

# Wireless Power Theft Monitoring

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**Abstract:** *The main aim of power theft monitoring and indication system at local substation using wireless technology indicate the location where the power is being stolen. The main purpose of power theft monitoring power is saving. Power theft is the biggest problem now-a-days, which causes huge loss to electricity boards and to cover these losses ultimately, prices are increased. So if we can prevent these thefts, we can save lots of power by keeping track of electricity used. We can determine where the greatest opportunity for energy savings lies becoming aware of overall energy use involves keeping track of the readings on the readings on the electric meter. The normal practice for power theft is to short the input and output terminals or to place a magnet on the wheel in case of old meters so by sensing current flow through the line & energy feedback we can prevent it using a circuit breaker.*

**Keywords:** Electrical power theft, wireless data transmission and receiving, tapping, meter tampering, anti-theft drives, Improvement in Key Performance Indicators (KPI)

## I. INTRODUCTION

Generation, transmission and distribution of electrical energy involve many operational losses. Whereas, losses implicated in generation can be technically defined, but transmission and distribution losses cannot be precisely quantified with the sending end information. This illustrates the involvement of nontechnical parameter in transmission and distribution of electricity. Overall technical losses occur naturally and are caused because of power dissipation in transmission lines, transformers, and other power system components. Technical losses in T&D are computed with the information about total load and the total energy bill. While technology in on the raising slopes, we should also note the increasing immoral activities. With a technical view, Power Theft is a non ignorable crime and at the same time it directly affected the economy of a nation. Electricity theft a social evil, so it has to be completely eliminated. Power consumption and losses have to be closely monitored so that the generated power is utilized in a most efficient manner. The system prevents the illegal usage of electricity. At this point of technological development the problem of illegal usage of electricity can be solved electronically without any human control. The implementation of this system will save large amount of electricity, and there by electricity will be available for more number of consumer then earlier, in highly populated country such as INDIA. Electrical power theft detection system is used to detect an unauthorized tapping on distribution lines. Implementation area of this system is a distribution network of electrical power supply system. Existing system is not able to identify the exact location of tapping. This system actually finds out on which electrical line there is a tapping. This is a real time system. Wireless data transmission and receiving technique is used. This will provide an additional facility of wireless meter reading with the same technique and in same cost. This will protect distribution network from power theft done by tapping, meter tampering etc. Energy is critical, directly or indirectly, in the entire process of evolution, growth and survival of all living beings and it plays a vital role in the socio-economic development and human welfare of a country. Minimization of transmission and distribution losses is of vital importance for cost reduction in power distribution networks for ensuring adequate power availability at economical rates to consumers. The T&D losses in various states of India vary from 20 to 35%. The transmission loss as compared to distribution loss is much smaller i.e. in the range of 3 to 4%. Hence a major portion of the total T&D losses lie in the sub- transmission and distribution systems. Distribution losses can be further classified as technical and commercial losses. The technical loss in distribution sector is in the range of 8 to 10% which depends on the length of LT & HT feeder.

The factors responsible for commercial losses are:

1. Theft/pilferage of energy.
2. Metering deficiencies such as stuck up or burnt meter.
3. Defective or tampered meters.
4. Errors in estimation of unmetered services.
5. Error in meter reading etc. 6. Poor accounting of energy.

The normal practice for power theft is to short the input and output terminals or to place a magnet on the wheel in case of old meters so by sensing current flow through the line & energy feedback we can prevent it using a circuit breaker and prevent the theft of power.

## II. THEFT OF POWER

These are power losses caused intentionally by human beings by illegal access to the power distribution networks. This is power theft. Electricity theft is termed as non-technical loss. This electricity theft is estimated to result in huge amount of revenue lost per year in India. All the utilities make effort to reduce the losses due to theft. Due to development of advanced technologies, the technical losses can be reduced substantially. However, for reduction of commercial losses, especially theft, a strategic approach is essential. Electricity theft includes: Tampering meters to show low meter reading.

1. By passing a meter.
2. Billing irregularities.
3. Direct hooking to LT line.
4. Usage of power more than contracted, especially by agriculture consumers.

