A Review of Current Indian Power Sector-Demand, Losses and Suggested Method for Improvement

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Abstract— In order to satisfy the high demand of electricity we need to achieve the large scale, long distance and high-efficiency transmission. For the development of strong transmission across the country, we need to analyse the current Energy Resources, Demand, Transmission and Distribution system in India .As India is rich in all kind of natural resources. A good electric supply is one of the main requirements to support the overall development hence we required to know the different electric region which supplies the electricity throughout the country. This paper start with the analyse of the existing data and issues of India's electricity transmission. Finally, strategies to reduce losses and improve the electric transmission and distribution system of India will be taken into account.

Index Terms —Efficiency, Energy, Resources, Transmission, Distribution and Electricity.

1. INTRODUCTION

India is in one of those countries whose demand for electricity is growing at very high rate. Every year the demand is increasing at very rapid rate. Although the country is self-sufficient to generate all the required power within the country itself. Since it is pleased with all kind of natural resources which is used in generating electric power [1]. The major problem is losses in transmission and distribution system of the country. The transmission and distribution system contributes 22.69% of total power generated within the country [2]. Since this sector needs a lot of improvement, therefore, we need to adopt certain new methods [3]. These factors and methods have discussed in detail.

2. Energy resources in India

India is full of all kind of renewable and non-renewable resources and the amount is too high. The natural resources for electricity generation in India are unevenly dispersed in different regions of the country.

The installed capacity of utility power plants is about 267,637 MW as on 31 March 2015 whereas the installed capacity of captive power plants in industries (1 MW and above) is about 47,082 MW as on 31 March 2015 [4].

Sources	Utility Capacity (MW)	%	Captive power capacity(MW)	%
Coal	164,635.88	61.51	27,588.00	58.60
Hydroelectricity	41,267.43	15.42	83.00	0.17
Renewable energy sources	31,692.14	11.84	Included in oil	-
Natural gas	23,062.15	8.61	5,21.00	11.08
Nuclear	5780,00	2.16	-	-
Oil	1,199.75	0.44	14,196.00	30.17
Total	267,637.35		47,082.00	

In India, the utility power capacity is under three different sector i.e. state, central and private[1]. The power capacity is discussed below

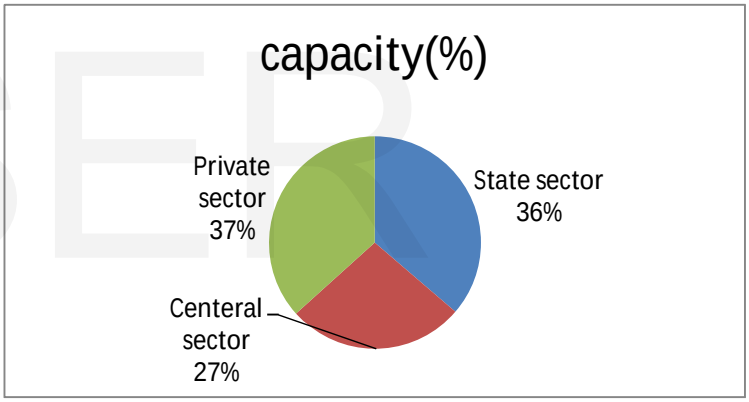

Figure (a) Utility power capacity under different sector

3. Demand

The world 4Th largest consumption of electricity is India [5]. The electricity sector in India is emerging at very fast pace. The peak demand in 2016 is about 140782 MW and the installed capacity is about 288004.97 MW which is quite high [6].

We accept a demand in 2017 will be about 220 GW and to fulfil this requirement we need to install is at least 300GW. The projected peak demand and installed in next 10 is shown in fig (b) and fig (c):

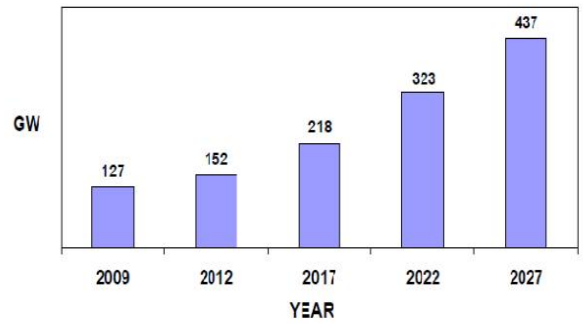

Fig (b) projected peak demand in India in next ten years

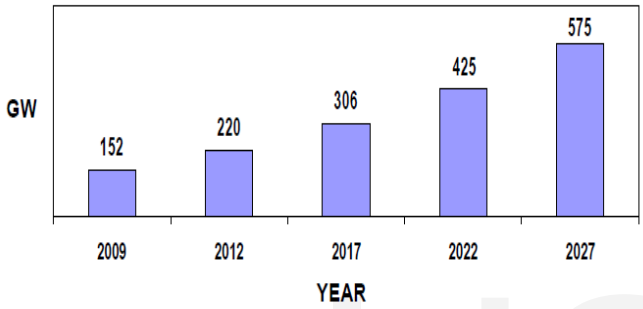

Fig (c) Projected installed capacity requirement in next ten year

Although the installed capacity in India is much more than the demand in India as they not dependent on other countries for power, though few region is expected to face an energy shortage. India's Central Electricity Authority anticipated for the 2016–17 fiscal year, a base load energy surplus and peaking surplus to be 1.1% and 2.6% respectively [7]. India has become power surplus country despite lower power tariffs [8].

