

# India's Green Energy Corridor; New Perspective of Renewable Energy

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**Abstract**—Renewable energy is the energy that can be collected from renewable resources, which are naturally replenished on a human timescale such as sunlight, wind, rain, tides and geothermal heat. With Conventional energy reaching its limits and hampering the environment it is for the betterment of the future generations that we pay importance to our country's renewable energy sources and policies governing it. The paper reviews India's growth in renewable sector, examines the institutional setup and the policy initiatives, with reference to country's current sustainable energy solutions. The paper at first summarizes India's past energy scenarios, current situation. It highlights the issues and gaps.. Following this assessment is the analysis of existing policy and programs of 12<sup>th</sup> five year plan has been done. India started the Green Energy Corridor to reach on summit in global race of obtaining energy sustainability. The works of an optimist government has been discussed to know in which desire the acceleration would reach. The estimation of future India's renewable energy scenario after functioning with Green Energy Corridor has been given along with recommendations on the basis of observations. Results suggest that the integration between states and the central along with greater participation of the private sector will play a key role in promoting the development of renewable energy power in the country.

**Keywords:** Green Energy Corridor.

## 1. INTRODUCTION

Energy is one of the major inputs for the economic development of any country. In the case of the developing countries, the energy sector assumes a critical importance in view of the ever-increasing energy needs requiring huge investments to meet them. The three main energy sources are Coal, oil and gas in all over world, USA have largest share and India India is the world's third largest producer and fourth largest consumer of electricity.

(BP Statistical Review of World Energy, June 2004)<sup>1</sup>.

The opportunities in India are huge, which forwards size of the remaining challenges; although incomes and corresponding standards of living are on the rise, India is still home to a third of the world's poor and gross domestic

product (GDP) per capita is well below the international average. India's energy sector has grown tremendously in recent years. Further economic and population growth, allied to structural trends such as urbanisation and the nature of the envisioned industrialisation, point unmistakably to a trend of continued rapid expansion in demand for energy. Recognising this challenge, Indian policy-makers are making strenuous efforts to remove obstacles to investment in energy supply, while moving ahead with complementary policies on efficiency and energy pricing that can constrain growth in consumption.

The transformed Indian government has responsible for number of policies and schemes to welfare the paper is analysing to trends of energy consumption as compared to production .The comprehensive study has been done over Indian social as well as economic policies and production and supply according to development of the country.

## 2. INDIA'S CURRENT ENERGY TRENDS

Energy use has almost doubled since 2000, and economic growth and targeted policy interventions have lifted millions out of extreme poverty; but energy consumption per capita is still only around one-third of the global average and some 240 million people have no access to electricity. In these circumstances, even with a growing focus on energy efficiency and subsidy reform, there are strong underlying reasons to expect continued rapid growth in energy demand. Three-quarters of Indian energy demand is met by fossil fuels, a share that has been rising as households gradually move away from the traditional use of solid biomass for cooking. Coal remains the backbone of the Indian power sector, accounting for over 70% of generation and is the most plentiful domestic fossil-fuel resource.

**Table 1: Trend in Production of Primary Commercial Energy in India**

Energy from	2001-02	2006-07	2011-12
Coal (MMT)	325.65	405	680
Lignite (MMT)	24.3	55.96	55.59
Crude oil(MMT)	32.03	33.97	39.51

<sup>1</sup> ENERGY SCENARIO 2004 estimation of world energy demand Bureau of Energy Efficiency

Natural gas (MCM)	29.69	37.69	46.63
Hydro power (BkWh)	82.8	103.49	165
Nuclear Power (BkWh)	16.29	19.3	44.64
Wind power (BkWh)	1.7	4	7

(Dr. Vimala M, February 2016)

Power is one of the most critical components of infrastructure crucial for the economic growth and welfare of nations. The existence and development of adequate infrastructure is essential for sustained growth of the Indian economy. India's power sector is one of the most diversified in the world. Sources of power generation range from conventional sources such as coal, lignite, natural gas, oil, hydro and nuclear power to viable non-conventional sources such as wind, solar, and agricultural and domestic waste. Electricity demand in the country has increased rapidly and is expected to rise further in the years to come. In order to meet the increasing demand for electricity in the country, massive addition to the installed generating capacity is required.

