

Altering Supply Frequency to Prevent the Theft of Electric Power at Distribution End

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Abstract:- In today's scenario electricity has become a dire need of almost every human being. The cost of generating electric power is beyond ones imagination. According to a recent study, it has been observed that power theft has become a major issue. This paper lays emphasis on the issue of power theft and provides an effective scheme to minimize the same. The scheme is entirely based on the idea of frequency variation at distribution end.

Keyword - Cycloconverter, Power theft, Frequency Controlled Scheme.

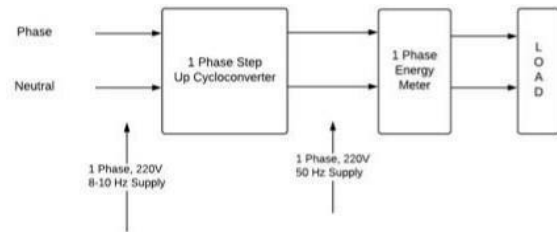
I. INTRODUCTION

It is estimated that nearly 25% of the world population is underprivileged from the benefits of electricity, out of which the Asian and African nations are the worse to be affected. According to a survey, In India Uttar Pradesh is the most populated state with a vast population of slums. These slums meet their daily electrical requirement by illegally tapping electricity. Congested overhead lines easily become prey of these illegal tapings. Every year a large portion of electric power is lost due to illegal activities.

These activities include tapping from transmission line and bypassing of energy meter. The proposed scheme in this paper suggests frequency variation between the distribution end and the consumer premises using cycloconverter. The range of frequency for the legal consumers will be 50Hz (60Hz USA) and for the defaulters it will be 8-10Hz. There are several devices which can alter the frequency such as, cycloconverter, matrix converter etc. However, cycloconverter is preferred in this scheme because of its simple construction and operation. Also from economical point of view, matrix converter has not been taken into account.

II. REFERED METHODOLOGY

In this scheme, the frequency will be varied at the distribution end. The existing system will have the same frequency throughout the system. However, in the proposed scheme, the system frequency will vary from the distribution transformer, output terminals of pole mounted substation and the consumer end.



The frequency between the distribution transformer and consumer premises will be in the range of 8-10Hz. This is possible by incorporating a step down cycloconverter at the distribution end which will step down the frequency of the Supply from 50Hz to a range of 8-10Hz.

Now, whenever an illegal consumer will try to tap the transmission line, he will have a supply with frequency of 8-10Hz.

His appliances will be damaged and hampered in the worst way. A step up cycloconverter at the consumer premises will step up the frequency of the supply from 8-10 Hz to 50 Hz, which the healthy frequency and the legal consumers appliances won't be hampered in any way. Both the cycloconverter must be oriented in sealed enclosures. The step down cycloconverter can be installed near the bushing of the secondary of distribution transformer. The step up cycloconverter can be placed in the energy meter with proper spacing.

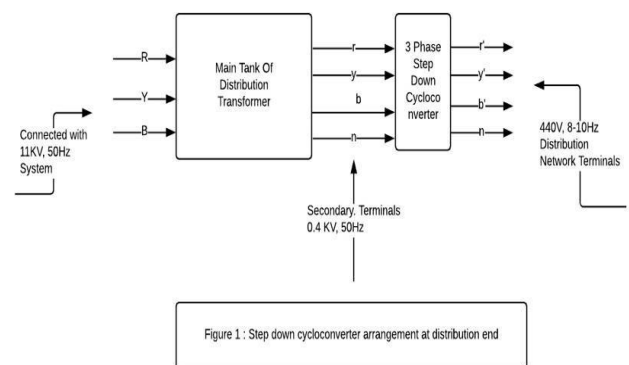


Figure 1 : Step down cycloconverter arrangement at distribution end

III. ACTUAL METHODOLOGY

The proposed scheme in this paper suggests frequency variation between the distribution end and the consumer premises using rectifier and inverter. The range of frequency for the legal consumers will be 50Hz (60Hz USA) and for the

defaulters it will be 0Hz (DC). There are several devices which can be used in the inverter however, IGBT is preferred because of its high switching frequency, reliability and it can be fully controlled. However, Also from economical point of view, other switches have not been taken into account. In this scheme, the frequency will be varied at the distribution end. The existing system will have the same frequency throughout the system. However, in the proposed scheme, the system frequency will vary from the distribution transformer and the distribution pole near the consumer premises.