4. Transmission System in India

4.1 Present Transmission System in India

In India, the generation of power is the responsibility of both central and state government. NEEPCO (National Thermal Power Corporation), SJVNL (Satluj Jal Vidyut Nigam Limited), NTPC (National Thermal Power Corporation), NHPC (National Hydroelectricity Power Corporation), THDC (Tehri Hydro Development Corporation) etc. are the firms for power generation utilities in India and Power grid is central transmission in India.
Gencos and Transcos are responsible for state level power generation and transmission respectively.
The country has been divided into five electric regions i.e. Northern region (NR), Eastern region (ER), Western region (WR), Southern(SR) and North Eastern region (NER). The Four region NR, ER, WR and NER have been interconnected with other with a single grid i.e. central grid. The only Southern region is asynchronously connected with central grid through HVDC links.

4.2 Development Issues of Transmission System in India

As the requirement of electricity is growing rapidly to satisfy this demand we need to develop a strong transmission system. In India the following measures have to be taken to satisfy this requirement:-
(i) Minimization of the right to way.
(ii) Protection of wildlife (iii) Creation of long distance high capacity transmission corridors to enable minimum cost per MW transfer as well as Optimal Transmission losses.
(iv)Strengthening of National Grid.

5. Distribution in India

5.1 Overview of the Existing System

Power distribution is the final and most crucial link in the electricity supply chain and, unfortunately, the weakest one in the country. It assumes great significance as the segment has a direct impact on the sector's commercial viability, and ultimately on the consumers who pay for power services. The sector has been plagued by high distribution losses (30% overall) coupled with theft of electricity, low metering levels and poor financial health of utilities with low-cost recovery. Due to the above, the distribution companies have not been able to undertake corresponding investment in infrastructure argumentation.

The distribution segment continues to carry electricity from the point where transmission leaves off, that is, at the 66/33 kV level. The standard voltages on the distribution side are therefore 66kV, 33 kV, 22 kV, 11 kV and 400/230 volts, besides 6.6 kV, 3.3 kV and 2.2 kV. Depending on the quantum of power and the distance involved, lines of appropriate voltages are laid. The main distribution equipment comprises HT and LT lines, transformers, substations, switchgear, capacitors, conductors and meters. HT lines supply electricity to industrial consumers while LT lines carry it to residential and commercial consumers.

5.2 Future Requirement in India

The government has set an ambitious target for system augmentation in the distribution segment. It plans to quadruple the distribution network by adding 3.2 million it. km of distribution lines in the Eleventh Plan. Another 4.2 million it. km is planned to be added in the Twelfth Plan. Thus by the end of the Twelfth Plan, the total distribution network in the country would have doubled, thus greatly facilitating delivery of power to the expanding base of end-use customers.

6. Power Grid of India

As on 31st August 2016, India has developed and operated about 1,31,728 ckt. Km network of transmission lines and with the transformation capacity of 2,66,163 MVA with 213 number of the substation that constitutes most of the India's interstate and inter-regional electric power transmission system and carries electric power across India. The role of Power Grid in India as follows:
Conditioning assessment and monitoring technique are used to help optimise maintenance intervals and reduce system outages.
Power Grid has developed Flexible to take advantages of the

system conditions for day to day maintenance work and also modify their annual maintenance program according to generation maintenance schedules insulator washing.
Techniques such as live-line working are also used to enable certain types of maintenance to be carried out without taking transmission lines out of service line live line maintenance-1.JPG, line live line maintainance-2.jpg.
Emergency restoration system is used for early restoration in case of natural disasters and exigencies- ERS-1.JPG, ERS-2.JPG.

7. T & D Losses in India

According to World bank India has one the highest T & D loss in the world. To reduce these losses government is trying their level best by introducing several new programs such as APDRP, RAPDRP and national smart grid etc.

7.1 Suggested Methods for Reduce T & D losses

(i) Level 1

Only a marginal improvement in T&D losses is assumed which in currently at 22.69 % on all India basis as of May 2013. Owing to Financial losses of distribution utility investment towards the grid minimal and hence reduction in T&D losses would not be significant and will only reduce to 15.94% till 2047 out which distribution losses will be 10.94% and transmission losses will reduce to 5 %.

(ii) Level 2

Although the 14 smart grid pilot project demonstrates the benefits of smart Grid technologies at pilot scale, a plan India large scale development of Smart Grid technologies is assumed to happen at a relatively low rate. Projecting based on conservatives estimates of leveraging the smart grid technologies T&D losses would reduce to approximately 11% by 2042 and will further reduce to 10% till 2047 out of which transmission loss will be 4% and distribution loss will be 6% by 2047.

(iii) Level 3

It is assumed that the investments are made as envisaged in the India Smart Grid Roadmap 1 toward achieving the stated goals demand response and integration of renewable energy. Building on the success of the pilot project various technologies are leveraged under a clean energy policy drive to achieve financially viable and sustainable smart grids.The T&D loss would reduce to below 12% by 2027 out of which distribution losses will be 7% and transmission losses will be 5% and would reach the benchmark of 7% by 2047 of which transmission losses will be 3% and distribution losses will be 9%.

(iv) Level 4

An aggressive drive is adopted by the dynamic 21st century India towards achieving sustainable economic growth energy independence and energy security. Reforms in the transmission and distribution sector are carried out via elimination of cross-subsidies innovative and competitive tariff structures increased private participation in the electricity business, electric vehicles, real-time energy markets, bi-directional flow of electricity. The global benchmark of 7% T&D losses is achieved by 2042 of which transmission losses will be 3% and distribution losses will be 4% and maintained thereafter till 2047.

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