

ASSESSMENT OF RENEWABLE ENERGY SCENARIO IN INDIA

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Abstract: At present the entire world is facing energy crisis. The energy consumption is growing at the rate of 2.2% per year and the most of energy comes from fossil fuel based technology. The growing demand for energy depends on imported energy or by conventional energy technologies. The energy consumption rate in India is growing year by year at the rate of 6 percent. Renewable energy has the potential to address the growing concern of energy and also an important tool in to conserve the natural resources. It is also important to minimize the environmental impact than conventional energy technology. India is the first country in the world to establish an exclusive ministry (MNES) for renewable energy development.

India has a healthy programme of cooperation in renewable energy which aims at nurturing closer linkages between scientific institutions, businesses and industry and encourages private investment. Our scientific and technological manpower form a sound basis for intensifying collaborative efforts in research, development, demonstration and transfer of renewable energy technologies.

The country mission has set the determined target to set up 20,000 MW of grid connected solar power by 2022. It is aimed to reducing the cost of solar power generation through (i) long term policy; (ii) large scale deployment goals; (iii) aggressive R&D; and (iv) domestic production of critical raw materials, components and products. The main challenge of the country is to make the renewable energy technologies safe, affordable efficient and convenient. The ministry has launched various been programmes such as biogas plants, photovoltaic systems, and biomass gasifiers,solar cookers and other solar thermal systems, etc. in rural areas of the country to promote the use of renewable energy.

Keywords: Economic growth, Energy demand, India, Renewable energy market.

Introduction: Energy is the main driving force to speed up the economic growth of the country. The energy demand in the country is growing year by year at the rate of 6 percent. India ranks sixth in the world in total energy consumption on population basis but per capita consumption is much lower than many countries. In order to become a global master it is essential to accelerate the energy sector.

Currently the 65% energy is produced from the conventional fossil fuel like coal and oil. The production of renewable energy ranks bottom of the total production just before the Nuclear energy. (Fig.1).It is predicted that energy shortages in succeeding years and the country requirement to

show a strong intention to develop alternative sources of energy. This is the right time to think on it otherwise India may drift behind as it directly affects the economic growth. With this power and energy scenario, Ministry of Power (MoP) and Ministry of Non-conventional Energy Sources (MNES), Government of India, has been promoting viable renewable energy technologies including wind, small hydro and biomass power, energy conservation, demand side management etc. MNES has been promoting various sources of renewable energy since 1990[1].

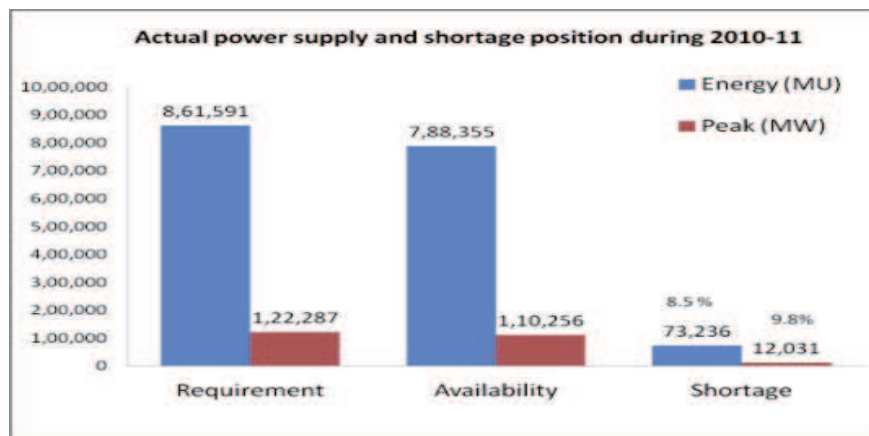


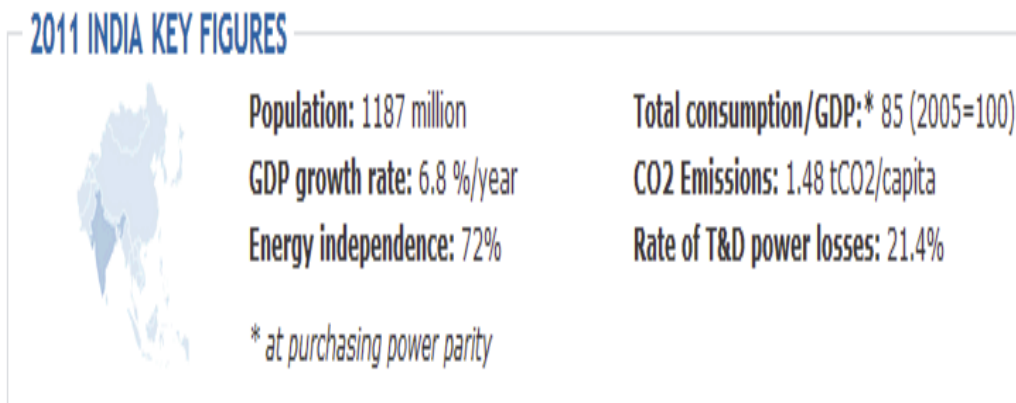
Fig.1 Actual Power supply and shortage of India

