

A REVIEW ON RENEWABLE ENERGY GENERATION DEVELOPMENT PLANNING IN INDIA

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ABSTRACT

Energy is vital for economic and social development of society. Presently, the global energy demands are met largely from oil, natural gas, and coal. However, these add to environmental degradation problem through gaseous emission, particulate matter, fly ash, bottom ash, CO₂, etc. which are very harmful to human life. The carbon dioxide (CO₂) and other gases released by burning fossil fuels contribute to the “green-house” effect which causes global climate change. The proper siting, installation and operation of renewable and non-conventional energy sources will help to control, replace and avoid adverse environmental impact. The power plants contribute 37% of total CO₂ concentration in the environment. Therefore, an integrated approach in the existing power generation system in India is necessary from an environmental point of view.

Keywords: Energy Management, Renewable Energy Generation, CO₂ Emissions Reduction and Green Electricity.

I INTRODUCTION

A majority of the Indian population does not have access to convenient energy services of LPG and electricity. Though India has made significant progress in renewable energy, the share of modern renewable energy in total generation is marginal. This forces to review the status and potential of different renewables in India. Several renewable hybrid energy sources such as wind, hydro, solar, biomass, geothermal etc. have high growth rates [1], [6]. These technologies are at the demonstration stage and future dissemination will depend on the experience of these projects. In section 2, total electrical generation is presented along with current status of renewable energy and CO₂ emissions [3],[8]. Advantages and limitations of renewable energy sources are discussed in Section 3. Solutions to the environmental problems are given in Section 4. Section 5 gives an overview of its major achievements in India. Suggestions to tackle the environmental problems are explained in Section 6 followed by the conclusion in Section 7 [3]-[7].

II Electricity Generation

2.1 Renewable energy generation

Renewable energy is energy that comes from resources which are continually replenished such as sunlight, wind, rain, tides, waves and geothermal heat [1]. In the world, 16% of global energy consumption comes from renewable resources. Out of 16%, 10% of energy is generated from traditional biomass and 3.4% from hydroelectricity. New renewable energy sources such as small hydro, modern biomass, wind, solar, geothermal, and bio-fuels accounted for another 3% and are growing very rapidly. The share of renewables in electricity generation is around 19% with 16% of electricity coming from hydroelectricity and 3% from new renewables. The renewable energy provides approximately 12% of a 200GW of electricity generation capacity installed in India [5]. Various types of energy generation in the world and in India is shown in Fig.1a and 1b [9]. Sector wise installation of total power is shown in Table 1[10]. Various type of energy generation is shown in Table 2 [10]. There is tremendous growth in renewable energy generation during the last three decades and is shown in Fig 2 [9].

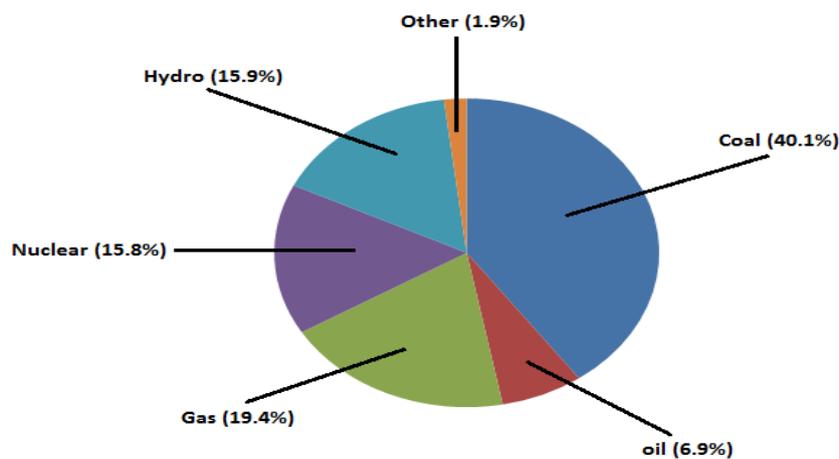


Fig 1a: Type wise Electricity generation in world (as on 2012)

