CHAPTER-6

ECONOMIC CONSEQUENCES OF TECHNICAL AND NON TECHNICAL LOSSES IN POWER SECTOR

India is world's 6th largest energy consumer, accounting for 3.4% of global energy consumption. Due to India's economic rise, the demand for energy has grown at an average of 3.6% per annum over the past 30 years. More than 50% of India's commercial energy demand is met through the country's vast coal reserves. About 76% of the electricity consumed in India is generated by thermal power plants, 21% by hydroelectric power plants and 3% by nuclear power plants [5].

Electricity is central to achieving economic, social and environmental objectives of sustainable human development. In the present digital age electricity has emerged as the most crucial and critical input for sustaining the process of economic as well as social development. Growth of different sectors of economy is not possible without matching development of the electricity sector. In fact it has become essential ingredient for improving the quality of life and its absence is usually associated with poverty and poor quality of life. Sub-transmission and distribution systems constitute the link between electricity utilities and consumers, their revenue realization segment. For consumers, it represents the face of the utility. Efficient functioning of this segment of the utility is essential to sustain the growth of power sector and the economy. However, the present situation is characterized by unacceptably high losses (both technical and commercial), poor quality and reliability of supply, billing, revenue collection, frequent interruptions in supply and resultant consumer dissatisfaction, etc.

Though the Indian power sector has achieved substantial growth during the post-independence era, the sector has been ailing from serious functional problems during the past few decades [6].

Per capita consumption of electricity in India increased from 178 kWh in 1985-86 to 338 kWh in 1996-97 (GOI, 2002) and 665 kWh in 2005-06 to 794 kWh in 2010-11 (General Review 2011). This level of per capita consumption is less than 1/20 of
that prevailing in the US, less than half that in China against the world average of 2400 kWh and the OECD (Organization for Economic Co-operation and Development) average of 6900 kWh [2]. According to the Government of India reports, inefficiencies were mainly due to:

- Unsatisfactory operational efficiencies, with the availability of thermal plants at less than 80 percent, losses (including theft of power) as high as 20 to 21 percent
- High transmission and distribution losses substantially higher than normal technical standards, with a high component on non technical losses, accounted for by poor/inadequate metering and high incidence of theft of energy
- Poor billing and collection, because of incorrect reporting and billing, inadequate collection efforts, tampering with meters and misreporting in collusion with consumers
- Imbalance in the mix of generation sources and undesirable proliferation of captive generating units
- Unmanageable size and monolithic structure, making it unwieldy, inefficient and unresponsive to change as well manpower related problems; poor productivity, low skills and lack of training for upgradation, low motivation levels.

Some 400 million Indians have no access to electricity primarily due to power shortages. While 80 percent of Indian villages have at least an electricity line, just 44 percent of rural households have access to electricity. According to a sample of 97,882 households in 2002, electricity was the main source of lighting for 53% of rural households compared to 36% in 1993. Almost all of the electricity in India is produced by the public sector. Power outages are common. Many buy their own power generators to ensure electricity supply. As of 2005 the electricity production was at 661.6 billion kWh. In the year 2004-05, electricity demand outstripped supply by 7-11% [2].
In important information provided under RTI Act by Central Electricity Authority regarding transmission loss it was reported that in 2009-10 the transmission losses were to the tune of 195538.36 million units. If we multiply the cost per unit as Rs 3, then the total loss in financial term will Rs 586615.08 crores (Approx.). This is only one year figure. If it is add 10 years transmission loss it will be around 5866150.8 crores rupees, enough money to build Delhi like metros in all major cities of India, enough money to build roads to take village kids to nearby town schools, enough money to build hospitals to take care our elderly people. The people who use ACs but do not pay for its use, they have factories but in connivance with electrical board people do not keen to pay as per their use. The reason for the significant amount of non-payment is political and economic changes and the response of the governments and the public to those changes. Payment default at the consumer end resulted in T & D companies defaulting on their dues to the generating companies, which in turn accumulate unpaid debts to energy suppliers, banks, and employees. The following are the reasons and their consequences on the whole system:

- The inability to pay for energy has led to rationing, which allows only for a few hours of electricity supply each day
- Political and economic changes, economic collapse or severe contraction in many countries
- Declining incomes, high inflation, high unemployment and rising energy prices severely eroded the ability of households to pay for energy and heat
- In an extreme example, some customers in some countries had threatened to shoot utility officials for attempting to disconnect supplies
- In most countries, the absence of adequate metering and poor location of meters effectively prevented any action against theft and non-payment.