**Table 2: Growth of Installed Capacity in India**

Installed capacity as on	Thermal (MW)	Nuclear (MW)	Renewable (MW)	Total (MW)	% Growth (on yearly basis)
31-Mar-2002	2,2720	26,269	27,897	105,046	4.49%
31-Mar-2007	3,900	34,654	42,414	132,329	5.19%
31-Mar-2012	4,780	38,990	63,493	199,877	9.00%
31-Mar-2015	5,780	41,267	77,044	271,722	11.98%
31-Mar-2016	5,780	42,783	85,510	301,965	11.13%

("All India Installed Capacity of Utility Power Stations", 19 October 2016.)

The utility electricity sector in India had an installed capacity of 308.83 GW as of 30 November 2016. Renewable power plants constituted 28.9% of total installed.

capacity<sup>2</sup>. The gross electricity generated by utilities is 1,106 TWh and 166 TWh by captive power plants during the 2014–15 fiscal<sup>3</sup>. The gross electricity generation includes auxiliary power consumption of power generation plants.

It can be seen in this table, the achieved thermal power generation capacity addition excluding renewable power is 85,510MW till 31<sup>st</sup> March 2016 which is 52.87% of targeted 155,870MW during 12<sup>th</sup> five year plan which would end on 31<sup>st</sup> March 2017.

<sup>2</sup> All India installed capacity (in mw) of power stations (as on 30.11.2016)

<sup>3</sup> "Growth of Electricity Sector in India from 1947-2015" CEA, India. 13 June 2015.

### 3.1 Consumption rate and Regionwise energy supply

Total electricity coverage was 81% in 2015-16 indicates the lack of connectivity in rural India. During the fiscal year 2014-15, the per capita electricity generation in India was 1,010 kWh with total electricity consumption (utilities and non utilities) of 938.82 TWh or 746 kWh per capita electricity consumption. Electric energy consumption in agriculture was recorded highest (18.45%) in 2014-15 among all countries<sup>4</sup>.

("World energy outlook - Energy access database"., 2016)

Accept few regions are expected to face energy shortage, power available adequately from the surplus regions with the higher capacity inter regional transmission links. We can see energy supply less in eastern and North eastern regions, there are several reasons behind that

To achieve sustainably, clean and green energy very crucial further we will see what policies government has set up in 12<sup>th</sup> FY plan for this sector. Since maximum part of the country comes under rural which still not completely covered in terms of power, planners and policy makers looking forward to reach all over parts of the country

**Table 3: All India (Anticipated) Power Supply Position in 2016-17**

Region	Energy			Peak power		
	Requirement MU	Availability MU	Surplus (+) Deficit (-)	Demand MW	Supply MW	Surplus (+) Deficit (-)
Northern	379,087	351,009	-1.8%	55,800	54,900	-1.6%
Western	379,087	405,370	+6.9%	51,436	56,715	+10.3%
Southern	310,564	320,944	+3.3%	40,145	44,604	+11.1%
Eastern	151,336	135,713	-10.3%	21,387	22,440	+4.9%
North-eastern	16,197	14,858	-8.3%	2,801	2,695	-3.8%
All India	1,214,642	1,227,895	+1.1%	164,377	169,403	+2.6%

("Load Generation Balance Report 2016-17", 2 June 2016.)

In the rural and tribal regions where electricity not been reach, yet there are Some 800 million Indians use traditional fuels – fuel wood, agricultural waste and biomass cakes – for cooking and general heating needs. Burning of biomass and firewood will not stop, these reports claim, unless electricity or clean burning fuel and combustion technologies become reliably available and widely adopted in rural and urban India. The growth of electricity sector in India may help find a sustainable alternative to traditional fuel burning.

<sup>4</sup> Growth of Electricity Sector in India from 1947-2015" CEA, India. 13 June 2015.

Along with population pressure over energy increasing, to develop our economy and living quality various policies has been initiated recently by the policy makers.

### 3. GREEN ENERGY CORRIDOR AND ITS SIGNIFICANCE

The Green Corridor Report has been one such report which gives clear cut energy shares and the trend that has been going. As of 2012, the capacity is of 200 GW which has gone up tremendously also there has been 6 fold times increase in the green energy sector since the 9<sup>th</sup> five year plan which only opens up for new project and more energy consumption. Among all the renewable sources of energy, the wind and solar has been the most feasible one for India. This is evident from the fact that per sq km our country can generate about 20/30 MW. Also biogas sector is on the progressive level with the help of Agricultural and Industrial Waste. Also to support this, there was expansion of the Renewable Capacity Addition Programme in the 12<sup>th</sup> year Plan. The seasonal trend of the wind energy in the country is maximum in the month between May to September.