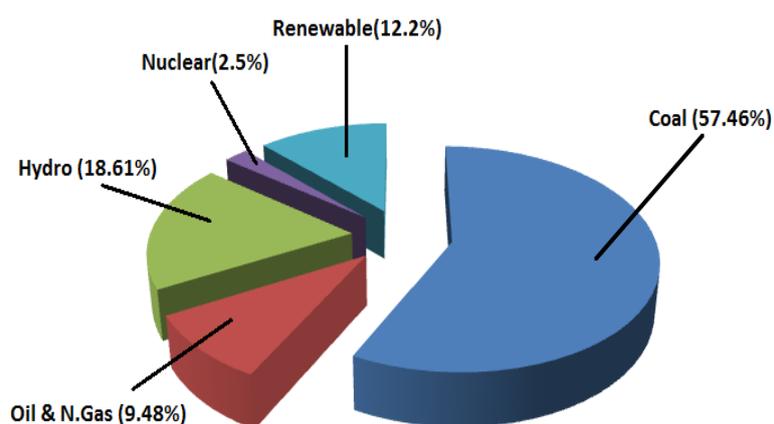


Fig 1b: Type wise Electricity generation in India (as on 2012)

Table 1: Sector Wise Installed Energy

Sector	MW	%age
State Sector	86,343.35	40.77
Central Sector	62,963.63	29.73
Private Sector	62,459.24	29.49
Total	2,11,766.22	

Table 2: Various Types of Energy Generation

Fuel	MW	%age
Coal	121,610.88	57.42
Gas	18,903.05	8.92
Oil	1,199.75	0.56
Total Thermal	141713.68	66.91
Hydro (Renewable)	39,416.40	18.61
Nuclear	4,780.00	2.25
Renewable Energy Sources	25,856.14	12.20
Total	2,11,766.22	100.00

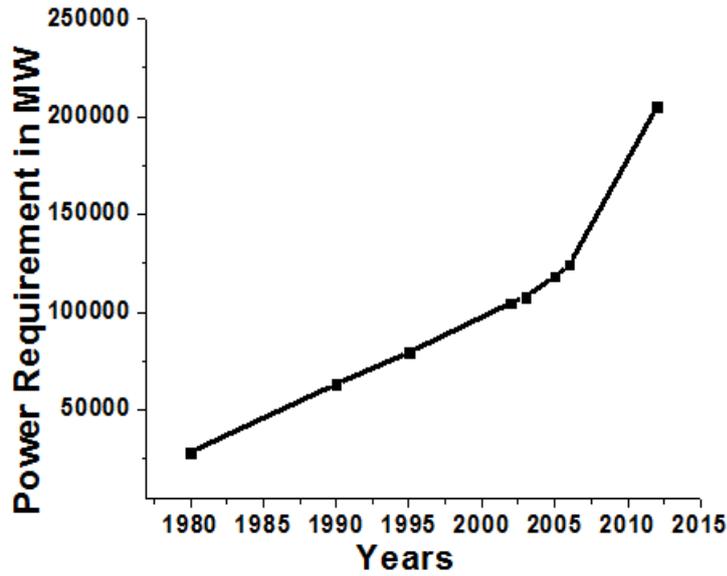


Fig 2: Plan wise growth of Power generation in India up to March 2012

Table 3: Plan wise growth of Power generation in India up to March 2012

Year	Power Generation(in MW)
1980	28448
1990	63290
1995	79470
2002	104851
2003	107973
2005	118420
2006	124310
2012	205000

2.2. CO₂ Emissions

The emission of greenhouse gases (GHGs) and their implications to climate change have sparked global interest in understanding the relative contribution of the electrical generation in industry. According to intergovernmental

panel on climate change (IPCC), the world emits approximately 27 gigatonnes of CO₂ emissions from multiple sources with electricity production emitting 10 giga tonnes or approximately 37% of global emissions [8]. However, electricity demand has increased by 43% over the next 20 years. The CO₂ emissions in the World (1990-2050) are shown in Fig 3 [9].