Thus the assessment of non technical losses in the Uttar Pradesh State will help to provide Uttar Pradesh Power Corporation Limited (UPPCL) policy makers
important assistance in making their analysis of the incremental costs and impacts of different combinations of loss reduction options.

The main issue in distribution systems or rather more appropriately the issue confronting the power sector as a whole, is the reduction of transmission and distribution (T & D) losses to acceptable minimum levels. The all-India T & D losses, which were about 15% till 1966-67, increased gradually and are now at 24.79% (1997-98). During the last few years, some of utilities variously estimated the losses in the range over 30% to 45% much higher than the preceding years. T & D losses in developed countries are around 7-8% only. Taking into consideration the Indian conditions such as far-flung rural areas, nature of loads, system configuration etc. The reasonable permissible (technical) energy losses should be about 10%-15% in different states. While the losses in EHV (Extra High Voltage) network are about 4%-5%, bulk of the losses occurs in T & D system. It is well known that these losses in distribution systems include non-technical or commercial losses and that of power by various users with or without connivance of utility staff. These constitute a large component of overall losses. There are also losses on account of defective (slow) meters, stuck up/burnt meters etc. Further on account of estimation involved in agriculture sector consumption (30% of total), absence of adequate metering at the system level, deficiencies in consumer metering the validity of figure of T & D losses being reported become questionable. General conclusions are that the reported losses are under estimated and cover up large commercial losses (theft), actual figures are higher, technical losses are also high and bulk of the losses occur in sub-transmission and distribution systems.

Inefficiency, frequent interruptions, flickers and poor voltage also characterize distribution systems. In addition the billing and revenue collections are very poor leading to combined state utility financial losses of Rs. 26,0000 crores every year. If the current trend continues, in another three years, state utility financial losses will reach Rs. 45,000 crores a year. It is, therefore, necessary to bring about improvements in planning implementation and operation of T & D systems in a scientific and efficient manner. The present traditional reactive and ad-hoc
approach to network development should be replaced by an approach based on technical and reliability requirements, economic considerations of costs of energy loss and expansion of system to meet the growth of prospective demand with least cost.

India’s power sector is characterized by inadequate and inefficient power supply. Since the country’s independence, consumers are confronted with frequent power cuts, and fluctuating voltages and frequencies. In addition, system losses are high throughout India’s T&D networks. In addition to these enormous direct losses, the indirect losses in terms of lost productivity and trade, sagging economic activity, rapidly shrinking of domestic and foreign investment in the sector, uneconomical and mis allocated investments in captive power, and reduced income generation could be many-fold.

The electricity sector in India had an installed capacity of 185.5 Giga watts (GW) as of November 2011, the world's fifth largest. Thermal power plants constitute 65% of the installed capacity, hydroelectric about 21% and rest being a combination of wind, small hydro, biomass, waste-to-electricity, and nuclear.

In terms of fuel, coal-fired plants account for 55% of India's installed electricity capacity, compared to South Africa's 92%; China's 77%; and Australia's 76%. After coal, renewal hydropower accounts for 21%, and natural gas for about 10%.

In December 2011, over 300 million Indian citizens had no access to electricity. Over one third of India's rural population lacked electricity, as did 6% of the urban population. Of those who did have access to electricity in India, the supply was intermittent and unreliable. In 2010, blackouts and power shedding interrupted irrigation and manufacturing across the country.

The per capita average annual domestic electricity consumption in India in 2009 was 96 kWh in rural areas and 288 kWh in urban areas for those with access to electricity, in contrast to the worldwide per capita annual average of 2600 kWh and 6200 kWh in the European Union. India’s total domestic, agricultural and industrial per capita energy consumption estimate varies depending on the
source. Two sources place it between 400 to 700 kWh in 2008–2009. As of January 2012, one report found the per capita total consumption in India to be 778 kWh.