The theft of energy by direct tapping of long LT lines passing through agricultural fields in rural areas or town feeders cause over loading of the system and lead to consequential failure of transformer.



**Figure 1: Tapped Transmission Line.**



**Figure 2: Tampered Meters**

### **III. REDUCTION IN THEFT OF POWER**

With large amount of electricity now being handled by DISCOMs, even one percent reduction in T&D losses will provide substantial benefits to utilities. To realize the benefits, systematic approach is necessary to reduce commercial losses due to theft. The reduction in commercial loss can be achieved with lesser cost in shorter time period. Periodic inspection by special vigilance group can substantially reduce theft.

#### **3.1 Methods for Reduction of Theft of Power**

##### **A. Technical/Engineering Methodology**

Electric power is not a new technology and innovations taking place enabled very efficient system to be installed and maintained. Many power systems devote inadequate resources and effort to Transmission and Distribution (T&D) Systems and do not use the latest technology. The investment necessary to reduce losses includes upgrading power lines, transformers, information technology monitoring systems and installing and maintenance of modern metering systems that are at the interface of the organization and the consumers of the electricity. Significant technological advancement in metering has occurred. Since much theft is from meter tampering it is important to replace old easy to tamper-with meters. New high-tech sealed meters that cannot be altered in any way and can be read automatically are expensive but can reduce theft when required of moderate to heavy power users and the investment in high technology metering requires a sound and complex infrastructure in place to make the System work effectively.

##### **B. Managerial Method**

Distribution Companies are very large entities that operate as bureaucracies even though many are private sector organizations. Combining strong technical improvements with intelligent and active anti-theft remedial measures may result into significant improvements. Corruption is one of the most difficult problem areas for Distribution Company because power theft occurs with the connivance of employees of the power organization. Increased investigation and surveillance may provide opportunity for more corruption. Employees may even extort money from electricity consumers not to disclose theft. Employees should be paid adequately so that they will. Not have to resort to bribes in order to support a family.

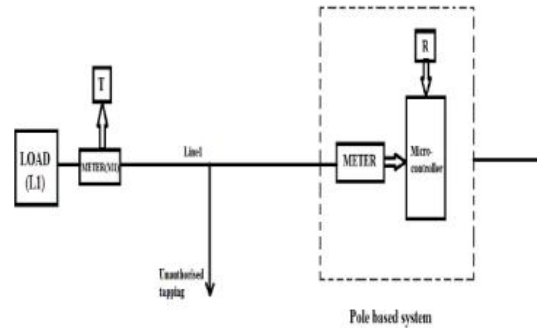
#### **Recommendations**

1. Non-compliance of Indian Electricity Act provisions against the defaulting consumers of Electricity & the Utility personnel in the prevalent theft practices resulting in Revenue Leakage. And corresponding to Energy loss with the resultant increment in the Technical losses. Realistic and plausible alibis for non-performance, inefficiency, corruption and delays needs to be pondered with appropriate action.
2. Administration should be reformed to bring out improved transparency, greater accountability and streamlining the structure eliminating all forms of corruption. The distribution companies need to provide transparent guidelines for enhancing performance to curbing theft of electricity. And develop Citizen-centric Administration for preventive anti-theft practices.
3. Improve methods of cadre management focusing on career progression, motivation and productivity enhancement. Also there must be accountability, monitoring of outcome orientation & review for optimal control of Theft.
4. Promoting services values & ethics related to efficiency, integrity, accountability & patriotism. There should be commitment to the Company for strict compliance of anti theft remedial measures to curb pilferage of electricity.

#### **3.2 Power Theft Detection**

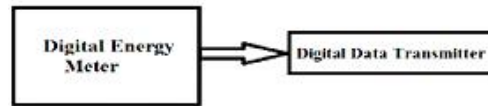
Digital energy meter (M1) will measure a consumed power by load (L1) over a period. It will send a data in proportion with consumed power to receiver with the help of wireless digital data transmitter. Receiver on the pole system will receive a data sent by transmitter in a load side meter. Receiver will send it to microcontroller. Also energy meter on pole will measure power sent over line1 and provide appropriate data to microcontroller. Now microcontroller has two

readings one is power calculated on pole itself and another is power consumed by load (L1) as shown in the figure below;



