

## Role Of Government In Accelerating Indian Economy's Transition Towards A Resilient Energy System In India

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### Abstract

*There is a transformation going on in the Electricity Sector of India from an electricity deficit country to an electricity surplus country. Due to the concern over climate change, sustainable development and environmental pollution and other related factors, the government is also changing the energy mix from focusing only on traditional sources to investing more on the renewable energy sources such as solar power and wind energy. In order to meet the future energy needs, India cannot depend only on primary energy sources as the domestic availability of these sources are comparatively lesser than the energy requirements of the country and this will increase the import dependency which is in fact dangerous to the economy. Considering the above issues the emphasis is shifting towards renewable energy sources such as solar and wind energy. Indian government has already started taking substantial initiatives to accelerate Indian economies' transition towards a resilient energy system in India. That includes fiscal incentives for clean energy, price regulation and other forms of government support such as Clean Environment Cess on the use of Coal and a part of the Cess amount collected is reallocated to support initiatives for developing renewable energy. India, being a member of the G20, in 2009, is committed to "phase out the inefficient fossil fuel subsidies that encourage wasteful consumption, while providing targeted support for the poorest". Based on the commitment, India has already started the reforms on the subsidies on gasoline on 2010 and on diesel on 2014. Against this background, the paper discusses the role of Government, over a period of time, in accelerating Indian economy's transition towards a resilient energy system in India. It also discusses the drivers of demand for energy in India. The study also attempts to understand the transition programs of neighbor countries and these experiences may be considered in India's transition. The paper gives an overall picture of Indian Energy Sector's in the past, present and the future*

**Keywords:** Energy systems, renewable energy, role of government, resilient energy, energy transformation

### 1 Introduction:

There is a transformation going on in the Electricity Sector of India from an electricity deficit country to an electricity surplus country. Due to the capacity addition over the last few years across different sources of energy, including thermal, nuclear and renewable energy, the country is moving to a comfortable situation where the supply of energy is more than the requirement. Due to the concern over climate change, sustainable development and environmental pollution and other related factors, the government is also changing the energy mix from focusing only on traditional sources to investing more on the renewable energy sources such as solar power and wind energy.

## 2 Objectives And Methodology

Against this background, the paper discusses the role of Government, over a period of time, in accelerating Indian economy's transition towards a resilient energy system in India. The study also attempts to understand the transition programs of neighbor countries and these experiences may be considered in India's transition. This paper adopts descriptive research method and is based on the reviews of research papers, articles and reports.

## 3 Overview Of India's Energy Sector

At the time of independence (1947) India was producing a total of 1,362 MW power through all sources. Out of the 1,362 MW produced, 62% came from Thermal Power (852 MW) and the remaining 38% from Hydro power. It is pertinent to note that other than Hydro power, there were no other source of renewable energy available in India in the year 1947.

**Table - I:** India's Power Sector Growth from 1947 to 2019

S. No.	During FY ending	Installed Total Capacity (MW)	Thermal (MW)	Renewable (MW)		Nuclear (MW)	Per Capita Consumption (kWh)
				Hydro	Others		
1	31-12-1947	1362	854	508	-	-	16
2	31-12-1950	1713	1,153	560	-	-	18
3	31-03-1956	2886	1,825	1,061	-	-	31
4	31-03-1961	4653	2,736	1,917	-	-	46
5	31-03-1966	9027	4,903	4,124	-	-	74
6	31-03-1974	16664	9,058	6,966	-	640	126
7	31-03-1979	26680	15,207	10,833	-	640	172
8	31-03-1985	42585	27,030	14,460	-	1,095	229
9	31-03-1990	63636	43,764	18,307	-	1,565	329
10	31-03-1997	85795	61,010	21,658	902	2,225	465
11	31-03-2002	105046	74,429	26,269	1,628	2,720	559
12	31-03-2007	132329	86,015	34,654	7,760	3,900	672
13	31-03-2012	199877	131,603	38,990	24,503	4,780	884
14	31-03-2017	326833	218,330	44,478	57,260	6,780	1122
15	31-03-2018	344002	222,906	45,293	69,022	6,780	1149
16	31-03-2019	356100	226,279	45,399	77,641	6,780	1181

