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POWER THEFT – A PRIMAL CONCERN

(The Novel Approach of Detection and Prevention of Power Theft)

[1]Mr. Anirban Saha, [2]Mr.Arshad Hossain, [3]Mr. Debojyoti Hazra, [4]Mr. Nirjhar Banerjee, [5]Mrs. Suparna Pal

[1-5]Department of Electrical Engineering, JIS College of Engineering, Kalyani, West Bengal, India

Abstract: Within a country of 1.33 billion people power theft is one of the greatest problems this country faces. India firms ranked electricity problems as the number one issue facing their businesses in the 2006 World Bank Enterprise Survey. Our power companies have approximately INR 3000 Crores losses every year. It is estimated that power theft accounts to 1.5% of Gross Domestic Production (GDP). This paper provides the in-depth knowledge of these problems and their solutions and also the power theft scenario in West Bengal.

Index Terms **– Power Theft, Technical Loss, Electricity Theft**

I. INTRODUCTION

India, the largest democracy with an estimated population of 1.33 billion, is on a road to rapid growth in economy. Energy, particularly electricity, is a key input for accelerating the economic growth. This theft of electricity is a criminal offence and power companies are also losing billions of rupees for this. And ultimately it is affecting the consumers who legally use the power energy. Further, it affects the investment decision and hampers economic growth and thereby the future nations as well. Non – technical loss (NTL) during transmission of electrical energy is a major problem in developing countries and it has been very difficult for the utility companies to detect and fight for people responsible for the theft. These losses affect quality of supply, increase load on the generating station, and affect imposed on genuine customers. This paper discusses the various ways of stealing the electricity and the factors that influence the customers to theft. And also the technical loss that we get from transmission and distribution line.

II. DIFFERENT MODES OF ELECTRICITY THEFT

Given below are the most prominent kinds of "theft" in India.

a. Billing Irregularities – It is the most commonly found electricity theft in India, it can be intentional or unintentional. In intentional irregularity the billing authority would take some menial bribe and record the meter at lower number than what it is shown. On the other hand, the unintentional irregularities range from ineffective measuring mechanism to substandard staff, which results in a big loss.

b. Unpaid Bills – Some people and organizations don't pay what they owe for electricity. Some residentials or business consumers may have left the city or an enterprise may have gone bankrupt.

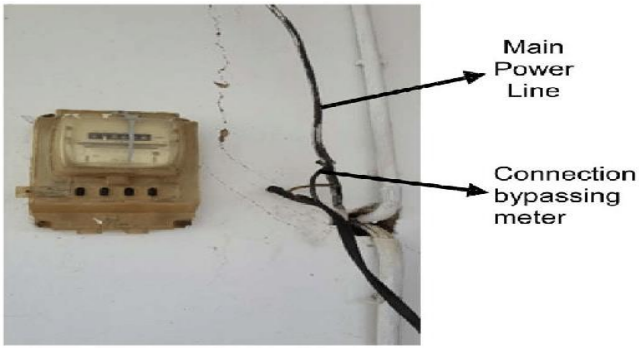
c. Fraud – It especially happens when the consumer deliberately tries to deceive the utility. The commonly seen practice is mentioned below –

(i) Injecting foreign element in the meter - In such Cases meters are manipulated via a remote by installing a circuit inside the meter so that the meter can be slowed down at any time.

(ii) Physical obstruction - This type of tempering is done to the old meters with a rotating element. A material is placed inside the meter to slow down the movement of the rotating element inside the meter. That way the meter reading will raise slowly.

d. Stealing Electricity – This is another mode of electricity theft which is mainly done by rigging a line from the power source to the meter (bypassing) –

(i)Meter bypass - it means the cable which goes from the nearest pole to the meter, the power is stolen by the consumer by using the second cable by cutting the main cable before the meter. In such cases, some energy passes through the meter, whose bill will be deposited by the consumer through the bill.



meter bypass

e. Direct Hooking – This is the most predominant method of electricity theft and the easiest one. In this way of electricity theft, a person consumes electricity illegally by connecting cable direct from the nearest line without legal electrical connection. More than 80% of residential theft is happening in this way.

direct hooking

f. Power theft & losses in transmission and distribution lines - So, power thefting is the situation which arises when the input current which is passing from distribution transformer to the consumer cannot be consumed by the consumer totally i.e, there is a possibility of thefting of energy.

ΣIin = ΣIout → No Theft
ΣIin ≠ ΣIout → Theft
Iin – Input Current to the distribution line from distribution transformer
Iout – Current consumed by the consumer

Moreover there are losses also in transmission and distribution line. These are two types:
Technical Losses
Commercial Losses

III. CALCULATION

We have to calculate Technical Losses and Commercial Losses separately. So, these technical losses are directly effected on electrical tariff but commercial losses are not implemented to all the consumers.
For example, lets calculate technical losses of one of a 11KV Distribution Line
Main length of 11 KV Line is 6.18 Kms.
Total nos. of distribution transformer on feeder 25 KVA = 3 No, 63 KVA = 3 No, 100 KVA = 1 No.
25 KVA Transformer Iron Losses = 100W, Copper Losses = 720W, Avg. LT Line Loss = 63W
63 KVA Transformer Iron Losses = 200W, Copper Losses = 1300 W, Average LT Line Loss = 260W.

100 KVA Transformer Iron Losses = 290 W, Copper Losses = 1850 W, LT Line Loss = 1390W
Max. Amp is 12 Amps
Unit sent out during to feeder is 490335 KWh
Unit sold out during from feeder is 353592 KWh
Normative Load diversity Factor for Urban feeder is 1.5 and for Rural feeder is 2.0

Total Connected Load=No's of Connected Transformer.

