

Measures for reducing transmission and distribution losses of Pakistan

M.A. Khan^a, S. Badshah^a, I.U. Haq^a, F. Hussain^b

^a International Islamic university, New Campus, H-10, Islamabad, Pakistan

^b National University of Computer and Emerging Sciences Islamabad, Pakistan

^a engradilee@gmail.com, ^a saeed.badshah@iiu.edu.pk, ^a ihsanulhaq@iiu.edu.pk, ^b farooq.hussain@nu.edu.pk

Abstract— Electricity is the backbone of economic stature of every country in current era. Many different ways have been devised to produce electricity and this exploration is still not seeing its end. But efficient Transmission and Distribution (T&D) of power is always a headache for supply companies especially in countries like Pakistan where short fall of electric power is already being faced. This paper shows percentage T&D losses by various electric supply companies of Pakistan, comparison of overall T&D losses of Pakistan with various countries of South Asia, Middle East, Europe, Africa etc and reasons for such high T&D losses. Short and long term measures for reducing these T&D losses of Pakistan.

Index Terms— T&D losses; comparison; measures; KESC; T&D components.

1 INTRODUCTION

Electricity is the need of the day and a lot of problems occur if its supply and demand do not match. This phenomenon is termed as shortfall which has serious effects on the economy of any country. The government of Pakistan has spent PKR 395 billion on subsidies in the fiscal year 2010–11, 75 percent of which went toward subsidizing power consumption.[1] This issued must be dealt with attention. In such a case load shedding becomes indispensable to share the electricity evenly and justifiably. But load shedding is bound to aggravate the industry as well as social behavior of public, hence, leading to social and economic instability. Effective steps should be taking to cope with electricity shortfall. One obvious solution to this problem is increasing power generation capacity. Non conventional methods such as renewable resources of energy may also be used to solve this problem. Another option which could be used as a solution to this problem is to consider T&D losses. Great deal of investigation is demanded to analyze these losses and find out its causes and suggest possible and effective actions to reduce these T&D losses. This might be more useful in countries like Pakistan where T&D losses are much more due to weak vigilance system and poor transmission and distribution plans.

In this paper a detailed study of T&D losses in different countries and their comparison is presented. Possible causes of high T&D losses are listed. Keeping in view these causes, some remedial steps are also suggested. In the 2010–11 fiscal year, the government paid PKR 82 billion to cover the costs of nonpayment of bills, theft, and transmission losses[1]. This amount can be used on the development of the country if T&D losses are controlled.

2 T&D LOSSES STATISTICS

T&D losses vary from company to company and country to country. Figure 1 shows T&D losses of various electric supply companies of Pakistan.

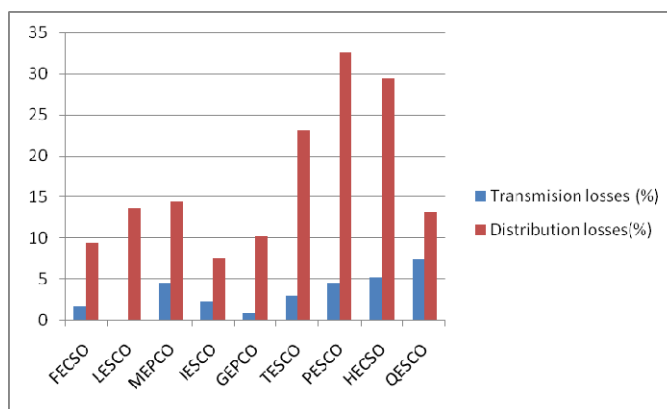


Figure 1: Percentage T&D losses for year 2009-2010 by various electric supply companies of Pakistan [2]

To compare these losses with various countries of the world, further study was carried out and collected data is presented in Figure 2, Figure 3, Figure 4 and Figure 5. These figures show losses' comparison with South Asia, Middle East, Europe and South Africa respectively. It has been noticed that these losses are lesser in case of developed countries than in case of developing countries. Even Middle East countries have reduced their losses to an optimum level.