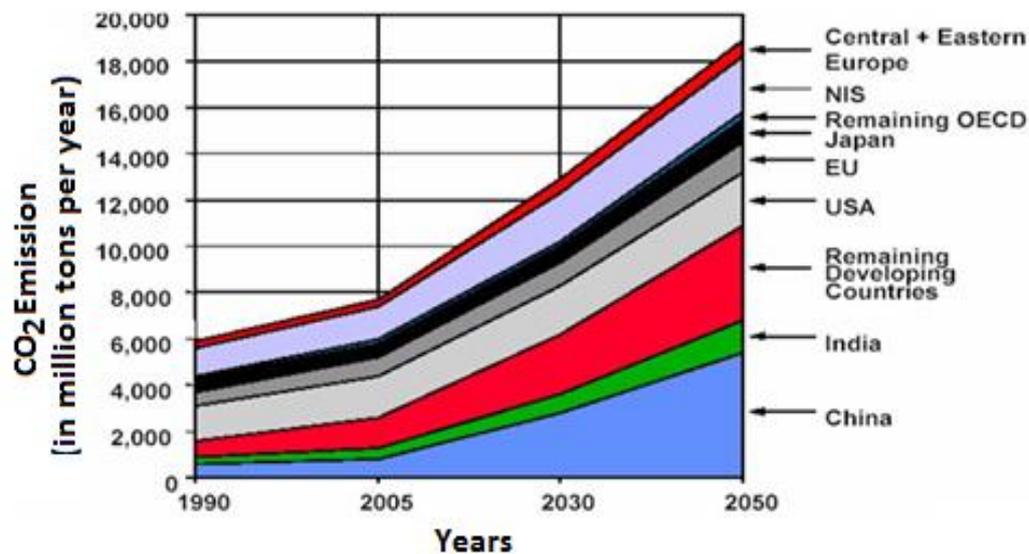


Fig 3: CO₂ emissions in the World (1990-2050)

III ADVANTAGES AND LIMITATIONS OF PROPOSED TECHNOLOGIES IN INDIA [1]- [11]

3.1 Advantages

1. Environmental benefits
2. The major advantage of the use of renewable energy is that it is non- exhaustible.
3. Renewable facilities generally require less maintenance than traditional sources, their fuel being derived from natural and available resources which reduces the CO₂ emission and the cost of operation.
4. Even more importantly, renewable energy generation produce little or no waste products such as carbon dioxide or other chemical pollutants, so has minimal impact on the environment.
5. Renewable energy products can also bring economic benefits to many regional areas, as most projects are located away from large urban centres and suburbs. These economic benefits may be from the increased use of local renewable energy resources as well.

3.2 Limitations

1. One limitation with renewable energy is that it is difficult to generate the amount of energy that can be produced by traditional sources. This may mean that we need to reduce the amount of energy we consume to adopt such innovative technologies.

2. Another limitation of renewable energy sources is the reliability of supply. Renewable energy often relies on the weather for its sources of power. Hydro generators head rain to fill dams to supply flowing water, wind turbines need wind to turn the blades, and solar cells need clear skies and sunshine to use the heat and convert it into electricity. When these resources are unavailable so is the capacity to make energy from them.
3. The energy production from these sources can be unpredictable and inconsistent. Moreover, the current cost of renewable energy technology is also far more than of traditional fossil fuel. This is because it is a new technology and is therefore capital intensive.

IV PROPOSED SOLUTION TO THE ENVIRONMENTAL PROBLEMS.

The renewable energy resources such as wind, solar, hydro, biomass etc. are more efficient and economical. The optional sizing of hybrid renewable energy system with battery plays an important role in this respect [11]. Renewable energy technologies have gained much attention in recent year as a potential solution to problems of air pollution, climate change, energy security etc. Interest in sustainable energy has grown many fold in recent years with concern about global warming and the desires of citizens, government leaders, academic and business leaders to take action in arresting the runaway growth of greenhouse emissions. As renewable portfolio standard and other sustainable energy-friendly policies are pursued by many counties around the world. Some of the renewable energy technologies are : Biomass, Combined heat and power, Geothermal electricity, Small hydro design and applications, Solar photovoltaic, Solar thermal electricity, Tidal and wave energy, Ocean thermal energy conversion, Wind turbine generators, Battery and storage, Energy efficiency, Hydrogen technology, Grid interaction sustainable energy sources, Carbon capture from power generation, Mitigation of greenhouse gases emission [4]-[11].

