
ANALYSING TRANSMISSION AND DISTRIBUTION LOSSES AND AGGREGATE TECHNICAL AND COMMERCIAL LOSSES IN JAMMU AND KASHMIR

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Abstract: In India, State Power Utilities are in existence for the last five decades. Over the period of time, these State Power Utilities have become unviable and unprofitable due to heavy liabilities and accumulated losses. It has been observed that India's power distribution segment is suffering from two types of losses, that is, Transmission and Distribution Losses (T&D) and Aggregate Technical and Commercial Losses (AT&C). In India, today most of the State Power Utilities are suffering from T&D as well as AT&C losses. T&D losses give an approximate value of losses suffered by State Power Utilities but AT&C losses give the accurate data of losses suffered by State Power Utilities. In this paper, data has been collected from secondary sources e.g., Central Electricity Authority Annual Reports, Digest of Statistics J&K Govt., Ministry of Power, and reports on the performance of State Electricity Board by Power Finance Co. Ltd. In this paper, an attempt has been made to compare T&D losses and AT&C losses of J&K with other states in India as well as with average T&D losses and AT&C in India. Further, a comparison has been made between T&D and AT&C in India with some other countries of the world. It has been inferred that high T&D losses and AT&C losses are the important factors for heavy losses suffered by State Power Utilities in Jammu and Kashmir.

Keywords: Aggregate Technical And Commercial Losses, Jammu And Kashmir, State Power Utilities, Transmission And Distribution Losses.

Introduction: Electricity is an essential source of commercial energy which is vital for sustained economic growth. The increase in demand of power means that the economy is growing and is leading towards modernization, industrialization and improvement in basic amenities culminating into a better quality of life of the people. The pivotal issue regarding the electricity situation in India has been the financial health of the State Power Utilities. Here the problem has not been only with generating side. The major problem has been in distribution and realization of revenue. It has been observed that India's power distribution segment is hampered by two types of losses, that is, Transmission and Distribution Losses (T&D) and Aggregate Technical and Commercial Losses (AT&C).

According to Central Electricity Authority, energy losses occur in the process of supplying electricity to consumers due to technical and commercial reasons.

- The technical losses are due to energy dissipated in the conductors, transformers and other equipments used for transmission, transformation, sub-transmission and distribution of power.
- These technical losses are inherent in a system and can be reduced to a certain level.

- Pilferage by hooking, bypassing meters, defective meters, errors in meter reading and in estimating un-metered supply of energy are the main sources of the commercial losses
- When Commercial losses are added to Technical losses, it gives Transmission & Distribution (T&D) loss.
- There is another component of commercial losses, which is attributable to non-recovery of the billed amount, which is reflected in collection efficiency.
- T&D losses together with loss in collection give us Aggregate Technical & Commercial (AT&C) losses.

Methodology for computation of T&D losses and AT&C losses and Collection Efficiency (Central Electricity Authority)

- **T&D Losses = { 1 - (Total energy Billed/ Total energy Input in the system) } x 100**
- **AT&C Losses = { 1 - (Billing Efficiency x Collection Efficiency) } x 100** Where **Billing efficiency = Total unit Billed/ Total unit Inputs**
- **Collection efficiency = Revenue collected / Amount Billed**

Reasons for High T&D and AT&C Losses: Studies all over the world establish the fact that high T&D and AT&C losses are due to various reasons such as lack of inadequate investment on T&D, lack of advanced technology, long transmission lines, improper management, theft of power, tampering with the meters etc.

Literature Review: Bobde and Tanaka 2018 examines the efficiency of electricity distribution utilities in India by using panel data from 2005 to 2012, and find positive effects of customer structure and population density on the efficiency of utilities. Also this paper examines efficiency advantages of public utilities in the Indian power distribution sector. The results of the data analysis states that interaction between ownership and population density is negative, implying that public utilities are less efficient than private enterprises in high population density areas. Also this study reveals that Government subsidies are negatively related to the efficiency of utilities.

Gour and Gupta 2016 examines in their study the socio economic and governance factors in determining the extent of electricity theft in Indian states by drawing data from 28 states of India over a time period of five years(2005-09). The objective of the study is to find out the state level determinants of power theft in India. The study finds significant negative impact of good governance indicators on power thefts. The results of this study also indicate T&D losses to be decreasing in the presence of private players.

