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Status Check: Journey of India's Energy Sustainability through Renewable Sources

S. Ghosh*, V. K. Yadav, G. Mehta**, V. Mukherjee***, R Birajdar***

** Research & Development (R&D) Department, Kirloskar Brothers Limited (Pune), Maharashtra, India (e-mail: santosh.ghosh@kbl.co.in, Ravindra.Birajdar@kbl.co.in).*
*** School of Electrical, Electronics & Communication Engineering, Galgotias University, Greater Noida, (UP), India (e-mail: v7k7y7@yahoo.co.in, gitanjali.iitr@gmail.com)*
**** Department of Electrical Engineering, ISM Dhanbad, Jharkhand, India (e-mail: vivek_agamani@yahoo.com)*

Abstract: India, akin to the rest of the world today, is grappling with balancing act between ever increasing demand of energy and alarmingly high level of green house gas emission, which is inevitable corollary of energy production in the conventional way. Researchers and energy policy makers around the world are now focusing on renewable energy (RE) technologies to find solution to this crisis. In India various agencies at both national and state level has been set up and bestowed with responsibility of development of renewable energy technologies, viz. Ministry of New Renewable Energy (MNRE), National Vidyut Vyapar Nigam Ltd. (NVVNL), Indian Renewable Energy Development Agency Limited (IREDA) and RE Development Agencies in respective states. In the present work, the preparedness of India in terms of forming institutional and policy frame work briefly discussed. Status of implementation of RE technologies, state wise and of India as a whole is critically reviewed.

Keywords: Energy Policy, Energy Sustainability, Renewable Energy.

1. INTRODUCTION

The exponential growth of Indian economy and increasing population are outpacing the rate of augmentation of electricity generation capacity in India. Energy shortage and peaking shortage were inflated to 11.1% and 11.9% respectively in 2008-09 from the level of 8.1% and 11.3% in 1997-98 [1]. Though, due to the subsequent addition of installed capacity, the country average of energy and peeking shortage has been brought down to 2.1% and 2.6% as on July 2015, however the state/region wise data mining reveals that some of the states faced energy shortage of 17.1% and peeking shortage of as high as 21% during Apr-July 2015 [1],[8]. About 1.5-2 billion people in developing countries do not have access to the electricity and 450 million of them are in India alone. Only about 56% of rural households and 93% of urban households has been so far electrified in India [2] [3]. Hence there is an urgent need of rapid expansion of generation and transmission capacity to deal with the present demand [2] and more so for the future. India would be required to generate an estimated massive 3400 TWhe/year of energy to take care of its 1700 million people by 2070, considering per capita electricity consumption of merely 2000 kWh/annum [4]. Even in this scenario the socio-economic and political scenario in India is making it difficult to enhance generation capacity, based on conventional technologies for both public and private power producers. The factors inhibiting setting up new plants are: social and environmental hindrance in coal mining, land acquisition, lack of necessary organizational changes responsible for supply chain management of fuel required to cater for added capacity, the exorbitant cost of capital and most importantly unpredictability of government policies. In addition, heavy dependence on imports of coal and petroleum fuels and volatility of world oil market are making power projects financing extremely risky [5]. In this scenario, for bridging over this ever widening gap between demand and supply of electrical energy, leveraging on renewable technologies has become imperative.

2. PRESENT INDIAN POWER SECTOR SCENARIO

Presently (as on July 2015) India is the sixth largest producer of electric energy in the world with total installed capacity of 2,75,912 MW [1]. The major chunk of it, about 69.5% is contributed by thermal power plants, while 15.2% comes from hydro, 2% from Nuclear, and 13.21% comes from renewable energy sources [1],[8]. Though rich in coal reserves and bestowed abundantly with renewable energy resources in the form of solar, wind, small hydro and bio-energy, and with small hydrocarbon reserves (0.4% of the world's total), India is a net importer of primary energy. More than 35% of the country's primary energy requirements are met through imports [6]. The institutional frame work of Indian Power Sector, under central government, is summarized in Table 1.