V MAJOR ACHIEVEMENTS OF NEW AND RENEWABLE ENERGY GENERATION

The ministry of new & renewable energy (MNRE) has been facilitating the implantation of broad spectrum programs [10]. Renewable energy is a sector that is still in its infancy as on February 2013, India has installed capacity of about 22.6 GW of renewable technologies, it is about 12% of total energy generation. The table 3 provide the capacity breakup by the various technologies in country as on 28.02.2013 are summarised as below [10].

Table 4: Renewable energy installed capacity in India (as on 28.02.2013)

Renewable Energy Programme/ Systems	Target for 2012-13	Deployment during February, 2013	Total Deployment in 2012-13	Cumulative achievement upto 28.02.2013

I. POWER FROM RENEWABLES:				
A. GRID-INTERACTIVE POWER (CAPACITIES IN MW)				
Wind Power	2500	83.20	1282.20	18634.90
Small Hydro Power	350	46.05	156.98	3552.29
Biomass Power	105	15.00	113.50	1263.60
Bagasse Cogeneration	350	20.00	315.70	2300.93
Waste to Power - Urban-Industrial	20	-	6.40	96.08
Solar Power (SPV)	800	210.18	505.48	1446.66
Total	4125.00	374.43	2380.26	27294.46
B. OFF-GRID/ CAPTIVE POWER (CAPACITIES IN MW_{EQ})				
Waste to Energy - Urban-Industrial	20.00	1.06	13.82	115.56
Biomass(non- bagasse) Cogeneration	60.00	5.06	60.59	443.10
Biomass Gasifiers – Rural	1.50	-	0.672	16.792
Biomass Gasifiers – industrial	10.00	-	6.02	140.10
Aero- Generators/Hybrid systems	0.50	0.24	0.44	2.09
SPV Systems (>1kW)	30.00	-	17.59	107.80
Water mills/micro hydel	2.00(500 Nos.)	-	(270 nos)	2131 Nos.

Total	126.00	6.36	99.13	825.44
II. REMOTE VILLAGE ELECTRIFICATION				
No. of Remote Village/Hamlets provided with RE Systems	-	-	-	-
III. OTHER RENEWABLE ENERGY SYSTEMS				
Family Biogas Plants (No. in lakhs)	1.25	-	0.77	46.11
Solar Water Heating - Coll. Areas (Million m ²)	0.60	-	0.91	6.92

VI SUGGESTIONS

Following suggestions are given for policy makers for development, dissemination and better and efficient use of renewable energy technologies in the country [5]:

- (1) Establishment of biomass/solar/wind power generation systems and energy saving in every government office.
- (2) Strenuous exaltation of renewable energy by government agencies, public sector, corporate, academic institutions etc.
- (3) Foundation of national-level body to increase awareness of renewable energy at comprehensive level.
- (4) Research and development of renewable energy technologies may be provided the financial support and sponsorship.
- (5) Setting up aspiring goals and targets for power generation by non-conventional sources.
- (6) Making it compulsory to install solar water heating systems for all urban residential and commercial establishments.
- (7) Imperative renewable energy systems provision for new residential, commercial and industrial buildings.
- (8) Restricting use of large battery energy storage systems and promoting use of bio-fuels in vehicles.
- (9) Abrogating duties/taxes on import of small-scale renewable energy generating equipment and providing manageable loans for setting up renewable energy enterprises.
- (10) Some mechanism of incentives for buyers and manufacturers of renewable energy equipment should be developed in rural areas. Cultivation of energy crops on marginal and degraded land.

VII CONCLUSION

In the present paper, attempt has been made to give overview of Conventional & Renewable energy sources. The pollutants emitted from the conventional energy sources are effecting the environmental and in turn affect the human life to a large extent. Some remedial measures have been suggested to reduce the greenhouse gases which will ultimately minimize the effects of these gases on human health. Therefore, the renewable energy is more essential for the benefits environment friendly. The green power generation technologies will play an important role in future power supply due to increased global public awareness for environment protection of any country in the world. The need to boost the efforts for further development and promotion of the renewable energy has been felt all over the world in light of high greenhouse emissions. An emphasis should be given on presenting the real picture of renewable energy potential.

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