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Present and Future Energy Scenario in India

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Abstract: *India's energy sector is one of the most critical components of an infrastructure that affects India's economic growth and therefore is also one of the largest industries in India. India has the 5th largest electricity generating capacity and is the 6th largest energy consumer amounting for around 3.4 % of global energy consumption. India's energy demand has grown at 3.6 % pa over the past 30 years. The consumption of the energy is directly proportional to the progress of manpower with ever growing population, improvement in the living standard of the humanity and industrialization of the developing countries. Very recently smart grid technology can attributeimportant role in energy scenario. Smart grid refers to electric power system that enhances grid reliability and efficiency by automatically responding to system disturbances. This paper discusses the new communication infrastructure and scheme designed to integratedata.*
Keywords*: Smart grid · FACTS devices · Energy scenario · Planning Commission · Projected power scenario*

I. Introduction

Due to demand and supply imbalance, transmission and distribution losses go on increasing. Consequently, grid frequency as well as plant load factor decreases. Fluctuation in state grid frequency is harmful to plant equipments. Due to peak demand, strain on power generation and utilization equipment increases which results in increasing a energy cost. The industrial sector is the major energy consuming sector in India and uses about 50 % of the total commercial energy available in the country. The main reason for higher specific energy consumption in Indian industries are obsolete technology, lower capacity, utilization, causal metering and monitoring of energy consumption, lower automation, raw material quality and poor handling, operating and maintenance practices. High economic growth in the Asia Pacific region, including India, is spurring a rapid increase in energy consumption. India has seen an expansion in the total energy use for the past five decades, with a shift from noncommercial energy to commercial energy sources. The trends in the production of primary commercial energy in the past five decades indicate coal as the most abundant among all commercial energy sources [1]. Petroleum and natural gas sector has significant growth in the domestic production and supply. Despite increasing dependency on commercial fuels, a sizeable quantum of energy requirements especially in the rural household sector, is met by non-commercial energy sources, which include fuel wood, crop, residue, and animal waste. However, other forms of commercial energy of much higher quality and efficiency are steadily replacing the traditional energy resources being consumed in the rural sector. Resources augmentation and growth in energy supply has not kept pace with increasing demand and, therefore, India continues to face serious energy shortages. This has led to increased reliance on imports to meet the energy demand.

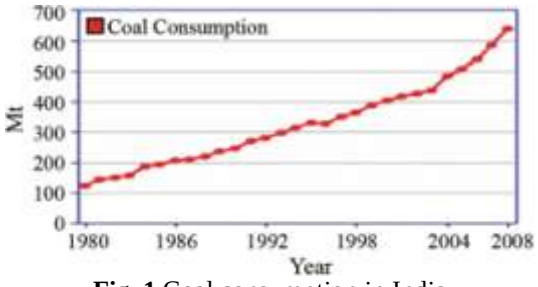

Fig. 1 Coal consumption in India

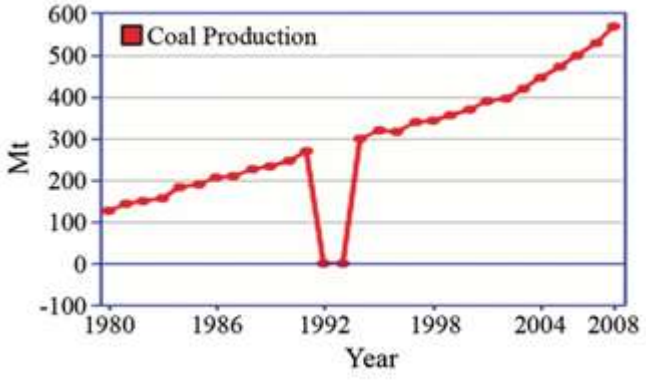

Fig. 2 Coal production in India

Future Outlook for Changing Indian PowerSector

The conditions of Indian transmission, generation and distribution are to be changed implementing by adapting new, and innovative strategies.

