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**ANALYSIS OF INFRASTRUCTURAL GROWTH OF ENERGY SECTOR IN INDIAN ECONOMY**

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**ABSTRACT**

Good social and physical infrastructure facilities are crucial for rapid economic growth, rapid human development, and poverty reduction. Thus, this study compares the levels of development of the social and physical infrastructure in India with those in other major emerging countries as well as developed countries. The study finds that India substantially lags behind other emerging countries in the access to and quality of health facilities, education, and vocational or skill training—probably a key reason why India has been so slow in eliminating poverty. Similarly, India's physical infrastructure also lags behind other emerging countries, especially in the sphere of electricity access and consumption per capita, internet access, level of air travel, and quality of sea ports. Given the urgent need for rapid development of our social and physical infrastructure, the study then tries to identify key challenges to infrastructure development and discusses some possible ways in which some of these challenges can be addressed.

**Key words:** economic growth, infrastructure development

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**INTRODUCTION:**

With rapidly changing socio-economic structure of the society, energy needs have increased significantly and the supply side is coming under pressure. This has raised the concern to economize on every aspect of energy sector value chain so as to meet the increasing demand in most efficient way. To address this concern, strong policy level initiatives and implementation strategies needs to be drafted and designed. Gaps need to be identified and addressed at planning level with well thought out execution mechanisms. Post liberalization, India has emerged as an economic powerhouse and is poised to grow at about 8% per annum over the next decade. It is likely that at present growth rates, India will be one of the top three economies of the world by 2030 along with the USA and China. To sustain economic growth of such proportions, concomitant growth in the infrastructure especially in the electricity sector is of paramount importance along with policy, legislative and administrative initiatives in almost across all the energy sector functionaries. Electricity constitutes a critical input to all major economic activities. It is evident that with continued peak demand deficit of 12-13% and energy shortage of 6-8%, India would not be able to achieve high levels of economic growth. „Electricity for all“ is not only an economic imperative but also a social obligation. If India is to fulfill its dream of becoming an economic super-power, then the electricity sector has to play a central role in enabling this transformation. This is well recognized that to ensure growth in the electricity sector it is necessary to invite private sector participation. This will increase competition, breaking the monopoly and leading to development of true market dynamics. Therefore, Government of India (GOI) has been taking path-breaking initiatives on the policy, regulatory and the reforms front. Enactment of the Electricity Act, 2003 was an excellent first step towards creating an efficient and competitive electricity market. Several policy initiatives have been introduced, which have created an enabling framework for private sector participation. A critical element of the structural reform process, which is currently underway, is the movement towards independent market mechanisms. These market mechanisms are expected to introduce economic efficiencies into the system, create a level playing field for all players and introduce competition across all segments of the business. It is envisaged that the consumers at all levels in the value chain shall benefit from introduction of competition and provision of choice. The above mentioned reforms can only be achieved by having systematic

legislative and institutional approach for the development of India's energy sector. In the 21st century, energy supply and consumption, food crises and climate change are among the issues of major concern to the international arena. Remarkable growth has been registered in the energy sector after independence. It has made significant contributions to the national economy, social welfare and the basic energy needs of the Country. However, today energy sector world across is confronting a number of obstacles in energy reserves, population numbers, domestic and global environmental issues. It is also constrained by industrial and economic structures, financial resources, technologies, management systems, and consumers' culture of energy wastage. In 2018, the integrated energy policy was published by GOI. This policy outlines the long-term national energy strategy, touching almost every important issue like conservation, relying on domestic resources, encouraging diverse patterns of development, contribution of science and technology, protecting the environment and increasing international cooperation for mutual benefit. The aim is to build a stable, economical, clean and safe energy supply system, one that will support sustained economic and social development with sustained energy development. A major prerequisite of the national energy strategy is having in place the relevant legislation, policies, plans, standards, institutions, along with other relevant measures. This is because human behaviors and socioeconomic relations that facilitate energy production, sale, and consumption need to be adjusted and regulated using legal tools. Government energy institutions are charged with the task of implementing national energy strategies, laws, policies, plans and other management measures.