Source: Central Electricity Authority, India

Today, India is producing 3,56,100 MW (as on March, 2019) in which 64% came from Thermal Power and the remaining 36% (123,040 MW) from renewable energy sources. Perhaps, there is a drastic increase in the other renewable energy sources from zero MW (in the year 1947) to 77,641 MW (other than Hydro) [1]. How was this possible? The policy makers of India had a clear foresight about the environmental protection, carbon foot print and clean energy right after Independence and took necessary steps in this direction. Secondly, the availability of solar energy is perhaps the highest in India when compared to the other countries in the world. These factors triggered the necessary policy initiatives which were implemented in a professional way and this led to this achievement, despite having low level

of technology and lesser capital. In addition to the thermal and renewable energy sources, the government is also investing in Nuclear energy sources, which is unavoidable considering the fact that India is a developing country and the demand for electricity is growing by leaps and bounds. Today the total electricity generated from nuclear energy is 6,780 MW compared to 640 MW in the year 1974. On the other hand, the per capita consumptions have also increased significantly from 16 kWh to 1,181 kWh per annum during this period.

The above table clearly indicate that India had increased its energy production tremendously over the years and the investment in energy production is significantly distributed across different sources.

#### 4 India's Energy Sector Today

Define abbreviations Today, among the total production capacity of 3,60,456 MW, 25% (90,177 MW) of the power production capacity is in the hands of the Central Government, 28.5% (102,818 MW) in the hands of the State Governments and 46.5% (167,462 MW) in the hands of the private sector [2]. Perhaps the contribution of private sector is increasing due to the policy initiatives of the government. The Government of India enacted Electricity Act 2003 (replacing the older acts, and amended in 2003 and in 2007) with the objective (a) of providing healthy competition in the Electricity Sector (b) of protecting the consumers' interest and (c) to provide power to all the citizens of India. This Act includes inter alia, the National Electricity Policy, Electrification of Rural India, open access in distribution, license free generation and distribution of power, etc. The shortfall in energy production in India in the year 2017-18 is only 8 billion KWh (i.e., - 0.7%) [3]. After 2015-16, compared to power production, power distribution is the major problem in India. There are certain states which have excess power production; and there are certain states which face power shortages. This problem is being addressed to, by developing necessary infrastructure for power transmission from the power surplus states to power deficit states.

Even though the major power production comes from thermal sources, it is to be noted that, among the total production of 3,60,456 (MW) units, nearly 34.6% comes from Renewable Energy Sources (12.6% from Hydro power and another 22% from renewable energy sources such as biomass, waste power, solar and wind energy).

**Table - II:** Gross Electricity Production by Source as on 21-08-2019

Source	MW	% of Total
<b>Total Thermal</b>	2,27,644	63.2%
Coal	1,95,810	54.3%
Lignite	6,260	1.7%
Gas	24,937	6.9%
Diesel	638	0.2%
<b>Hydro (Renewable)</b>	45,399	12.6%
<b>Nuclear</b>	6,780	1.9%
Renewable Energy Sources *	80,633	22.0%
<b>Total</b>	<b>360,456</b>	

Source: Ministry of Power, Government of India

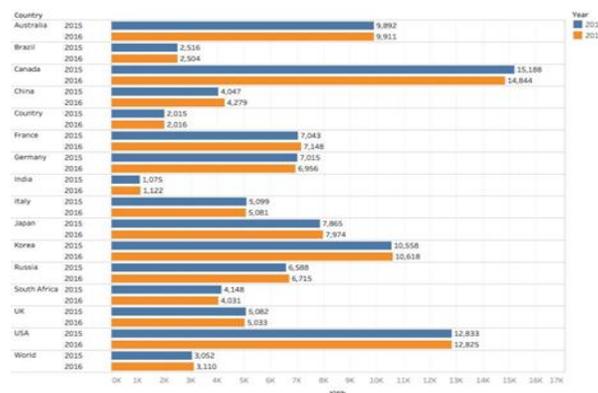
#### Demand Drivers

What are the drivers of demand in India? Increase in the population and economic growth are the drivers