Nisar and Monroy 2011 reviewed potential of renewable energy sources for the state of J&K (India). This paper gives broad view of energy situation in J&K and also highlights the current policies along with future strategies for the optimal utilization of renewable energy resources. They find out that state is facing acute scarcity of power, which can be measured from the fact that against a total peak requirement of about 2000MW, the state has been able to produce only 789MW by 2008. This huge gap between demand and supply of energy can be reduced through private sector participation and FDI.

Thakur and Kaushik 2006 This paper studies the comparative efficiencies of Indian state owned electric utilities (SOEU), which are mainly responsible for the generation, distribution

and transmission of electricity in India. This paper evaluated the performance of 26 utilities by using non-parametric technique of data envelopment analysis (DEA) and the impact of scale on the efficiency scores was also evaluated. The results from the study signifies that performance of several SOEU is sub-optimal, also suggesting the potential for significant cost reductions.

Objectives:

1. Analysis of Transmission and Distribution Losses and Aggregate Technical and Commercial Losses in Jammu and Kashmir

Methodology: The present study is based on the secondary data. Main sources of data collection include Government official records, Jammu and Kashmir Statistical Digest, Ministry of Power, Central Electricity Authority, Report on the financial performance of State Electricity Board, International Energy Agency etc.

Statistics of T&D Losses and AT&C Losses in J&K, India & world:

Table 1: State Wise T&D Losses In India In %

| STATE NAME | 2011 | 2012 |
|-------------------|------|------|
| ANDHRA PRADESH | 16.1 | 15.3 |
| ARUNACHAL PRADESH | 35.6 | 34.5 |
| ASSAM | 29.9 | 27.7 |
| BIHAR | 37 | 35 |
| CHATTISGARH | 34.7 | 32.7 |
| DELHI | | |
| GOA | 17.4 | 17.6 |
| GUJRAT | 22.7 | 22.3 |
| HARYANA | 24.4 | 22.7 |
| HIMACHAL PRADESH | 14.6 | 14.5 |
| JAMMU AND KASHMIR | 60 | 58.5 |
| JHARKHAND | 33.5 | 40.8 |
| KARNATAKA | 20.1 | 19.6 |
| KERALA | 19.1 | 18.6 |
| MADHYA PRADESH | 34.1 | 32.6 |
| MAHARASHTRA | 22.5 | 21.6 |
| MANIPUR | 43.3 | 38 |
| MEGHALAYA | 30 | 28.4 |
| MIZORAM | 35.4 | 34.3 |
| NAGALAND | 30.8 | 28.1 |
| ODISHA | | |
| PUDUCHERRY | 13.5 | 13.5 |
| PUNJAB | 17.8 | 16.8 |
| RAJASTHAN | 27.6 | 24.8 |
| SIKKIM | 42.4 | 38.8 |
| TAMIL NADU | 18 | 17 |
| TRIPURA | 20.9 | 20.1 |
| UTTAR PRADESH | 28.9 | 24.4 |
| UTTRAKHAND | 22.5 | 20.5 |
| WEST BENGAL | 23.5 | 22.3 |

Source: Annual Report,2014-15 on The Working of SPUs in India

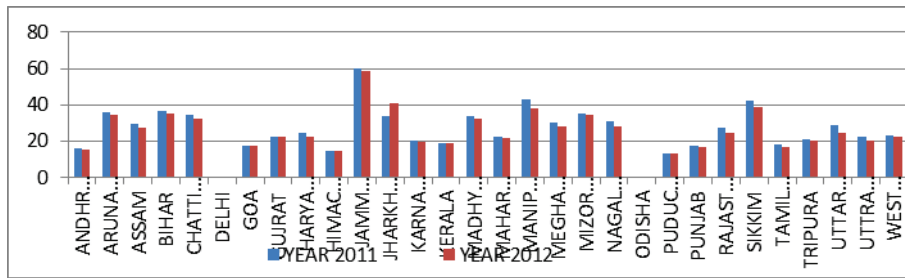


Figure 1: Trend in the State wise T&D losses in India

State wise T&D losses in India: In Table 1 and Fig 1, we see that during the year 2011, the T&D losses in J&K state were 60% which was the highest in India. During 2012, the T&D losses in J&K were 58% which was still the highest in the country.