#### **EXISTING STATUS OF LEGISLATIVE FRAMEWORK:**

In India the categorical distribution of sectors within the energy sector is by and large similar to many other countries. The classification of sectors is primarily done on the basis of energy resources. Therefore, a general classification of India's energy legislation can also be done on the basis of energy resources: (a) coal industry laws, (b) oil & natural gas laws, (c) power sector laws, (d) atomic energy laws, (e) new & renewable energy laws, and (f) energy conservation laws. The constitution has mandated the powers to the ministries under special articles to discharge their functions and duties. The energy laws are formulated by different ministries working in the energy sector and ultimately passed by the parliament. There are rules and regulations apart from the laws which are formulated by the ministries in the central government. The legislation provides guiding framework whereas rules and regulation are the logical extension of laws that give the executives further clarity to exercise laws in a better way. Additionally, there are some special legislative provisions to deal with specific issues that might arise from time to time. There are some common policies pertaining to all energy sectors. These policies are broader in scope and cover a wide range of issues. Some such policies are - National Electricity Policy (2005), Rural Electrification Policy (2006), National Tariff Policy (2006), Integrated Energy Policy (IEP) (2006) and New Hydro Policy (2008), etc. Some sector specific policies are also formulated by the ministries and further substantiated by the prevailing laws and regulations. These are more detailed in nature and set the working procedure with more clarity. Some administrative regulations such as documents, statements and directives are issued by concerned central ministries as and when required and are to be followed by all the administrative functionaries and organizations. State and Local regulations are legal documents formulated by the state ministries, municipal bodies at local level and their Standing Committees. In Indian legal system, many laws and regulations have energy-related provisions; for example, environment and forest related laws. Energy standards are an integral part of the energy legal system as well. These could be classified as national, professional, local, compulsory and recommended standards. These are meant to bring in efficiencies at use level. In the Indian energy sector, there have been number of energy laws, policies governing specific sector, state and local level energy regulations, administrative regulations and energy standards. Several international treaties have also been ratified. The energy laws are meant for developing a robust and sustainable energy supply and service system so that energy access to all can be made available at reasonable cost. It should enable the use and administration of energy, measures for increase in energy efficiency, creating a social and environmental friendly energy network, and promoting the development of sustainable society. As availability of energy is a right to common

and rich alike, the poor section of society cannot be deprived of. Hence, economics of energy supply is required to be regulated in such a way that access to all is ensured without harming business interest of producers. Some important provisions of a few Acts are discussed in the following sections.

### **PROVISIONS FOR RENEWABLE ENERGY:**

In the time of energy shortages and depleted fuels, new and renewable sources of energy supply deserve more attention. Environmental concerns have made the renewable energy even more crucial in the present context. Recent policy level developments promise to have significant contribution from the renewable sources of energy but this is to be viewed in the context of socio-economic dimensions and implementation realities. The Electricity Act 2003 has outlined several enabling provisions to accelerate the development of renewable energy based generation such as promoting cogeneration and generation of electricity from renewable sources of energy. The Regulatory Commissions specify the obligations of various entities to procure a specific percentage of renewable energy out of the total consumption of electricity in the area of the distribution licensee. National Electricity Policy, 2005 and The IEP, 2006 also provide that progressively the share of electricity from non-conventional sources would need to be increased as prescribed by State Electricity Regulatory Commissions. The increasing international recognition for India's renewable capacity enhancement and interest shown by foreign investors for building energy infrastructure with a special thrust on green energy has been seen recently. Bilateral/multilateral cooperation frameworks to promote renewable energy development have also been established.