However these are the challenges faced by the energy operators

- High Ramp rate of load, particularly during the evening peak hours
- Sharp change in load, particularly at the hour boundaries mainly due to agricultural load changes with consequent frequent spikes.
- Frequency fluctuations in case of contingencies leading to generation or load loss; poor Frequency Response Characteristics (FRC) of individual sub-systems
- Impact of Wind Generation variability on Host state.

**Table 4 Wind / Solar Addition Plan for RE Rich States**

State	Existing capacity (MW)		Addition in 12 <sup>th</sup> Plan (MW)		Total capacity (MW)	
	wind	solar	wind	solar	wind	solar
Tamil Nadu	6370	7	6000	3000	12370	3007
Karnataka	1783	6	3223	160	5006	166
A.P.	392	92	5048	285	5440	377
Gujarat	2600	600	5083	1400	7683	2000
Maharashtra	2460	17	9016	905	11476	922
Rajasthan	2100	200	2000	3700	4100	3900
Total	15705	922	30370	9450	46075	10372

(Report on Green Energy Corridors, July 2012)

In country from last decade the rise in production of electricity has appreciable but country still not achieved overall satisfaction; full electrification has reached upto 20 states and 6 union territories. Below the table shows progress of electricity according to states.

**Table 5: State and their village electricity status**

States	% electrification rate	Unelectrified villages
Himachal Pradesh	99.81%	34
Uttar Pradesh	99.77%	224
Uttarakhand	99.52%	76
Rajasthan	99.26%	332
Madhya Pradesh	99.51%	258
Karnataka	99.86%	39
West Bengal	99.96%	14
Jammu & Kashmir	98.31%	107
Tripura	98.03%	17
Bihar	97.46%	993
Chattisgarh	99.55%	675
Odisha	95.33%	2210
Jharkhand	93.98%	1775
Assam	92.31%	1950
Manipur	91.55%	201
Mizoram	94.03%	42
Nagaland	94.14%	82
Meghalaya	82.9%	42
Andaman & Nicobar	86.11%	-
Arunachal Pradesh	73.3%	1404

("Progress report of village electrification as on 31-07-2016", 2016)

It can be seen that Arunachal Pradesh has lowest in this list, actually it has been decided in 12<sup>th</sup> FY plan to reach all over India but not reach yet.

It is evident from the data provided above that Arunachal, Andaman & Nicobar States have low electrification % so to full fill this programmes like RME (Remote Village Electrification) was initiated.

#### 4.1 Remote Village Electrification

This particular programme had the vision to provide electricity to the remote areas of the country where it was not feasible or cost effective to provide mainstream power supply. The interesting fact about this programme was to provide the power generated by the Renewable Sources which was a quantum leap in the sector. The energy generated was to be distributed through state nodal agencies and other power departments. While the power source was efficient and reliable the policies itself were falling short of expectations as there were many loopholes.

Here are the following loopholes that could be summarized

- Few State Departments failed to conduct proper investigation and surveys of the villages.
- Some villages were reoccurring in various programmes other electrification and power supply programme and thus were put on hold.
- The implementation was not efficient. Take the case of West Bengal, out of 24 villages only six villages had been covered due to delay in tendering.

- Maintenance & Operation were ignored after the completion of the project and thus the beneficiaries were left hopeless and resentful.

The programme may have been a success with lighting up of 7971 villages out of 10131 sanctioned villages. However the focus is on the growing potential of the Renewable Energy in the country. It is evident from this programme that the renewable energy sector is expanding and what we need to do to nurture it is to channel it with proper policies and guidelines.

However these are the challenges faced by the energy operators

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(Energy)

#### 4. RECOMMENDATION & CONCLUSION

The Programs & policies like Make in India & Digital India will only achieve success if the power sector backs it up extensively. The current power sector is dependent on non renewable energy source which will ultimately exhaust. To achieve sustainability and protect our environment The Green

Energy Corridor is the most practical initiative to fulfil the demands we need in the hour. Also the existing policies have been found out that it is not enough to cater the expansion and maintenance of renewable energy sources. Rural Electrified Village programme is one such case where the maintenance and implementation could not be done. So to avoid this kind of hindrance what we can do is to form a body of both government and private sector and work towards its development and the policy makers should provide enough incentives and penalties to the service providers.

Thus the Green Energy Corridor will only be successful by integration of State Government & Central Government & Private Participation or in other words PPP models. This would just level up the efficiency of the project and distribution of the power and then we will be able to see a better stronger nation India.

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