On the other hand, the neighboring state of J&K, that is, Himachal Pradesh which is having a similar topography to that of J&K, was having T&D losses of only 14.6% in 2011 and having 14.5% in 2012 which is far less than that of J&K. Other states which are having significant T&D losses are North Eastern states, for example, Arunachal Pradesh is having 35.6% and 34.5% T&D losses respectively for 2011 and 2012. Assam is having 29.9% and 27.7% T&D losses, Manipur is having T&D losses of 43.3% and 38%, Meghalaya is having T&D losses of 30% and 28.4%, Mizoram is having T&D losses of 35.4% and 34.3%, Nagaland is having T&D losses of 30.8% and 28.1%, Sikkim is having T&D losses of 42.4% and 38.8%, Tripura is having T&D losses of 20.9% and 20.1% respectively for 2011 and 2012. Still J&K is far behind these states. Also these North Eastern States are considered underdeveloped but are still having lesser T&D losses than J&K.

Comparison of T&D Losses in Jammu and Kashmir with India: In Table 2 and Figure 2, we see that while T&D losses in India were at 31.25% in 2004-05, it has come down to 22.77% in 2014-15. T&D losses have shown a slow but steady decline in India throughout these years. On the other hand, T&D losses in J&K during 2004-05 were 48.04% but during 2014-15, these were at 55.21%. It is seen that during these 10 years, the T&D losses have grown significantly. The losses show a growth of 14.92% during this period. During these 10 years, the highest T&D losses were recorded during the year 2009-10 which stood at 63.10%. T&D losses have started to come down from 2009-10 onwards till 2013-14 but 2014-15 showed a slight increase again.

Table 2: T&D losses in India and J&K in %

| Year | India | J&K |
|---------|-------|-------|
| 2004-05 | 31.25 | 48.04 |
| 2005-06 | 30.42 | 47.22 |
| 2006-07 | 28.65 | 47.09 |
| 2007-08 | 27.2 | 51.06 |
| 2008-09 | 25.47 | 61.9 |
| 2009-10 | 25.39 | 63.1 |
| 2010-11 | 23.97 | 63.04 |
| 2011-12 | 23.65 | 61.61 |
| 2012-13 | 23.04 | 57.4 |
| 2013-14 | 22.84 | 54.57 |
| 2014-15 | 22.77 | 55.21 |

Source: Annual Report of Central Electricity Authority 2015-16

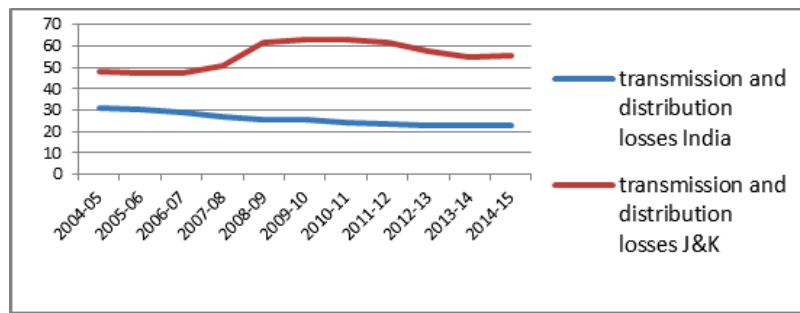


Figure 2: Trend of T&D losses in J&K and India in %

Comparison of AT&C Losses in Jammu and Kashmir with India: From the Table 3 and Figure 3, we can see that during the year 2004-05 AT&C losses in India were at 34.33% which have come down to 24.62% in 2014-15. AT&C losses in India have shown decline till 2010-11. But in 2011-12 AT&C losses show a slight increase and they were at 26.63%. After that there was decline and during 2013-14 it was lowest at 22.58%. But again there was a slight increase in AT&C losses during 2014-15 which were at 24.62%.