3 COMPONENTS OF T&D LOSSES

Energy losses occur in the process of supplying electricity to consumer. These losses can be categorized as technical and commercial losses. Main reasons of technical losses are energy dissipation in the conductors and equipment used for transmission, transformation and distribution of power. These technical losses are inherent in the system and can be reduced to an optimum level. Commercial losses are caused by pilferage defective meters and errors in meter reading etc. Reasons of these technical and commercial losses are given here.

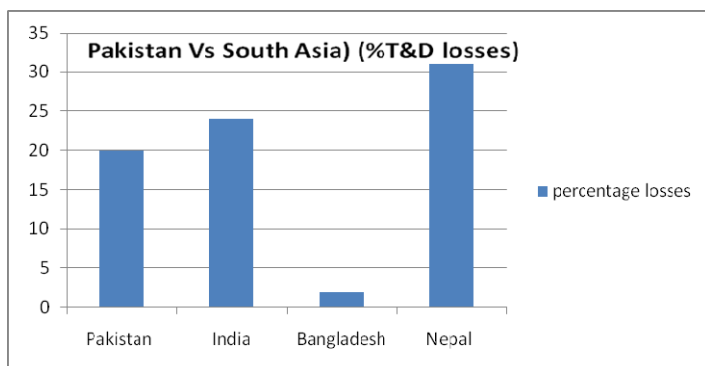


Figure 2: Percentage T&D Losses Pakistan VS South Asia for year 2009[3]

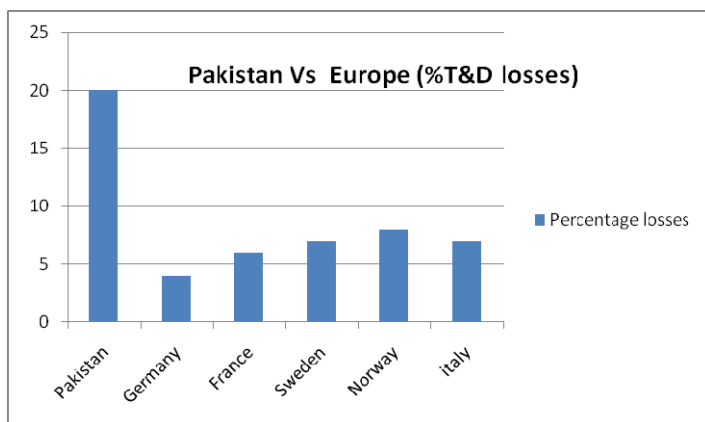


Figure 3: Percentage T&D Losses Pakistan VS Middle East for year 2009[3]

3.1 Reasons for high technical losses

Following are the major reasons for high technical losses in Pakistan [4]:

- Haphazard growths of sub – transmission and distribution systems with short term objective of extension of electric power supply to new areas.
- Rural electrification through long 11kV and LT lines in very large scale.
- Improper load management.
- Inadequate reactive compensation.

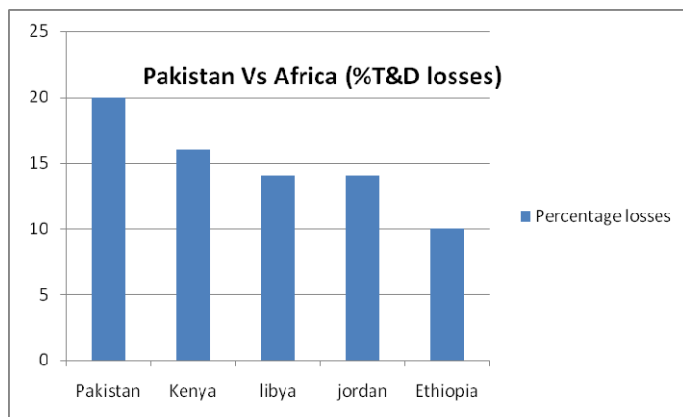


Figure 4: Percentage T&D Losses Pakistan VS Europe for year 2009[3]