Total Connected Load= (25×3) + (63×3) + (100×1).
Total Connected Load=364 KVA.

Peak Load = 1.732 x Line Voltage x Max Amp

Peak Load = 1.732x11x12
Peak Load =228 KVA.

Diversity Factor (DF) = Connected Load (In KVA) / Peak Load.

Diversity Factor (DF) = 364 /228
Diversity Factor (DF) =1.15

Load Factor (LF)= Unit Sent Out (In KWh) / 1.732 x Line Voltage x Max Amp. x P.F. x 8760

Load Factor (LF)=490335 / 1.732x11x12x0.8×8760
Load Factor (LF)=0.3060

Loss Load Factor (LLF)= (0.8 x LF x LF) + (0.2 x LF)

Loss Load Factor (LLF)= (0.8 x 0.3060 x 0.3060) + (0.2 x 0.306)
Loss Load Factor (LLF)= 0.1361

Calculation of Iron losses:

Total Annual Iron loss in KWh = Iron Loss in Watts X Nos of TC on the feeder X 8760 / 1000

Total Annual Iron loss (25KVA TC) =100x3x8760 /1000 = 2628 KWh
Total Annual Iron loss (63KVA TC) =200x3x8760 /1000 = 5256 KWh
Total Annual Iron loss (100KVA TC) = 290x3x8760 /1000 = 2540 KWh
Total Annual Iron loss =2628+5256+2540 =10424Kwh

Calculation of Copper losses:

Total Annual Copper loss in KWh =Cu Loss in Watts X Nos of TC on the feeder LF X LF X 8760 / 1000

Total Annual Copper loss (25KVA TC) = 720x3x0.3×0.3×8760 /1000 =1771 KWh
Total Annual Copper loss (63KVA TC) = 1300x3x0.3×0.3×8760 /1000 =3199 KWh
Total Annual Copper loss (100KVA TC) = 1850x1x0.3×0.3×8760 /1000 =1458 KWh
Total Annual Copper loss =1771+3199+1458=6490Kwh

HT Line Losses (KWh)=0.105 x (Conn. Load x 2) x Length x Resistance x LLF /(LDF x DF x DF x 2)

HT Line Losses= 1.05 x (265×2) x 6.18 x 0.54 x 0.1361 /1.5 x 1.15 x1.15 x 2
HT Line Losses = 831 KWh

Peak Power Losses= (3 x Total LT Line Losses) / (PPL x DF x DF x 1000)

Peak Power Losses= 3 x (3×63+3×260+1×1380) /1.15 x 1.15 x 1000
Peak Power Losses= 3.0

LT Line Losses (KWh)= (PPL.) x (LLF) x 8760

LT Line Losses = 3 x 0.1361 x 8760
LT Line Losses = 3315 KWh

Total Technical Losses = (HT Line Losses + LT Line Losses + Annual Cu Losses + Annual Iron Losses)

Total Technical Losses = (831+ 3315 + 10424 + 6490)

Total Technical Losses = 21061 KWh

% Technical Loss = (Total Losses) / (Unit Sent Out Annually) x 100

%Technical Loss = (21061/490335) x100= **4.30%**

% Technical Loss=4.30%

IV. Reasons of Power Theft in India

As we all know electricity is necessary for each an every one of us. But because of the high price of electricity poor people could not effort electricity. This is one of the biggest reasons of power theft. Lack of available capacity, weak infrastructure and poor electricity supply governance are recognized as the main cause for such a generalized failure. With regard to governance, it has been suggested that more than 20% of the total electricity generated in India is stolen. It is seen that in many parts of the country, power theft increases during elections. Since farmers form the majority of the country's electorate, political leaders often promise them free or subsidised electricity in order to get votes. Also, most of the overhead electrical wires in India are still not insulated and that invites illegal hook-ups.

V. Solutions

Monitoring - Authority should appoint someone to monitor if anyone using electricity illegally.
Using of smart meters - With smart meters we no longer need to give our energy supplier manual reading. The smart meter shows a digital reading which automatically sent to our energy supplier every month.
Using webcam - Meter bypassing has a big part in residential power theft. To prevent this government need to install webcams where they see some irregularity in the meter reading.
Using sensors - Installing sensors to the poles and when someone do the hooking in that line the sensors will send a alert sound to the authority.

VI. Conclusion

It is rudimentary to understand that power theft is a major area of concern to date, and there is a pressing need for a pragmatic solution for the same. The schemes Like Deendayal Upadhyaya Gram Jyoti Yojana will have an important role to play in this respect. Indeed, we should acknowledge that there are enough laws and regulations to protect the electricity sector and the crimes committed therein, so what is needed is a proper implementation mechanism for the already existing laws.

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VIII. Authors

Mr. Anirban Saha is currently pursuing Bachelor of Technology (B. Tech 8th sem) in Electrical Engineering from JIS College of Engineering, Kalyani.

Mr. Arshad Hossain is currently pursuing Bachelor of Technology (B. Tech 8th sem) in Electrical Engineering from JIS College of Engineering, Kalyani.

Mr. Debojyoti Hazra is currently pursuing Bachelor of Technology (B. Tech 8th sem) in Electrical Engineering from JIS College of Engineering, Kalyani.

Mr. Nirjhar Banerjee is currently pursuing Bachelor of Technology (B. Tech 8th sem) in Electrical Engineering from JIS College of Engineering, Kalyani.

Mrs. Suparna Pal is currently an Assistant Professor in the Department of Electrical Engineering in JIS College of Engineering, Kalyani. She completed her M.Tech from the University of Calcutta in 2002 and has 17 years of teaching experience. Her areas of interest in research includePower System, Control System and Renewable Energy.