Renovation and Modernization of Generation Sector

Clean Coal Technology

Cleancoaltechnologiesofferthepotentialforsignificantreduction in the environmental emissions whenused for power generation. Thesetechnologiesmaybeutilizedinnewaswellasexistingplantsandaretherefore,aneffective way of reducing emissions in the coalfiredgenerating units. Several of these systems are not onlyveryeffective inreducingSO_xandNO_xemissionsbut,becauseoftheir higher efficiencies they also emit lower amount ofCO_2perunit of power produced. CCT's can be usedtoreducedependence on foreign oil and to make use ofawidevariety of coal available. Blending of various gradesof rawcoalalong with beneficiation shallensureconsistencyin quality of coal to the utility boilers. Thisapproachassumesgreater relevance in case of multiple gradesofcoalsavailableindifferentpartsofthecountryandalsocoalsofdifferent qualities being imported by IPPs.MinistryofEnvironment and Forests, vide their notificationdated June30,1998 hadstipulated the useofraworblendedorbeneficiatedcoalwithanashcontentnotmorethan34%onanannualaveragebasiswitheffectfromJune1,2001.CPCBhasconstitutedaSteeringCommitteeconsistingrepresentativefromsomeSEBs,CPCB,MinistryofCoal,Ministryof Power, CEA and World Bank to carry outcostbenefit analysis of using clean coal technologiesandassessand prioritize technically feasible and economicallyviable
measures to improve coal quality.

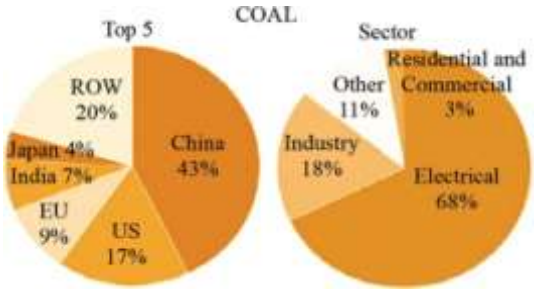

Fig.3 Indiaintopfivecoalconsumers,sectorwisecoal consumption

Development of National Grid

Under the power for all missions, India has set a target of 200,000 MW of installed capacity by the end of 2012. The transmission segment has a major role in achieving thismission as an efficient transmission capacity and network will prove essential to transfer power from generating stations to distribution networks. In the past, transmission planning was done with respect to generation and was focused on setting up transmission systems that could evacuate power safely. However, with the changing scenario, the transmission sector started to move towards integrated system planning because generation capacities are distributed unevenly in different regions. While thermal capacity is in the eastern region, hydro capacity is concentrated in the northern and north-eastern regions. The capacity is used to evacuate power according to the demand in other regions like the western region. Thus, the integrated system planning has turned out to be a good option. In the central sector, the central transmission utility (CTU), known as the Power Grid Corporation of India Ltd (PGCIL), is responsible

for national and regional trans- mission planning, while the state sectors have separate State Transmission Utilities (STU). Private sector participation is negligible in transmission and there is only one public–private partnership project, the Tala Transmission Project. Four private companies have been granted licenses for developing transmission projects. While three companies have entered joint ventures with PGCIL, one company is a private company that has been awarded independently. Transmission network includes transmission lines and transmission substations through which electricity is evacuated from a generator to a distributor. India has over 126,999 circuit/km (ckt km) of 220 kV of transmission lines up to Jan 2010 and its substations are of 188,155 MVA capacity for 220 kV up to Jan 2010. In order to increase the transmission capability of power the important role plays by national grid development. It is envisaged to add new inter-regional capacities of20,700 MW at 220 kV and above during the Eleventh Plan Period. This would increase the total inter-regional trans- mission capacity of national power grid at 220 kVand
above from 14,100 MW (by the end of the Tenth Plan) to 37,750 MW by 2011–2012.

Role of Renewable in the Power sector

The scenario of dominant energy sources in world as a whole is not different from that of India. The world's energy supply is largely based on fossil fuels. It is estimated that by 2030, 80 % of primary energy mix will be dominated by fossil fuels. Oil will remain as the dominant fuel and the demand for coal will rise more than that of any other fuel in absolute terms. In such a scenario, the realisation that these exhaustible sources of energy and are also contributing to environmental problems has made renewables a lucrative and sustainable option. This has also led the governments around the globe, along with industries, thinking seriously about alternative sources of energy, the need for which was further affirmed by the 1973 oil embargo and oil price shock of 2008, coupled with the ever increasing oil prices. To boost investment in renewable energy, it is essential to introduce clear, stable and long- term support policies. A number of policy measures at national level, which could be applied concurrently, would significantly improve the framework for renewable energy in India. However, they must be carefully designed to ensure that they operate in harmony with existing state levelmechanismsanddonotlessentheireffectiveness.