Energy Scenario in India: Electricity generation capacity additions in India from 1950 to 1985 were

very low when compared to many countries. But from 1990 onwards country has become one of the fastest growing markets for new electricity generation capacity. The country's annual electricity generation capacity has increased in last 20 years by about 130 GW, from about 66 GW in 1991 (MOP,1992) to over 100 GW in 2001, to over 199 GW in 2012[2]. India's Power Finance Corporation Limited projects that

current and approved electricity capacity addition projects in India are expected to add about 100 GW of installed capacity between 2012 and 2017. This growth makes India one the fastest growing markets for electricity infrastructure equipment[3]. However it is still less than those achieved by China and other Asian countries.

India



Demand Trends: The demand for electricity as in previous years, during the year 2010–11, demand for electricity in India far exceeded 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. [2]. 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

Total Energy consumption and Energy use per capita: Per capita energy consumption in India is 510 kg of energy while it is 7,778 in US and the World average of energy consumption is close to 1818 kg [4]. Total energy consumption per capita remains very low (0.64 and 700 kWh in 2011) and but it is increasing rapidly (3.1%/year) for total energy consumption and 6.8%/year for electricity over the last ten years which is much less than China.

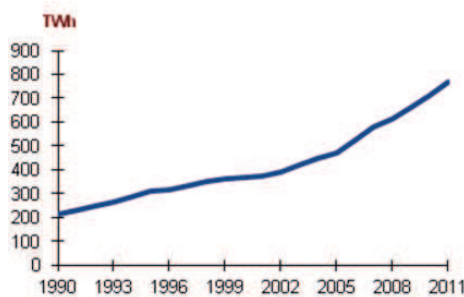


Fig.2. Energy consumption trend in India

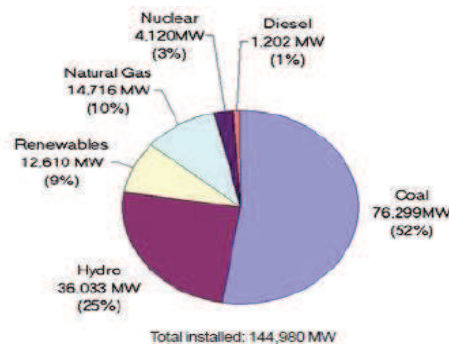


Fig.3. Energy Scenario in India

Over view of Renewable Energy in India: Coal and oil is the dominant fuel used to produce energy in India which unsustainable both for public health and environment.

The renewable energy sources in India represent only 11% of the country’s electricity capacity. Poverty eradication and future economic development are mainly linked to the expansion of modern energy availability. So solving the energy shortage through sustainable solutions is the key for economic and environmental development. India is the first country in the world to set up a ministry of **non-conventional energy** (MNCE) resources, in early 1980s. But it failed to achieve the required goals in the production of energy. As a result India is still lagging behind other nations in the use of renewable energy. However, the renewable energy is growing rapidly. With an installed capacity of 13.2 GW, renewable energy sources (excluding large hydro) currently account for 9% of India’s overall power generation capacity. In

its 10th Five Year Plan, the Indian government had set itself a target of adding 3.5 GW of renewable energy sources to the generation mix. In this period, more than 5.4 GW of wind energy was added to the generation mix, as well as 1.3 GW from other renewable energy sources. The target set for the period from 2008-2012 was increased to 14 GW, 10.5 GW of which to be new wind generation capacity [5]. Indian renewable energy programme is primarily private sector driven. It offers significant investment and business opportunities. New investment in renewables has now exceeded US\$ 10 billion per year. New opportunities have emerged and new business has been created. Indian companies begun to explore foreign stock exchanges as source of funds. Merger and purchase activities are now quite frequent. The enthusiasm in the renewable energy industry could be credited to the policies and continuation facilities from the Government.