Table 3: AT&C losses in India and J&K in %

| year | India | J&K |
|---------|-------|-------|
| 2004-05 | 34.33 | 69.41 |
| 2005-06 | 33.02 | 66.85 |
| 2006-07 | 30.62 | 66.71 |
| 2007-08 | 29.45 | 67.51 |
| 2008-09 | 27.37 | 72.37 |
| 2009-10 | 26.78 | 72.06 |
| 2010-11 | 26.04 | 72.79 |
| 2011-12 | 26.63 | 71.45 |
| 2012-13 | 25.48 | 64.06 |
| 2013-14 | 22.58 | 57.02 |
| 2014-15 | 24.62 | 61.3 |

Source: Annual Report of Central Electricity Authority 2015-16

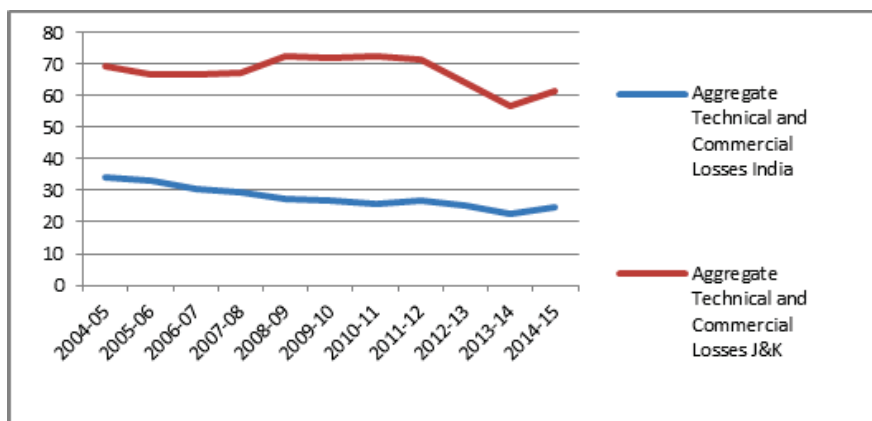


Figure 3: Trend in AT&C losses in India and J&K

When we see AT&C losses of J&K during 2004-05, though AT&C losses have shown a decline but the decline is not very significant. The AT&C losses in 2004-05 were at 69.41% and in 2014-15 at 61.3%. The AT&C losses were highest in J&K during the year 2010-11 at 72.79%. After that there is decline in AT&C losses. During 2014-15 there were again increase AT&C losses in India as well as J&K.

Comparison of T&D Losses of Various Countries in 2011 and 2012: From Table 4 and Figure 4, it is seen that the T&D losses in India for the year 2011 and 2012 were 23.97% and 23.65% respectively. This value was one of the highest in the world. When compared to some of the developed countries of the world, we see that India is lagging behind considerably, for example, Japan had T&D losses of 4.98% & 4.79% respectively for the same period. For Germany, these values stood at 4.7% and 4.6% respectively for the same period.

When compared to some of the developing nations like China, South Africa, and Brazil we see that T&D losses are higher than developed countries but still considerably lower than that of India, for example, China is having AT&C losses of 6.54% and 6.56% for 2011 and 2012 respectively. South Africa is having 9.61% and 10.19% T&D losses for 2011 and 2012 respectively and Brazil is having 16.08 % and 16.63% T&D losses for 2011 and 2012 respectively. This shows that T&D losses in India are much higher than other developing countries which is a cause of concern for the country.

Table 4: T&D Losses of Various Countries in %

| NAME OF THE COUNTRY | 2011 | 2012 |
|---------------------|-------|-------|
| KOREA | 3.57 | 3.47 |
| JAPAN | 4.98 | 4.79 |
| GERMANY | 4.7 | 4.46 |
| ITALY | 6.46 | 6.61 |
| AUSTRALIA | 5.94 | 5.68 |
| SOUTH AFRICA | 9.61 | 10.19 |
| FRANCE | 6.47 | 7.99 |
| CHINA | 6.54 | 6.56 |
| USA | 6.41 | 6.73 |
| CANADA | 6.27 | 8.19 |
| UK | 8.06 | 8.26 |
| RUSSIA | 12.59 | 12.59 |
| BRAZIL | 16.08 | 16.63 |
| INDIA | 23.97 | 23.65 |
| WORLD | 8.9 | 8.89 |

Source: International Energy Agency(IEA) (EXCEPT INDIA)