Plan of Smart Grid for India

The effect of Smart Grid towards Indian power sector is promisingandforesightingtotransformanddevelopsecure, adaptive,efficientandsustainablesystemby2027toprovide thecitizenswithreliableandcompetitiveenergybyusageof innovative technologies and policies to fulfill the needs and aspirations of all by active participation of stakeholders.Smart Grid has a very wide view towards the future and is passion at elyprogressingtoachievethetargetsandgoalspropagated in the 5 year plans. These 5 year plans are dividedas:

(a) Near Term Plan(2012-2017)
(b) Mid Term Plan(2017-2022)
(c) Long Term Plan(2022-2027)

The focus of the Near Term Plan (12th 5 year plan from 2012 till 2017) is:

- Access to 'electricity forall'
- Reduction of transmission anddistribution
- Reduction in powercuts
- Improvement in powerquality
- Renewableintegration
- Standards for smart appliances-energy efficient and disaster recovery (DR)ready
- Increase in inter-regional power exchangecapacity
- Wide areamonitoring
- Efficient PowerExchanges
- Training and capacity building in utilities and in the industry to build, operate and maintain smart grid systems andapplication.

The goal of the Mid Term Plan (13th give year plan from 2017 to 2022)is

- ReductionofT&Dlossestobelow10%inallutilities
- End ofload-shedding
- Improvement in powerquality
- Efficient forecasting and dispatching ofrenewable
- Infrastructure and standards forelectric vehicles
- 1,200 kV ac system inoperation
- Mandatory standards for appliances regarding DR readiness, energy efficiency andemission
- Exportofsmartgridproductstooverseas

The Long Term Plan (14th 5 year plan from 2022 to 2027) will look at:

- Economically viableutilities
- Stable 24 9 7 power supply toall
- 33%ormorerenewableinpowersystem
- EV infrastructure leveraged as virtual Power Plant(VPP)
- Export of Smart Grid products, solutions and services overseas.
- IT network and CRM system for electric utilities provided to other service providers such as water and gas distribution, land revenue collection,etc.

Power Scenario in India in Coming Future

India's electricity consumption accounts for about 4 % of world'stotalelectricity consumption anditisgrowingatthe rate of 8–10 % per year. In India total energy shortage is 9 % with peak shortage at 15.2 % and country's power demand is likely to around 120 GW at present and to 315to 335 GW in 2017. In order to estimate the total future requirements of individual fuels of the different sectors directly and indirectly through power, the study considers two fuel mix scenarios for the gross generation of electricity. In the first scenario, one assumes the business-as- usual growth of share of new renewables in the total gross generation of electricity with some moderate challenges so as to reduce the share of coal in thermal generation from 70 % in 2009–2010 to 60 % in 2031–2032. The second scenario, on the other hand, assumes a much higher rise in the share of renewables in power generation such that the share of coal can be brought down to 50 % by 2031–2032. In both the scenarios these have tried to keep within the realmsofrealismbysettingthesharesofnewrenewablesas substantially lower than what the national action plan of climate change has targeted due to the slow pace of their adoption in the Indian energy industry. Table 1 shows the fuel composition of electricity generation as per the base line scenario, while the shares of coal and renewables in the
scenario of accelerated introduction of new renewables are 60 and 9.4 %, respectively in 2021–2022 and 50 and 17.7 % in 2031–2032 and those of all other fuels remains the same as in the base line fuel composition scenario.

II. Conclusion

In this paper, present and future energy scenario in India is discussed. India's growing economy has forced the country to increase installed power capacity to 200 GW this year. Despite this growth in supply, the country is still facing major challenges in providing electricity access to all the households and also improving reliability and quality of power supply. Its power systems are struggling to overcome power shortages and poor power quality.

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