at least 20-25% greater than the VA load). So to get the ideal rating for an Uninterruptible Power Supply (UPS), add 25% to the total VA load and use an Uninterruptible Power Supply (UPS) with a rating equal to or greater than that sum. With the total load, use the UPS/UPS power capacity rating that is ideally required (considering cost, efficiency, effectiveness and required runtime):

Ideal UPS rating

$$\begin{aligned} &= \text{Total load} + 25\% \\ &= 7164 + 25\% \\ &= 8955 \text{ VA} \end{aligned}$$

So, it is better to use a UPS with a rating of 8955 VA.

Capacity and Capability of Uninterruptible Power Supply (UPS) Before Load

- Power or rating of Uninterruptible Power Supply (UPS) = 119 kVA
- Maximum Current To get the capacity/total current ($I_{\text{max}} = I_n$) that can be accommodated by UPS

$$I_{\text{Max}} = I_n = \frac{S}{3 \cdot V_{L-N}}$$

$$\text{UPS rating} = 8955 \text{ VA} = 119 \text{ V So}$$

that obtained total current/current maximum ($I_{\text{max}} = I_n$) Which Can accommodated U

$$\text{PS } I_{\text{Max}} = I_n = \frac{119000}{3 \times 119} = 333 \text{ A.}$$

Capacity and UPS Capacity After Load When a power failure occurs, it is necessary to know how long the UPS can survive and stay on in order to meet the needs of the Network Search Station system during the power transition from power outage to power back on or using a generator set. The UPS runtime must be greater than the time requirement. Battery Capacity (based on battery enclosure) = $192 \text{ V} \times 167 \text{ A} \times 1 \text{ h} = 32064 \text{ VAh}$ After getting the battery capacity, the runtime can be obtained.

$$\text{UPS rating} = 8955 \text{ VA} = 119 \text{ V S}$$

that obtained total current/current maximum ($I_{\text{max}} = I_n$) Which Can accommodated U

$$\text{PS } I_{\text{Max}} = I_n = \frac{119000}{3 \times 119} = 333 \text{ A}$$

CONCLUSION

The conclusion of this paper are: The conclusions of this study are as follows: a. The UPS rating at the Iconneti Network Search Station has a power that is greater than the ideal UPS rating (UPS oversizing). This is done to get a longer runtime and if there is an additional server. The UPS rating must be greater than the VA load, at least 20-25% greater. To get a UPS with an ideal rating, add 25% to the total VA load, use a UPS with a rating equal to or greater. UPS capacity (rating) to determine the maximum load that can be installed. Battery capacity determines how long the UPS can be turned on without electricity or on-battery (UPS runtime). UPSi loadi at the Iconneti Network Search Station is 37.25% from 119i

kVA, it still can be done by adding more loads/servers. UPS runtime is 3 hours 56 minutes, this time is more than enough for the transfer of electricity source to the generator set

REFERENCES

- Hafiz Al Hakim Nasution, Zulkarnain Lubis, Beni Satria, 2024 Scientia Journal "An Analyzed Design Of Automatic Battery Charger Based On Thyristor" olume 13, Number 03, 2024, DOI 10.58471/scientia.v13i03ESSN 2723-7486 (Online)
- Rahmaniar, R., Syahputra, M. R., Lesmana, D., & Junaidi, A. (2022). Sosialisasi Pemahaman Bahaya Tegangan Sentuh Dan Hubung Singkat Sistem Kelistrikan Bagi Masyarakat Desa Kota Pari. *RESWARA: Jurnal Pengabdian Kepada Masyarakat*, 3(2), 357-362
- Theresia Bornito Sitohang, Beni Satria, Amani Darma Tarigan, 2024 Power Elektronik: Jurnal Orang Elektro "Analysis of Automatic Transfer Switch (ATS) Working System in Solar Power Plant (PLTS) Against Battery Voltage Value" Vol.13, No.2, 2024, p-ISSN: 2301-6949, e-ISSN: 2715-5064
- Dino Erivianto, Ahmad Dani2, Haris Gunawan, 2020, Seminar of Social Sciences Engineering & Humanities e-SCENARIO "Electrical Energy Conversion System as Alternative Energy for Household Needs" Medan - Saturday, December 26, 2020 ISSN 2775-4049
- Afit Muhammad Lukman1, Yusuf Bachtiar, 2018 Evolution Journal "Analysis of Internet Network Management, Maintenance and Security Systems at IT Telkom Purwokerto" Volume 6 No 2 – 2018, ISSN: 2338 – 8161
- Aryza S et al, (2024) A ROBUST OPTIMIZATION TO DYNAMIC SUPPLIER DECISIONS AND SUPPLY ALLOCATION PROBLEMS IN THE MULTI-RETAIL INDUSTRY. *Eastern-European Journal of Enterprise Technologies*, (3).
- Muhammad Afangi Ridwan Hakiki Alafi, 2023 Electrical Engineering Final Project "Calculation Analysis for Determining the Capacity of Uninterruptible Power Supply (UPS) in the Bali Nusa Dua Convention Center Building" Electrical Engineering Study Program, Electrical Engineering Department, Bali State Polytechnic 2023.
- Muhammad Fakhri Yusuf, 2021 Electrical Engineering Thesis "Design of Voltage and Current Monitoring on Electronic Devices" Uninterruptible Power Supply Radar using the radio Link method at Sultan Iskandar Muda Airport" Faculty of Science and Technology, Electrical Engineering Program, Panca Budi Development University, Medan, 2021.
- M. Nanak Zakaria, Rachmad Saptono, Yoyok Heru Prasetyo I, Hendro Darmono, Septriandi Wirayoga, Yani Ratnawati, Ahmad Setiawan, 2024 "Polinema Community Service Journal," Amateur Repeater Radio as a Supporting Tool for Rapi Communication (Indonesian Inter-Resident Radio) in Malang Regency" Vol.11 No.2 July 2024.
- Satria, B., & Fatahanan, I. (2024). Implementation Of Hydroponic Device Control System Via Website. *Journal of Information Technology, computer science and Electrical Engineering*, 1(3), 106-113.
- Alhidayat, Samuel Jie, Wa Ode Zulkaidah, Mustarum Musaruddin, Mansur, 2023 Jurnal Fokus Elektroda, "Analysis of the Use of Uninterruptible Power Supply (UPS) as a*

Solution to Overcome Shock Voltage in the Power Supply of the Motor Control Center (MCC)" Volume 08 No 04, Year 2023: Pages 295-302. e-ISSN: 2502-5562. Open Access at:<http://ojs.uho.ac.id/index.php/jfe>/Publisher: Department of Electrical Engineering, Halu Oleo University, Kendari, Southeast Sulawesi

Ade Akbar Mukhlisin¹, Suhanto¹, Lady Silk, 2019 Seminar Proceedings, "Design and Control of Uninterruptible Power Supply (UPS) Battery Monitoring Using Hybrid Energy with the Internet of Thing (IOT) Concept" National Aviation Technology Innovation (Snitp) 2019, ISSN: 2548-8090