of demand for electricity in India. According to the world population prospects report 2017, India is the second most populated country in the world having 1,320 million population [4] and it is projected that in 2024, India will be the most populated country in the world surpassing China. Hence, population is and will be one of the major driving forces of electricity demand in India, present as well in the future. Economic Growth in India was only around 1% in the first three decades after its independence [5] because of the socialistic approach of the Government. India slowly opened its economy in the mid 1980s and drastic policy reforms took place in the year 1991 with the introduction of LPG (Liberalization, Privatization and Globalization), these policy changes opened up the economy. Due to these changes, India could achieve 7.5% growth rate in the late 2000s and India is aiming at achieving 10% growth rate which will have a greater impact on the demand for power and fuel. The acceleration of structural reforms and the government's steps to improve the ease of doing business in India has enhanced foreign investment in India [6].

In addition to the above factors, the recent developmental ambitions of the Indian Government also will play a major role as driving demand for power and energy requirements. The Government of India has set various targets for the year 2022: The first target is to increase the installed capacity of renewable energy to 175 GW, followed by 24X7 power for all, housing for all, developing 100 smart cities, providing gas connections to all residents in India and reducing the oil and gas import by 10% (base year 2014-15) [7]. India's energy demand is likely to increase to 25% of the total global energy demand in the year 2040. India's per capita consumption of energy is less than 50% of the world's average (2016) [8] and it is likely to increase as the government electrifies all the Indian households and provide clean cooking fuel to all the residents of this country. One more motivating initiative is the MAKE IN INDIA initiative launched by the Government of India recently, which facilitates increased production of all items in India including military equipment, most of which are now being imported. This will provide a two pronged advantage: One, production will improve leading to increasing GDP and this help the economy to kick start, in the sense that this will lead to increased demand in most of the sectors like Iron & steel, cement, power, etc. This will further have a cascading effect on increased employment which will further lead to increase in demand for housing, essentials and other items and will ultimately lead to a prosperous state. Secondly, with the reduction in import of defense equipment (which is substantial now), there will be huge saving in foreign exchange and this will eventually lead to a situation where investments in India will be more attractive. As per the NITI Aayog report 2017 [7] urbanization in India would grow from 31% in the year 2012 to 51% in the year 2017, this will increase the percentage of urban population which perhaps will increase the consumption of energy in India as they move from using traditional cooking fuels to cleaner cooking fuels, and increased usage of electrical appliances.

Source: Central Electricity Authority, Ministry of Power, Government of India

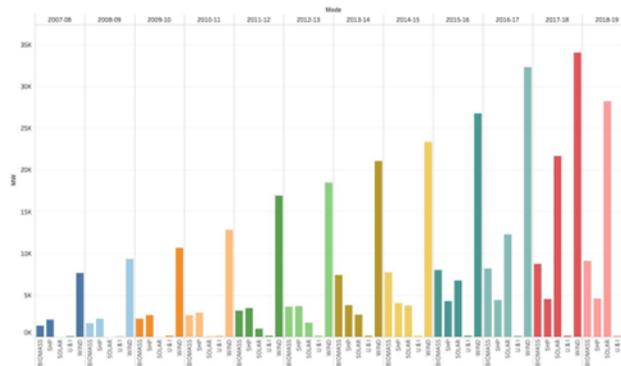


**Fig. 1.** Per Capita Electricity Consumption in Various Countries

## 5 Transition towards a resilient energy system

To meet the future energy needs, India cannot depend only on primary energy sources as the domestic availability of these sources are comparatively lesser than the energy requirements of the country and this will increase the import dependency which is in fact dangerous to the economy. Considering the above issues, India needs to focus on modifying its energy mix. In this context, the emphasis is shifting towards renewable energy sources such as solar and wind energy. This is imperative, not only from the economic perspective but also from the environmental perspective. It is good to invest more on the renewable energy sources because it will reduce the percentage of carbon emission and reduce the global warming effect.