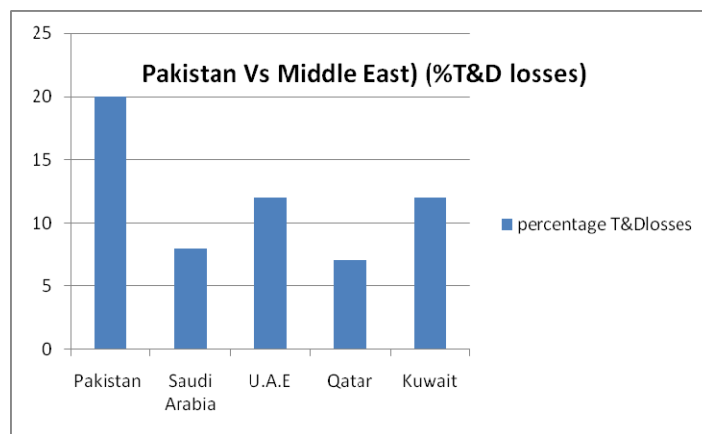


Figure 5: Percentage T& Losses Pakistan VS Africa for year 2009[3]

- Poor quality equipment used in agricultural pumping in rural areas, air –conditioners and industrial load in urban areas.
- Large stages of transformation(which increases iron losses and copper losses)[5].

3.2 Reasons for high commercial losses

Theft and pilferage account for a substantial part of the high T&D losses. In 2000, Karachi electric supply corporation (KESC) reported that only 52% of its 1.67 million customers were paying their electricity bills[6]. Mainly two categories of consumer’s commits theft/pilferage of electricity i.e. non-consumers and bonafide consumers. Some of the bonafide consumers willfully commit the pilferage by the way of damaging and or creating disturbances of measuring instruments installed at their premises. the cultural mindset, and have consumers understand that they need to pay for electricity. Some illegal ways of abstraction or consumption of electricity are stated below[7]:

- Tampering the meter readings by mechanical jerks, placement of powerful magnets or disturbing the disc rotation with foreign matters
- Burning of meters
- Meter bypassing (locally known as Kunda System)
- Stopping the meters by remote control
- Changing the C.T ratio and reducing the recording
- Changing the sequence of terminal wiring
- Errors in meter reading and recording
- Improper testing and calibration of meters
- Making an authorized extension of loads, especially those having H.P traiff.

4 MEASURES FOR REMOVING TECHNICAL LOSSES

4.1 Short term measures

Following measures are suggested for short term losses of electricity [8]:

- Identification of the weakest areas in the distribution system and strengthening/improving them so as to draw the maximum benefits of the limited resources.
- Reducing the length of LT lines by relocation of distribution sub stations/installations of additional distribution transformers (DTs).
- Installation of lower capacity distribution transformers at each consumer premises instead of cluster
- Formation and substitution of DTs with those having lower no load losses such as amorphous core transformers.
- Installation of shunt capacitors for improvement of power factor.

4.2 Long term measures

Following long term measures are suggested for electricity T&D technical losses [7]:

- Mapping of complete primary and secondary distribution system clearly depicting various parameters such as conductor size line lengths etc.
- Carrying out detailed distribution systems studies considering the expected load development during the next 8-10 years.
- Compilation of data regarding existing loads, operating conditions, forecast of expected loads etc.
- Preparation of long-term plans for phased strengthening and improvement of the distribution systems along with associated transmission system.
- Estimation of the financial requirement for implementation of different phases of system improvement works.
- Formulation of comprehensive system improvement schemes with detailed investment program so as to meet system requirement for first 5 years period.