India currently suffers from a major shortage of electricity generation capacity, even though it is the world's fourth largest energy consumer after United States, China and Russia. The International Energy Agency estimates India needs an investment of at least $135 billion to provide universal access of electricity to its population.

The International Energy Agency estimates India will add between 600 GW to 1200 GW of additional new power generation capacity before 2050. This added new capacity is equivalent to the 740 GW of total power generation capacity of European Union (EU-27) in 2005. The technologies and fuel sources India adopts, as it adds this electricity generation capacity, may make significant impact to global resource usage and environmental issues.

Electricity distribution network in India is inefficient compared to other networks in the world. India's network losses exceeded 32% in 2010, compared to world average of less than 15%. Loss reduction technologies, if adopted in India, can add about 30 GW of electrical power, while simultaneously reducing electricity cost and carbon footprint pollution per MW Hr used.

As in previous years, during the year 2010–11, demand for electricity in India far outstripped availability, both in terms of base load energy and peak availability. Base load requirement was 861,591 (MU) against availability of 788,355 MU, an 8.5% deficit. During peak loads, the demand was for 122 GW against availability of 110 GW, a 9.8% shortfall.

In a May 2011 report, India's Central Electricity Authority anticipated, for 2011–12 year, a base load energy deficit and peaking shortage to be 10.3% and 12.9% respectively. The peaking shortage would prevail in all regions of the country, varying from 5.9% in the North-Eastern region to 14.5% in the Southern Region. India also expects all regions to face energy shortage varying from 0.3% in the North-Eastern region to 11.0% in the Western region. India's Central Electricity Authority expects a surplus output in some of the states of Northern India, those
with predominantly hydropower capacity, but only during the monsoon months. In these states, shortage conditions would prevail during winter season. According to this report, the five states with largest power demand and availability, as of May 2011, were Maharashtra, Andhra Pradesh, Tamil Nadu, Uttar Pradesh and Gujarat.

Despite an ambitious rural electrification program, some 400 million Indians lose electricity access during blackouts. While 80% of Indian villages have at least an electricity line, just 52.5% of rural households have access to electricity. In urban areas, the access to electricity is 93.1% in 2008. The overall electrification rate in India is 64.5% while 35.5% of the population still live without access to electricity.

According to a sample of 97,882 households in 2002, electricity was the main source of lighting for 53% of rural households compared to 36% in 1993.

The 17th electric power survey of India report claims:

- Over 2010–11, India's industrial demand accounted for 35% of electrical power requirement, domestic household use accounted for 28%, agriculture 21%, commercial 9%, public lighting and other miscellaneous applications accounted for the rest.

- The electrical energy demand for 2016–17 is expected to be at least 1392 Tera Watt Hours, with a peak electric demand of 218 GW.

- The electrical energy demand for 2021–22 is expected to be at least 1915 Tera Watt Hours, with a peak electric demand of 298 GW.

If current average transmission and distribution average losses remain same (32%), India needs to add about 135 GW of power generation capacity, before 2017, to satisfy the projected demand after losses.

In 2010, electricity losses in India during transmission and distribution were about 24%, while losses because of consumer theft or billing deficiencies added another 10–15%.
According to two studies published in 2004, theft of electricity in India, amounted to a nationwide loss of $4.5 billion. This led several states of India to enact and implement regulatory and institutional framework; develop a new industry and market structure; and privatize distribution. The state of Andhra Pradesh, for example, enacted an electricity reform law; unbundled the utility into one generation, one transmission, and four distribution and supply companies; and established an independent regulatory commission responsible for licensing, setting tariffs, and promoting efficiency and competition. Some state governments amended the Indian Electricity Act of 1910 to make electricity theft a cognizable offense and impose stringent penalties. A separate law, unprecedented in India, provided for mandatory imprisonment and penalties for offenders, allowed constitution of special courts and tribunals for speedy trial, and recognized collusion by utility staff as a criminal offense. The state government made advance preparations and constituted special courts and appellate tribunals as soon as the new law came into force. High quality metering and enhanced audit information flow was implemented. Such campaigns have made a big difference in the Indian utilities’ bottom line. Monthly billing has increased substantially, and the collection rate reached more than 98%. Transmission and distribution losses were reduced by 8%. Power cuts are common throughout India and the consequent failure to satisfy the demand for electricity has adversely effected India's economic growth.