**Figure 3: Power Theft Detection**

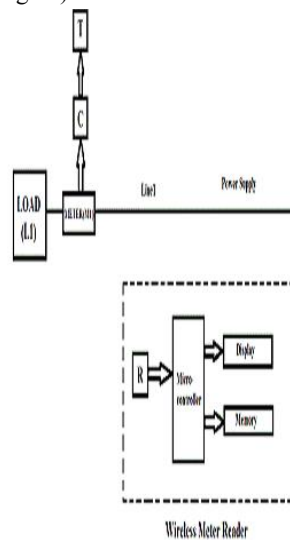
Suppose there is tapping done by any unauthorized person on the line to connect his appliance as shown in figure 1. Over a certain period there will be difference between meter reading (M1) and pole based reading. Microcontroller will compare these two values and if the measured value on pole is more than value send by meter (M1) by some tolerance then power theft is happening on line1. This theft signal generated on pole system can be transmitted to substation by power line communication technique or by wireless technique whichever is suitable an economical



**Figure 4: Load Side Energy Meter**

### 3.3 Wireless Meter Reading

Now a day utility company personnel goes at every house to take the readings of meters for billing purpose. It will create problem when consumer is out of Town or home is locked due to other reasons. This system of wireless meter reading is based on the same principle of wireless data transmission that is used in power theft detection. Utility company personnel will have a device consists of wireless data receiver with microcontroller and display. When that device is in the range of data reception it will receive the data sent by transmitter in the load side meter. For this one counter has to be installed in the load side meter (shown in figure).



**Figure 5: Wireless Meter Reading**

It will keep a record of power consumed by load over a given time (say one month). This recorded data will be sent by transmitter wirelessly. Receiving device will receive the meter reading and keep its record with consumer serial number. For this device should be in the range of transmitter. Hence, utility company personnel don't have to check every meter. He can take reading without going to consumer's house.

#### **Adoption of High Voltage Distribution System**

(Low Voltage Distribution System) is extensively used in India for supplying electrical power to remote villages. Use of agricultural pump sets increases technical losses and commercial losses (due to direct hooking). As a result, the overall Energy losses in power system increase. By using High Voltage Distribution System (HVDS) unauthorized tapping can be eliminated. HVDS was implemented on 11kV Baroda feeder.

#### **Replacement of LT AB Cable**

LT ABC is replaced. Based on the experience, this will lead to reduction in commercial loss by 2.5%. ERDA observe an appreciable reduction of 1.85% in AT&C losses.

#### **Anti-Theft Drives**

By conducting Anti-Theft drives twice or thrice in every month by setting up of vigilance squads, carrying out surprise inspections etc., losses due to thefts can be reduced. If this exercise continues at this pace then after one year, the impact would be around 1.6%

#### **Replacement of Meters**

Total 1241 faulty meters were replaced and total loss reduced due to replacement of meter is 0.72%

#### **Ring Fencing**

Reduction of losses calculated based on the installation of meters at boundary locations at all desired places. Loss reduction is estimated as 0.6%.

#### **Shifting of Meters**

Losses are estimated based on shifting of 3781 meters from inside of premises to outside. Total loss reduction was calculated as 0.21%.

### **IV. CONCLUSION**

Reduction in power theft and keeping it within reasonable bounds is more likely to be successful in systems with a good Governance Culture. This is because the theft reduction mechanism finds a friendly environment for initiation and implementation. Electric power systems can be restructured to make power sector organizations operate in competitive environments where efficiency and effectiveness in service delivery are both virtues and necessities. Electricity theft due to pilferage is closely related to the corporate governance indicators with higher levels of theft without effective accountability and high levels of corruption. Electricity theft can be reduced by applying technical solutions such as tamper-proof meters, Technology & managerial methods such as inspection and monitoring and restructuring Distribution Company and Electricity Regulation. The progress in technology about electrical distribution network is a non-stop process. New things and new technology are being invented. The proposed system found to be little bit complex as far as distribution network is concerned, but it's an automated system of theft detection. It saves time as well as help to maximize profit margin for utility company working in electrical distribution network. Utility company can keep a constant eye on its customer.

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