Source: Central Electricity Authority, Ministry of Power, Government of India

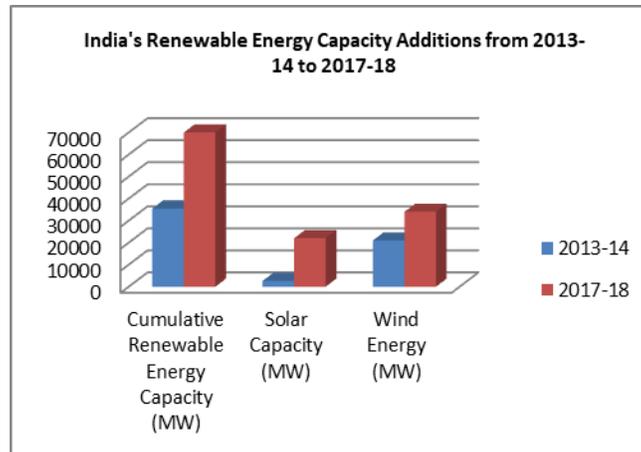


**Fig. 2.** Installed Capacity of R.E.S During Last 12 Years

Indian government has already started taking substantial initiatives to accelerate Indian economies' transition towards a resilient energy system in India. That includes fiscal incentives for clean energy, price regulation and other forms of government support such as Clean Environment Cess on the use of Coal and a part of the cess amount collected is reallocated to support initiatives for developing renewable energy [9]. India, in 2009, as a member of the G20, had made a commitment to “reduce the fuel subsidies that encourage wasteful consumption, while providing targeted support for the poorest” [10]. Based on the commitment, India has already started the reforms on the subsidies on gasoline on 2010 and on diesel on 2014.

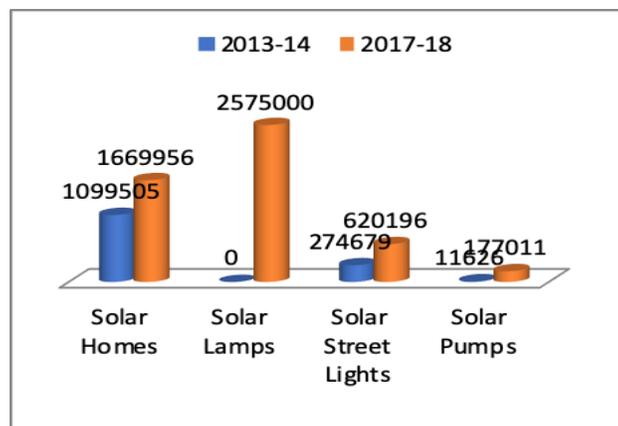
The above chart indicates that India's investment in renewable energy capacity is progressively increasing over the years. The Small Hydro Power (SHP) capacity has increased from 2,045.07MW to 4,593.15 MW; The Wind Energy Capacity has increased from 7,666.84 MW to 35,625.97 MW; Biomass Capacity has increased from 1,325.63 MW to 9,103.5 MW; Urban & Industrial Water Power has increased from 85.75 MW to 138.30 MW and perhaps, the Solar power production capacity has increased from 2.12 MW to 28,180.71 MW, which is a remarkable capacity addition compared to other sources.

Source: Ministry of New and Renewable Energy, Government of India



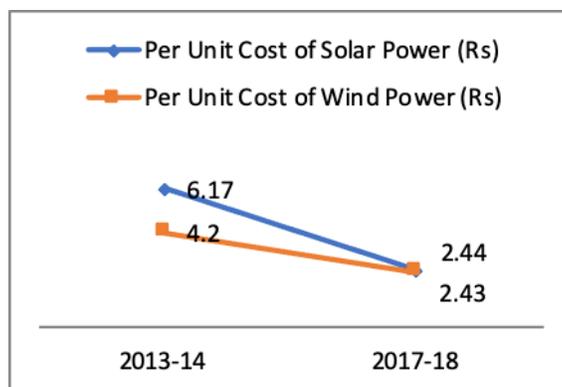
**Fig. 3.** India's Renewable Energy Capacity Additions from 2013-14 to 2017-18