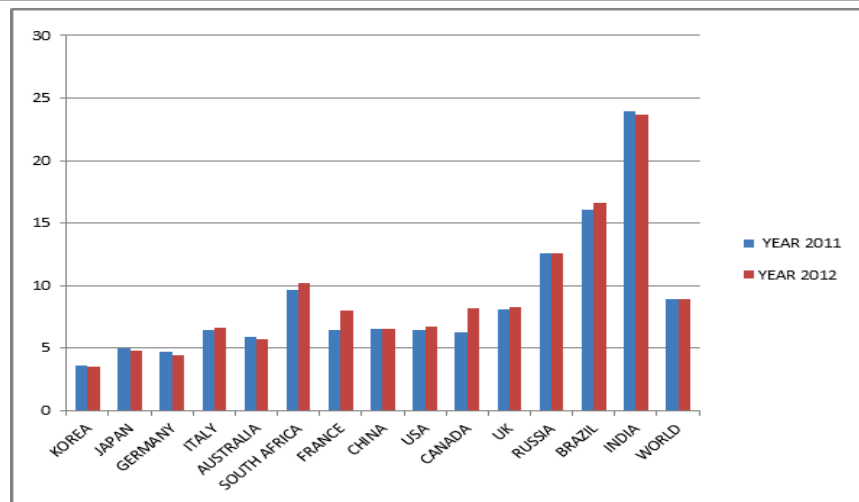


Figure 4: Trend of T&D Losses of Various Countries in %

Profit and Loss of J&K Power Utilities in Crores During 2012: From Table 5 and Figure 5, it is evident that in Jammu and Kashmir, the power utilities are having losses in crores of rupees. The power utilities are constantly under loss. The losses during 2003-04 were 996 Crores. During 2014-15, there losses were 3699 Crores. There we see an increase of 27%. During this period, we see that the losses are massive although we see some improvement in situation during the years 2006-07,2008-09,2010-11 and 2013-14, yet when we see the overall condition for the period, we see a tremendous increase in losses suffered by the state power utilities in Jammu and Kashmir.

Table 5: Profit and Loss of J&K State Power Utilities in 2012

| YEAR | PROFIT/LOSS (in Cr) |
|---------|---------------------|
| 2003-04 | -996 |
| 2004-05 | -1080 |
| 2005-06 | -1349 |
| 2006-07 | -1228 |
| 2007-08 | -1351 |
| 2008-09 | -1279 |
| 2009-10 | -2183 |
| 2010-11 | -1771 |
| 2011-12 | -2692 |
| 2012-13 | -2938 |
| 2013-14 | -2221 |
| 2014-15 | -3699 |

Source: Year Book Jammu and Kashmir Power development Department 2015-16

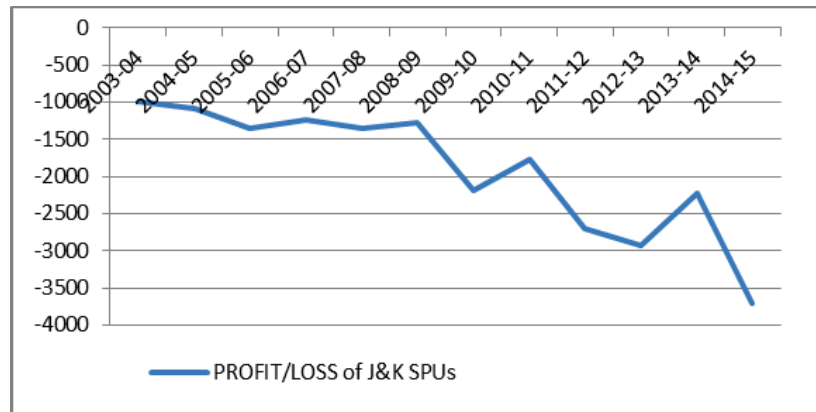


Figure 5: Trend of Profit and Loss of J&K State Power Utilities in 2012

Finding and Conclusion: The above discussion shows that there is an increase in T&D losses and there is some decrease in AT&C losses in Jammu and Kashmir. But still these are the highest in the country. This is having a bearing on the performance of power utilities in J&K which are showing tremendous losses consistently. If these T&D losses and AT&C losses are managed properly and they come up to the national average, we can see an improvement in the performance of state power utilities in J&K.

Suggestions: The state Govt should take high T&D and AT&C losses seriously and work towards improving the performance of state power utilities. Some of the measures which the Government can take:

1. Setting up vigilance mechanism which will check the theft of power.
2. If someone is found tampering the meters, there should be provision for heavy penalties.
3. The investment in T&D sections should be increased.
4. There is more T&D loss in lengthy transmission lines. These lines can be made shorter and more direct.

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