### **NUCLEAR ENERGY:**

The Department of Atomic Energy since its inception has been able to establish a network of institutions engaged in R&D as well as industrial activities and acquire expertise in all aspects of the nuclear fuel cycle. India has a flourishing and largely indigenous nuclear power program and expects to have 20,000 MW nuclear capacities on line by 2020 and 63,000 MW by 2032. It aims to supply 25% of electricity from nuclear power by 2050. The Indian Atomic Energy Commission (AEC) is the main policy body. The Nuclear Power Corporation of India Ltd (NPCIL) is responsible for design, construction, commissioning and operation of thermal nuclear power plants. However, the recent calamities seen in Fukushima (Japan) have hindered the progress and protest by environmental activist has become the cause of concern. The government is still continuing with its ambitious plan albeit with higher standards for safety and protection.

### **INFRASTRUCTURE, GROWTH: INDIAN CONTEXT**

However, the importance of infrastructure goes far beyond its impact on growth. It speeds up the nation's production and distribution of economic output as well as to its citizens' overall quality of life. It is often said that infrastructure can be considered, if not the engine, then the wheels of economic growth. This is one part of the infrastructure story. The other part is that infrastructure helps to spread the benefits of growth, which makes the development process more inclusive. Lack of such infrastructure facilities is considered to be a major structural weakness, which holds back to underutilization of existing productive capacity and constrain, that may have unfavorable impacts on profits and production levels adversely. Weak and inadequate infrastructure leaves the country backward and allows its people to stagnate in poverty and a lower standard of living. Investigate the relationship between physical infrastructure and per capita NSDP. What is the impact of infrastructure development on poverty? Patra and Acharya (2017) examine the spatial disparities in infrastructural facilities across 16 major states in India and in turn analyses its impact on regional economic growth. Empirical evidence suggests that there is a positive relationship between Infrastructure Development Index & Per Capita Net State Domestic Product and negative relationship between Infrastructure Development Index & Poverty. Hence, effort should be directed to create more infrastructure facilities at the state level to raise the state domestic product and reduce the level of poverty and unemployment of the people concerned.

## THE GROWTH IN CAPACITY, PRODUCTION AND CONSUMPTION OF HYDRO, THERMAL AND NUCLEAR ENERGY DURING THE PLANS:

During the first plans (2003-04), construction of a number of major river valley projects like Bhakra-Nangal, Damodar Valley, Hirakund and Chambal Valley was taken up. These projects resulted in the stepping up food production and energy generation. Emphasis in Second Plan was on development of basic and heavy industries and related need to step-up energy generation. During the Third Plan, emphasis was an extending energy supply to rural areas. The significant development in this phase was the emergence of inter-state grid system. The country was divided into five regions, regions electricity boards were established in each region to promote integrated operation of constituent energy system. In the mid-sixties the country experienced successive droughts which influenced the planners to re-orient the emphasis on rural electrification. Thus the three Annual Plans, that followed the Third Plan aimed at consolidating the programmes. Initiated during the Third Plan.

During Fourth Plan envisaged the need for central participation in expansion of electricity generation programmes in strategic locations to supplement the activities in the State sector and removal of imbalance and to enable equitable distribution. Progress in energy generation programmes during the end of the Fourth Plan was substantial.

Emphasis in Fifth Plan was on speeding up the construction and commissioning and the construction work on others was speeded up. A number of power stations were commissioned and construction work on others was speeded up. Consequent upon these efforts, the total installed generating capacity in the country reached to about 8 million KW at end of Fifth Plan. The installed capacity at the beginning of the current sixth plan period was 26 million K.W. During the Ninth plan, IREDA sanctioned capacity of 1261.71 MW and 2.84 lakh metric tonnes coal repayment (MTCR/annum). The financial achievements in terms of loan sanction and disbursement were of the order of Rs. 3851.63 crore and Rs. 2027.03 crore respectively. During the Eleventh plan, capacity addition target of 41,110 MW comprising 14,393 MW hydro, 25,417 MW thermal and 1,300 MW nuclear was fixed for the 11th Plan. The sector wise, type wise summary of this capacity addition target is given in Table below.

