INTELLIGENT ELECTRICITY THEFT CONTROLLER

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Abstract-- This proposed model provides an intelligent control for electricity theft in distribution system due to direct tapping on LT line or bypassing the meter. Here we use three phase step down cycloconverter/variable frequency drive to step down the fundamental frequency of three phase supply from 50 Hz to 10 Hz of the distribution transformer 11kV/0.4kV or pole mounted substation where no load could work properly and then distribute the power, but for the legal consumer another single phase step up cycloconverter/variable frequency drive merged with the energy meter of the consumer to step up back the frequency level to 50 Hz. Hence being the intelligent controller of electricity theft due to direct hooking’s or tapings on the distribution line. The proposed model has been realized and analyzed in Matlab.

Keywords-- Cycloconverter, Energy Meter, Intelligent controller.

I. INTRODUCTION

Indian power sector loses a lot of money on the electricity theft cases. Direct tapings on the distribution line is one of the major methods of stealing electricity and hence we are proposing a model which would curb this method of stealing of electricity. Now to stop this stealing the only method is to somehow varying the electrical parameters of the power being distributed through the distribution line. We came to the crux that by raising or lowering the frequency of the distributed power to a certain level the appliances which will be directly connected to the distribution line would not work as they will get the supply at low frequency and hence there would be no power consumption. The proposed method is to change the frequency where only licensed consumer can use electricity of 50 Hz frequency. This method makes an impediment for those who use illegal electricity by tapping from LT lines and bypassing energy meters, they cannot use 50 Hz of supply. For illegal consumers, consumed electrical frequency will be in the range other than 50 Hz. Now to lower the frequency to a certain level we require three phase step down cycloconverter. The consumers which are consuming the power in a fair manner will need to get supply at 50 Hz only so that the appliances could work, this will happen only when we convert the lowered frequency back to 50 Hz for this single phase step up cycloconverter will be used fitted inside or merged along with the energy meter of the consumer. Hence the consumer will get the same 50 Hz supply and his consumption will be
metered through the energy meter and on the other hand person trying to directly tap the line will get power at low frequency hence no power will be consumed. If the consumer himself tries to bypass the meter he also will get the supply at low frequency and hence no power consumption will occur.

II. METHODOLOGY
In this proposed model the variation in frequency will take place at the distribution end. In existing system frequency remains same throughout the line. In the proposed system frequency will get lowered from distribution transformers, pole mounted substation’s output terminals and again get raised at consumer end. Considering an 11kV/0.4kV distribution transformer or pole mounted substation, on the LT line a three phase step down cycloconverter will be attached inside a sealed enclosure which will step down the fundamental frequency of 50Hz to the range of 8-10Hz and then at this lowered frequency the power will be distributed. One single phase step up cycloconverter will be installed at the consumer end merged with the energy meter which will step up the lowered frequency back to 50Hz so that legal consumer with the energy meter can use electricity and appliances can work at the normal frequency. Now if any person tries to directly tap the LT line which is now distributing power at lowered frequency or bypass the energy meter will not be able to consume any power. In this paper the effect of lowered frequency on the load will be discussed.

I. III. PROPOSED MODEL FOR DISTRIBUTION SYSTEM

Figure 1: Block diagram of the proposed model at distribution end

Fig 2: Matlab Model for Six pulse Three phase Step down Cycloconverter.

IV. PRINCIPLE OF OPERATION
1. Three Phase Step Down cycloconverter
In this proposed matlab model of three Phase Step down cycloconverter we have used three individual six pulse single phase step down cycloconverter with each phase of LT line, which converts the fundamental frequency of 50Hz to 10Hz. Step down Cycloconverter basically consists of SCR’s or thyristors divided in two groups one being Positive or
P-converter and other Negative or N-converter and works on natural or line commutation of thyristors
In figure 3, the internal circuit diagram showing the assembly of the eight SCR’s or thyristors forming the P-converter and N-converter of the single phase step down cycloconverter used with each phase coming out of the distribution transformer for stepping down the frequency to 10hz is shown

Figure 3: Internal circuit diagram of single phase step down cycloconverter attached to R phase of 0.4 kV line of the distribution transformer and giving output of 10Hz

Figure 4: Fabricated and mean output voltage waveform for a single phase step down cycloconverter analyzed in matlab
The output voltage waveform at lowered frequency of whole circuit of six pulse three phase step down cycloconverter is shown in figure 5.

Figure 5: Output voltage waveform of six pulse three phase step down cycloconverter analyzed in MATLAB

1. Single phase step up cycloconverter
The single phase step up cycloconverter which is used to step up the frequency level from 10Hz back to 50Hz for the legal consumers will be placed at the consumer end and will be merged with the energy meters of the consumers so that they will get supply at 50Hz. The working principle of single phase step up cycloconverter is same as single phase step down cycloconverter as explained above the only difference occurs at the commutation technique used. Here in the case of step up cycloconverter we use forced commutation to get the output frequency of 50Hz from 10Hz input.

Figure 6 shows the arrangement of single phase step up cycloconverter with the energy meter of the legal consumer to get the supply at 50Hz

Figure 6: Circuit diagram of single phase step up cycloconverter merged with the energy meter of legal consumer supplying 50Hz, 220V
III. RESULTS AND DISCUSSION

The effect of lowered frequency on the illegal consumer load and the type of load when direct tapped the LT line or bypassed the meter and draws power at a lowered frequency of the range 8-10Hz is discussed here.

1. Figure 8 shows the FFT analysis of output waveform of three phase step down cycloconverter, containing THD=23.57% and also complex harmonics which are usually filtered out by the machine inductance, but as for the illegal consumers frequency is low which in-turn lowers the inductance hence no filtration occurs.

CFL tube lights used contains ballast or choke which is inductive in nature and have Inductive reactance \( X = 2\pi f L \) which restricts the high current in the CFL, but as the frequency is effectively lowered down hence CFL will get damaged or will not consume any power.

2. Flickering of lamps at lower frequency as filament coil of Incandescent lamp cools at each half cycle of the alternating current.

CONCLUSION

The proposed model in figure 1. enables successful control of electricity theft in comparison to the present system with the variation in the frequency of the power to be distributed to the consumers leads to the curb the electricity theft due to direct tapping on the LT line or bypassing the energy meter as the illegal consumer will draw power at low frequency where no appliance could work properly.

VI. FUTURE ASPECTS

1. Implementation of IOT (Internet of Things) is possible with this proposed model where each pole mounted substation or distribution transformer along with the sealed three phase step down cycloconverter will have a unique ID whose control will be available at the substation and variation in the frequency can be controlled via internet.

2. At the consumers end the energy meters can be employed with the IOT and shall have unique ID due to which its reading could be directly get uploaded on the server where the substation staff while sitting in their office can see the reading of the meter as well as power consumption.

3. By implementing harmonic filters along with the cycloconverters best results can be obtained.

VIII. REFERENCES