Renewal energy installed capacity in India (as of December 31, 2012)

Type ^[62]	Technology	Installed capacity (in MW)
Grid connected power		
	Wind	18420.40
	Small hydro	3496.14
	Biomass	1248.60
	Bagasse Cogeneration	2239.63
	Waste-to-Energy (WtE)	96.08
	Solar	1176.25
Off-grid, captive power		
	Waste to Energy-Urban	113.60
	Biomass non-bagasse cogen	426.04
	Biomass Gasifiers - Rural	16.696
	Biomass Gasifiers - Industrial	138.90
	SPV Systems (>1 kW)	106.33
	Aerogen/Hybrids	1.74

Tab.1. Over view of Renewable Energy in India

The MNRE estimates that there is a potential of around 90,000 MW for power generation from different renewable energy sources in the country (wind power, hydro power and biomass). Besides, the potential for solar energy is estimated at around 20 MW per square kilometer.

The launching of Jawaharlal Nehru National Solar Mission is a mile stone and is the highlight of the 11th plan. Other major achievements launching of Pan India renewable energy market which introduced

solar specific purchase obligations, improved cook stoves, and initiated research development activities in renewable energy which may provide basic lighting facilities for over 5000 villagers in the country.

Hydro Electric Power in India: India ranks 7th in hydro electricity production and produce 3.5% the world total hydro power [6]. The present installed capacity is approximately 37,367.4 MW which is 21.53% of total Electricity Generation in India. Here also 97% of share is of public sector. National

Hydroelectric Power Corporation (NHPC), [Northeast Electric Power Company](#) (NEEPCO), Satluj jal vidyut nigam (SJVNL), Tehri Hydro Development

Corporation, NTPC-Hydro are a few public sector companies engaged in development of Hydroelectric Power in India.

India Share of renewables in electricity production (incl hydro)

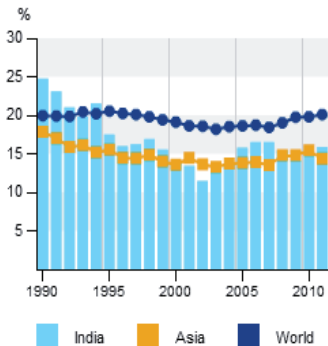


Fig.4. Indian Share of Renewables

Total Renewables in India till Aug 2012 = 25,445 MW (Approx.)

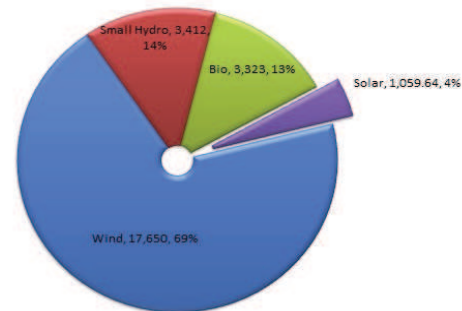


Fig.5.Total Renewables in India

Indian Wind Energy Sector Overview: In this sector India occupies fifth position in the world (WVER, 2010). It produces 6% of India's total installed power capacity. The production of wind power in India began in the 1990s by [Tamil Nadu Electric Board](#) near Tuticorin. [Suzlon](#) and [Vestas](#) are the pioneer companies in wind power, with an installed generation capacity of 15.9 GW in

India[7]. The largest wind power generating state was [Tamil Nadu](#) accounting for 30% of installed capacity, followed in decreasing order by [Maharashtra](#), [Gujarat](#), [Karnataka](#), and [Rajasthan](#). By 2014 government is determined to install 6 GW of additional wind power capacity.

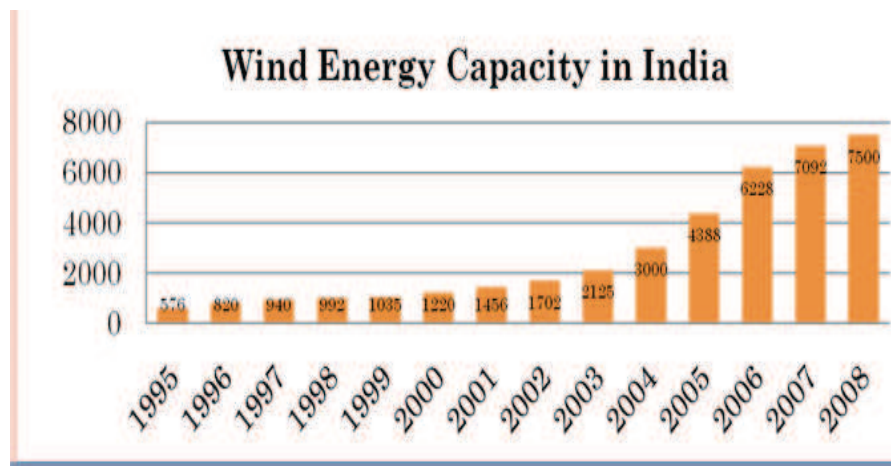


Fig.6.Key Trend in India Wind Energy Industry

Biomass power Overview: In this system biomass, bio gas, forestry and agro residue and agricultural wastes are used as fuel to produce electricity for villages with power plants of up to 2 MW capacities.[6]. Biomass gasifier technologies are mainly used in rural India where surplus biomass resources are used in energy production. India has already installed 25 rice husk based gasifier systems for distributed power generation in 70 remote villages of Bihar, Gujarat and Tamilnadu.