India has doubled the renewable energy capacity from 35,500 MW in the year 2013-14 to 70,000 MW in the year 2017-18. India is occupying the fourth position globally in the total wind power installed, fifth globally in the total renewable energy power installed and sixth globally in the total solar power installed. Indian Government has sanctioned 41 solar parks in 21 states with aggregate capacity of 26,144 MW, around 17 lakh homes get solar energy in India, 25 lakh 75 thousand solar lights have been distributed to students and around 6 lakh 20 thousand street lights have been converted to be electrified under solar energy till 2017-18 in addition to one lakh seventy seven thousand solar pumps being used for irrigation [11]. Renewable Energy Sector created around 10 million man days employment created per annum at multiple levels in India.



**Fig. 4.** Solar Homes, Solar Lamps, Solar Street Lights and Solar Pumps in India

The per unit cost of solar and wind power has drastically come down in the recent times. In 2013-14 the per unit cost of solar power was Rs. 6.17 and in 2017-18 it has come down to Rs. 2.44. Similarly the per unit cost of wind energy also has radically come down from Rs. 4.20 in the year 2013-14 to Rs. 2.43 in the year 2017-18. It indicates that the solar and wind power is affordable at a minimum price for consumption.



**Fig. 5.** Per Unit Cost of Solar and Wind Power in India

## 6 Towards The Future

Today, with the largest production capacity of renewable energy, India is one of the top most countries in the world in Renewable Energy Sector and has most ambitious renewable capacity expansion programs in the world. As per the Paris Agreement on Climate Change 2016, India agreed to reduce its emissions intensity by up to 35 per cent and increase the low-carbon sources of power to at least 40 per cent of the total power generation by 2022 (equivalent to 175 GW). But, in the recent United Nations climate summit, India's Prime Minister Narendra Modi announced that India will be doubling its target for renewable energy from 175GW to 450GW by the year 2022 [12]. Perhaps, this is an excellent example of the commitment of the Indian Government towards developing a resilient energy system. In addition to the above, the government targeted installing 20 GW of solar power by 2022 but it was achieved four years ahead of schedule, in January 2018 itself. India then set a new target of achieving 100 GW of solar power and 75GW of wind power by 2022. Three of the top five largest solar parks worldwide are in India. The world's largest solar power plant with a capacity of 2,255 MW, Bhadla Solar Park has been constructed in Rajasthan. [13].

### India's Energy Policy

This vast improvement has been achieved because of the strident power policy of Govt. of India since independence, which focused on strategies for the encouragement and development of renewable energy sources by the use of incentives offered by the Central and State Governments. A long-term energy policy perspective is provided by the Energy Policy Review Report 2020, which spells out policy guidance for the growth of the energy sector. In order to move towards increased energy and clean energy, the government has taken suitable steps under appropriate strategies and the latest addition to the sources of power is the shale gas.

## 7 Conclusion

Because India is ideally placed for achieving a resilient energy system on account of Increased investment in infra-structure for present as well as the future growth in power generation, necessitated on account of increased urbanization, Skill development initiatives launched by the government leading to more entrepreneurship and development of industries, Make in India initiative of the Central government leading to increased manufacturing activity and upcoming of large number of industries, Local production of defense equipment leading to import substitution, saving useful foreign exchange and development of ancillary industries which will spur the requirement of power. Import of defense equipment is the largest expenditure in Indian budget. Further motives for the initiative are the availability of cheap and efficient and knowledge labour, Vast scope for solar power since located in the tropical zone, Ideal for the

generation of other renewable energy sources and excellent support for renewable energy sources through subsidies and grants being offered by the Government. Further, there is vast untapped potential for renewable energy sources and corporates are also assisting the transformation through CSR (Corporate Social Responsibility) initiatives.

In the light of the above discussions, it is clearly evident that transformation in India from non-renewable energy sources to clean energy is vital and essential. The New Energy Policy initiatives facilitates the transformation which will lead to cost reduction, protection of environment and increased generation to meet the ever-growing demand for power.

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