The frequency between the distribution transformer and consumer premises will be 0Hz (DC) which will be because of the rectifier installed at the distribution end. This is possible by incorporating a rectifier at the distribution end which will convert the AC supply into DC supply.

Now, whenever an illegal consumer will try to tap the transmission line, he will have a DC supply.

His appliances won't work and hampered in the worst way. A 3 Phase inverter will be installed on the distribution pole near the consumer premises, which will convert the DC supply to AC supply, and the legal consumers appliances won't be hampered in any way. The inverter must be oriented in sealed enclosure. The rectifier can be installed in the distribution substation. The 3 Phase inverter can be installed on the distribution pole near the consumer premises.

IV. CASE STUDY OF POWER THEFT IN PROPOSED SCHEME

This proposed scheme against theft is studied on various types of load. One of the disadvantage of DC transmission is designing the Protection Switchgear. DC current generally will not have natural zero crossing and because of this forced zero is obtained by using the combination of L-C & R. Though it is not impossible but the circuitry is typical and the same has to be manufactured at voltage levels and implemented. Further, shock hazards are too dangerous in DC.

Originally, DC was used because AC had not been perfected. All it was good for was to produce light and run some nearby motors. It couldn't be transmitted even from city to city without incurring huge losses. AC, with the addition of both UP and Down voltage transformers ended that. Now, with AC and transformers, it is possible to efficiently transmit power over very long distances with very little losses. However, with new technology, relating to cryogenic cables and ultrahigh voltages, it is possible that DC may become a viable contender for long distance transmission of power.

V. MERITS OF DC POWER DISTRIBUTION

- Capacitance and Inductance will not be present, so capacitive leakage and inductive impedance will be absent.
- Due to tremendous progress in DC-DC converters, it's economical to go for High Voltage DC and IR losses can be drastically reduced.

V.RESULTS

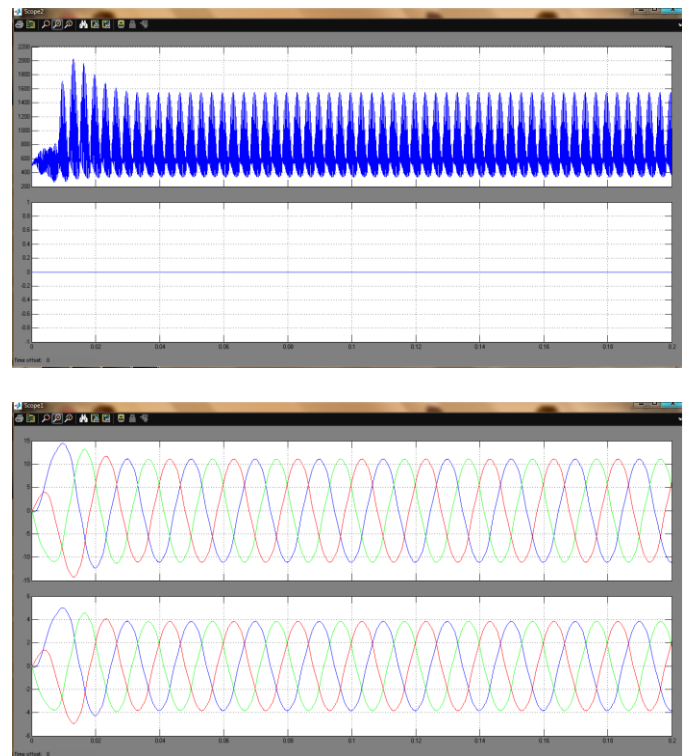


Fig. Rectification and Inversion

The illegal consumers will have DC supply, so their appliances which are designed to work on AC supply won't work. Their appliances may face severe damage by overheating. As for the legal consumers, the distribution pole near their premises will have an inverter mounted over it. The inverter will convert the DC power to AC power and hence the legal consumers won't face any problem using their appliances.

CONCLUSION

This paper provides an effective method to minimize the power theft by 75%. Even if the transmission line is illegally tapped, the absence of inverter would prove fatal to the illegal consumers.

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