5 MEASURES FOR REMOVING NON-TECHNICAL LOSSES

There is a range of methods being deployed by utilities the world over to cope with power theft. Some of these measures are given below [7].

- Set up vigilance squads to check and prevent pilferage of energy.
- Severe penalties may be imposed on those tampering the meter seals etc.
- Energy audits should be introduced and responsibilities with strict orders should be given to the district officers (executive engineers) for energy received and energy sales in each area.
- Installation of tamper-proof meter boxes and use of tamper-proof numbered seals.
- Providing adequate meter testing facilities. A time bound program should be chalked out for checking the meters, and replacement of defective meters with tested meters.
- Subsidies to customers with low income in the form of lower tariff. This step will reduce electricity theft [8].

6 OTHER INITIATIVES REQUIRED

Keeping the above in view it is very essential that immediate steps are initiated to have an assessment of the realistic T&D losses in each of the states and that immediate steps are taken to reduce the same in a systematic manner by all the players in the field.

- The government should draw plans to provide financial support to the utilities for installation of meter on at least all the distribution transformers in a phased manner
- It should be made obligatory for all big industries as well as the utilities to carry out energy audit of their system to identify high loss areas and take remedial measures to reduce the same.
- Schemes for giving incentive to utilities that are able to reduce T&D losses beyond a certain limit should be launched.
- Financial institutions should be encouraged to provide easy loans to utilities for taking remedial measures to reduce the T&D losses.
- Publicity campaigns should be carried out to aware consumer of high penalties on unauthorized use of electricity.
- Pakistan's energy short-fall reflects years of underinvestment and partly implemented reforms, resulting in a situation where power consumption has risen 80 percent, with supply failing to maintain this pace therefore Utilities should prepare Master Plans for their systems which will help to develop a strategy to meet the growing electricity demands of different sectors of the state's economy over the next 15 years.[9]

Conclusion

Electric power crisis of Pakistan can be reduced to a large extent by controlling the power transmission and distribution losses. Power transmission and distribution losses can be reduced by reducing technical and commercial losses. It is highly recommended to follow the short and long terms measures

suggested in this paper for reducing T& D losses of Pakistan. However complete solution of diminishing electric power crisis lies in the fact to increase the power generation capacity of the country.

References

- [1] Zaffar Bhutta, "Energy Crisis: Rather than Reduce Subsidies, Government Increases Power Outages," *Express Tribune*, July 18, 2011
- [2] Electricity demand forecast based on Power Market Survey 20th Issue National transmission and Despatched Company Limited pakistan
- [3] <http://data.worldbank.org/indicator/EG.ELC.LOSS.ZS> [accessed 24/06/2012].
- [4] Sri.S.R.Sadugo "Effect of System Load Factor on Transmission & Distribution Losses." *IOSR Journal of Electrical and Electronics Engineering (IOSRJEET)* ISSN: 2278-1676 Volume 2, Issue 2 (July-Aug. 2012), PP 01-06
- [5] S.pande "Computation of Technical Power Loss of Feeders and Transformers in Distribution System using Load Factor and Load Loss Factor" *INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY SCIENCES AND ENGINEERING*, ISSN: 2045-7057 VOL. 3, NO. 6, JUNE 2012
- [6] T.B. Smith "Electricity theft—comparative analysis," *Energy Policy*, ISSN: 0301-4215 vol.32 (2003), pp. 2067–2076
- [7] M.S. Bhalla, "Transmission distribution losses(power)" *In the proceeding of National conference on Regulation in infrastructure Services: Progress and the way forward* . New delhi, India, November 2000.
- [8] "Electricity theft: Overview, issues, prevention and a smart meter based approach to control theft" , *Energy Policy*, ISSN: 0301-4215 vol 39, Issue 2 feb 2011 pp 1007–1015
- [9] Mehreen Khan, "Energy Subsidies Cripple Pakistan Economy, Says Study," *Financial Times Blog*, July 27, 2011.