Biogas: Under this category small scale biogas plants

are installed to meet the demand of cooking energy in rural India. A huge amount of biomass is available from sugar mills, paper mills, textiles and other small scale enterprises (SME) [8] [9]. Under this programme near about 4.44 million small scale biogas plants were installed and 158 projects are in pipeline [5].

Indian Solar Energy Market Overview: India is a tropical country and receives maximum solar radiation ranging from 4 to 7 kWh/square meter/day across the country [10]. The country has the share of 1% among the global solar power and determined to

rise it up to 5% by 2015. After launching the [Jawaharlal Nehru National Solar Mission](#) under the National Action Plan on Climate Change, country plans to generate 1 GW of power by 2013 and up to 20 GW grid based solar power, 2 GW of off-grid solar power and

cover 20 million square meters by 2020. The first solar thermal power project (2X50MW) is in progress in Phalodi (Rajasthan), and is constructed by Corporate ISPAT Alloy LTD.

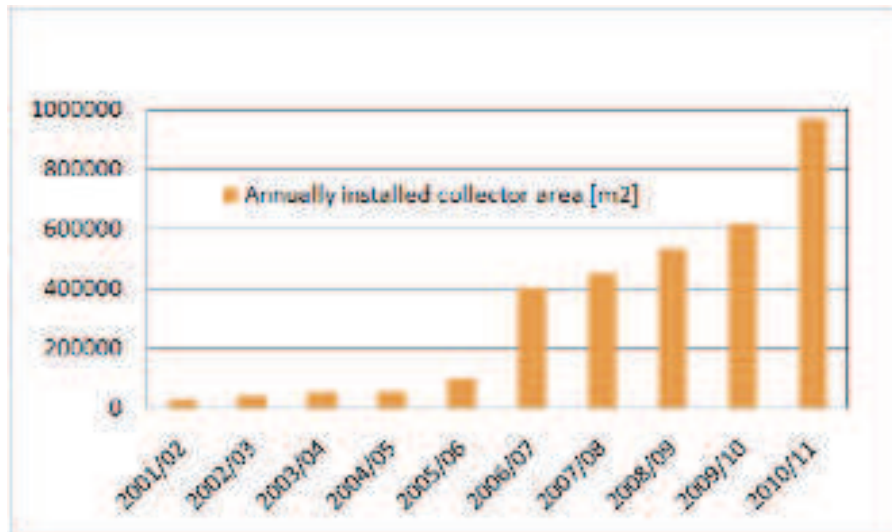


Fig.7. Trends in Indian Solar Industry (Source: MNRE)

The figure shows the annually installed collector area in India as per the Federal Ministry of New and Renewable Energy (MNRE).

Research and development: Research and development efforts of the Ministry are mainly concerned to reduce the cost, improvement of efficiency, reliability, long-life and manufacture of complete systems. In 2012, a total of 29 research projects with total budget of cost ₹8.60 crores in the area solar thermal power, solar photovoltaic, hydrogen and fuel cell, biofuel, and biomass cook stoves have been sanctioned. The Research and development activities have already been taken up with national laboratories, universities, scientific and educational institutions and industry.

Problems with Indian Power sector: The electricity sector of India faces many issues. Few are,

- **Free electricity** for farmers to gain a political favor exhausted the cash reserves. Nonpayment of electricity bills further worsened the situation.
- **Shortages of fuel:** Despite the availability of coal reserves India is facing a severe shortage of coal. The country isn't producing enough to feed its power plants

- Ecological and environmental changes and public water wars or disputes forced hydroelectric power projects slowed down its capacity.
- About 800 million people in India to continue using traditional biomass energy sources which create pollution and causes 300,000 to 400,000 deaths per year and other chronic health issues [11].

Regulation and Administration: The Ministry of New and Renewable Energy (MNRE) of India is India's apex central government body regulating the Renewable Energy sector in India. It is responsible for planning, policy formulation, processing of projects for investment decisions, monitoring project implementation, training and manpower development, and the administration and enactment of legislation in regard to Renewable Energy power generation, transmission and distribution. It is also responsible for the administration of India's Electricity Act (2003), the Energy Conservation Act (2001) and to undertake such amendments to these Acts, as and when necessary, in conformity with the Indian government's policy objectives.

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