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Central Electricity Authority (CEA) was constituted under the aegis of Electricity Act 2003 (EA 2003) [7]. Policy recommendations, evaluation of electricity sector performance, advising the Ministry of power on technical issues, data management of the power sector, preparation of technical standards for electrical plants, electric lines and connectivity to the grid are some of the major responsibility of this organization. Central electricity regulatory commission (CERC) had been constituted under EA 2003 to promote competition, efficiency and investments and quality of supply. It also plays an advisory role for government on various issues such as availability of fuel and raw materials, generation from renewable resources; tariff based competitive bidding, open access for power transmission and import of electricity from other countries. CERC also plays instrumental role in formulating various policies. Rural electrification policy, tariff policy, national electricity policy, Rajiv Gandhi Gramin Vidyutikaran Yojana (RGGVY)-A policy initiative to provide electricity to all un electrified villages of India, had come into existence under this commission [8].

Table 1. Indian Power Sector organizational structure at different level of governance

Functions	Central Government (GOI)	State Government	Non Govt. (Private)
Policy	MOP, MNRE	State Govt. Ministry for Power and RE	-
Planning	CEA	SEB	-
Regulation	CERC	SERC	-
Generation	NGU	GENCO	IPP
Transmission	PGCIL	STU	PTSP
Execution	NLDC, RLDC	SLDC	
Distribution	-	State distribution utilities	PDSP
Trade	PTC India Ltd. Licensee	Licensee	Licensee
Energy Efficiency	BEE		
Law	Appellate Tribunal		

MOP: Ministry of Power; MNRE: Ministry of New and Renewable Energy; NGU: National Generating Units; PGCIL: Power Grid Corporation of India Limited; NLDC/RLDC/SLDC: National/Regional/State Load Dispatch Centre; PTC: Power Trading Corporation of India Limited; BEE: Bureau of Energy Efficiency; SEB: State Electricity Board; GENCO: Generation Company (State); STU: State Transmission Utility; IPP: Independent Power Producer; PTSP/PDSP: Power Transmission/ Distribution Service Provider.

2.1 State electricity regulatory commissions(SERC)

SERCs have the responsibilities to determine the tariff for generation, transmission, distribution and wheeling of electricity within the respective states. SERCs regulate electricity purchase, the operations of intrastate transmission, distribution of licenses including the price for distribution and supply within the state [8]. They are also responsible for encouraging cogeneration and generation of electricity from renewable and environmental friendly sources of energy.

2.2 The Bureau of Energy Efficiency (BEE)

It is an agency of GOI, under the Ministry of Power created in March 2002, with prime responsibility to increase the conservation and efficient use of energy in India. GOI has proposed to make it mandatory for all appliances in India to have ratings by the BEE starting in January 2010 [9], with primary objective to mitigate the demand supply gap through demand side management.

3. POLICY INITIATIVES OF GOI FOR POWER SECTOR REFORMS AND PROMOTION OF RE TECHNOLOGIES

Electricity Regulatory Commissions Act 1998, Electricity Bill 2001 and The Electricity Act 2003 (EA 2003) were enacted by Indian parliament to bolster the power sector reform process by addressing the major issues involving generation, distribution, transmission, trading and privatization of power sector and promotion of RE technologies [10]. Salient features of EA 2003 are:

- Generation of power has been de-licensed and captive generation is freely permitted, Large Hydro-projects, however need concurrence from CEA.
- Open access in transmission.
- Unbundling of State Electricity Boards.
- State Electricity Regulatory Commission (SERC) establishment is made mandatory.
- Stand-alone systems for rural and remote area.
- Privatization of power sector.

EA 2003 also made provision for the promotion of renewable energy and co-generation technologies, and provided policy frame work for purchase of electricity from these sources. The regulators' forum constituted in line with the provisions of EA 2003, National Electricity Policy and Tariff Policy, notified guidelines for procurement share of different renewable energy sources within overall renewable procurement obligation (RPO) percentage, guidelines for process of competitive procurement of renewable energy and introduced renewable energy certificate (REC) mechanism [10]. The primary objective of REC mechanism is to bridge the gap between availability of renewable energy resources in a particular state and the requirement of the renewable procurement obligation (RPO).

Further, the GOI has released its National Action Plan on Climate Change (NAPCC) in mid-2008, in which eight critical missions have been identified, viz. Nation Solar Mission, National Mission for Enhanced Energy Efficiency and National Mission for Green India etc. with one of its