**Table 1**  
**11TH PLAN CAPACITY ADDITION TARGET-SECTOR WISE**

(Figures in MW)

Sector	Hydro	Thermal	Nuclear	Total (%)
CENTRAL	8,742	12,790	1,300	22,832 (55.5%)
STATE	4,481	6,676	0	11,157 (27.2%)
PRIVATE	1,170	5,951	0	7,121 (17.3%)
TOTAL	14,393	25,417	1,300	41,110 (100%)

A moderate target was set for state and private sectors keeping in view the preparedness of various state power utilities and IPPs.

## GROWTH IN GENERATION DURING 11TH PLAN

Electricity is in the concurrent list in the constitution. The National Electricity Policy (NEP), recognizes electricity as a "basic human need" and targets a rise in per capita availability from 631 units to 1,000 units per annum by the end of 2018. To fulfill the objectives of the NEP, a capacity addition of 78,577 MW has been proposed for the eleventh five-year plan. The power sector is expected to grow at 9.5 percent per annum

**Table 2**  
**Eleventh plan power capacity addition targets (MW & per cent)**

Sector	Hydro	Thermal	Nuclear	Total (MW)	Share (%)
Central	9,685	26,800	3,380	39,865	50.7
State	3,605	24,347	0	27,952	35.5

<b>Private</b>	3,263	7,497	0	10,760	13.8
<b>Total</b>	16,553	58,644	3,380	78,577	
<b>Share (%)</b>	<b>21.1</b>	<b>74.6</b>	<b>4.4</b>	<b>100</b>	

A number of projects envisaged for the Eleventh Five-Year Plan have made steady progress, with most of these in a position to be commissioned well within the Plan period. The status of placement of orders for the main plant (thermal projects) and main civil works (for hydro projects) is given in Table-3.

**Table-3**  
**Status of Eleventh five Year Plan Capacity additions (MW)**

<b>Status</b>	<b>Central</b>	<b>State</b>	<b>Private</b>	<b>Total</b>
Commissioned	2,230	4,783	250	7,263
Under Construction	27,945	14,337	8,578	50,860

As per the Integrated Energy Policy (IEP), issued by the Planning Commission, GDP growth rates of 8%-9% have been projected during the 11th Plan. Assuming a higher growth rate of 9% and assuming the higher elasticity projected by the IEP of around 1.0, electrical energy generation would be required to grow at 9% p.a. during the 11th plan period. Also generation has to be collectively met by utilities, captive plants and Non-conventional energy sources. No reliable plans about captive power capacity expansion are available but based on indications available from the manufacturers for addition in captive capacity and present utilization of available capacity, the generation from captive plants is expected to increase from 78 BU to 131 BU per annum. Since the load factor of non-conventional energy sources is very low (about 20% on an average), even though the capacity projected by MNRE from these sources is about 23,500 MW by the end of 11th Plan, the expected generation would be only around 41 BU. The generation from these renewables however has not been taken into account for planning purposes.

## CONCLUSION

Energy is one of the few sectors of the Indian economy, which recorded a spectacular growth during the last five decades. More important is the fact that plans after plan energy development was accorded relatively greater importance, which is reflected in the fact that investment on energy increased. Proposed outlay for the eleventh plan of Rs. 10460 crore (at constant price) includes GBS of Rs. 3537 crore. The main challenge before the energy sector for fuelling the proposed growth in the Eleventh Plan is to enhance energy supply in cost-effective ways. The persistent shortages of electricity both for peak power and energy indicate the magnitude of the problem. The very high load factor of 76.8% for the system indicates that the system is operating under strain or has limited reserve. At the same time, for want of natural gas, some gas-based power plants are kept idle. Nuclear plants are also operated at lower load factors for want of adequate uranium. Power shortages are an indication of insufficient generating capacity and inadequate transmission and distribution (T&D) networks.

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