

CHAPTER-8

**CONCLUSION
AND
POLICY IMPLICATIONS**

8.1. Conclusion

The present study entitled ‘Infrastructure Development in India: A Study of Power Sector’ put an exclusive attempt to explore various dimensions of the power sector in India. This study was mainly based on time series analysis using period of 14 years from 2001 to 2014. There were three objectives of the study which had successfully achieved by using appropriate statistical tools followed by logical analysis of statistical results. The objectives of this study were- 1) To examine the relationship between electricity consumption and economic growth in India, 2) To examine the technical efficiency of power sector in India, and 3) To examine the financial performance of power sector in India.

Therefore, firstly, this study revealed the causality between the electricity consumption and economic growth; secondly, it evaluated for the technical efficiency of power sector in India; and finally, it analysed the financial performance of power sector in India. Beside these, the study systematically presented the journey of power sector in India.

Growth of any developing economy like India economy depends heavily on level of infrastructure. Among various constituents of infrastructure, power or electricity is most important as it provides blood to the other constituents of infrastructure. India had also recognized the importance of power. Therefore, after independence the GOI, the state electricity boards (SEBs) had been established. Due to disparities in the availability of resources across India, the central power units and regional electricity boards were established.

In India, two major sources - thermal and hydro, are available for the electricity generation. Thermal power generation recorded significant contribution in power generation due to more capacity additions at the thermal power stations. After liberalization, thermal power units showed better efficiency than the hydro units.

The state wise analysis of installation of power generation shows that Maharashtra, Gujarat and Uttar Pradesh are among those states which have more installed capacity for electricity generation. It is so due to the heavy industrialization in these states happened after liberalization. These states are doing well in thermal power generation.

The installation of power generation units leads to generation of electricity and also to increase of consumption of electricity. Despite sustained endeavor on the installation of electricity generation units India, it is founds that there is deficit in the power supply. The demand of electricity is very high but the supply is not escalating to meet the demand. India is facing sheer power shortage which is increasing day by day. The share of electricity consumption in India shows that the industrial sector has the largest share of the electricity consumption followed by agriculture sector. Domestic consumption and commercial consumption are at third and fourth position respectively.

Power or electricity helps to establish and run production units of the economy Therefore, it accelerates the growth. This accelerated growth further leads to expansion of power sector in terms of power generation and consumption both. Here, in the study, the causality between the electricity consumption and economic growth is examined.

For the purpose of causal relationship between electricity consumption and economic growth, the time series analysis needs the stationarity requirement for the examination of causal relationship. This study investigated co-integration between electricity consumption and economic growth; and found the existence of co-integration between them (Shah, 1970). The results of granger causality test reveal that economic growth causes the electricity consumption while electricity consumption does not cause economic growth. It indicates that there is uni-directional relationship between the variables (Dadibhavi,1991; Masih & Masih, 1996; Paul and Bhatiyacharya, 2004).

In the present study, the data envelopment analysis (DEA) has been adopted for the examination of technical efficiency of power sector in India from 2000-2001 to 2013-2014. In this analysis, thermal power units and hydro power units were taken as decision making units (DMUs). Thermal power units were denoted as DMU1 whereas hydro power units were denoted as DMU2. In technical efficiency investigation, at first, Malmquist index of annual means is calculated jointly for both the DMUs. Secondly, Malmquist index of firm mean is calculated separately for thermal and hydro. It is found that the thermal power unit is more efficient than the hydro power unit. Finally, the productivity of the power sector is compared within the groups- thermal and hydro applying the same technique. This examination of technical efficiency of power sector in India disclosed that DMU1 (thermal) is efficient than DMU2 as DMU1 shows no change in its productivity over the time while DMU2 has shown some improvement. Since hydro units are not fully efficient, there is a great scope of innovation in hydro units.

Finally, the study proceeded for the analysis of the financial performance of the power sector. Various financial aspects of the power sector are analysed in detail. It primarily focused on costs structure and revenue realization in power sector. As most of the states are dependent on other states for power, power purchase cost is one of the major components of cost of electricity supply in India. As electricity is highly subsidised in India, revenue generated out of tariff is much lesser than the cost incurred. As tariff cost ratio is less than one for the entire period of the study, it indicates that power sector in India is far beyond breakeven point. Therefore, financial performance of power sector is really a matter of concern in India.

8.2. Policy Implications

The findings of the present study have interesting policy implications. India's Policy makers give an extra ordinary importance to infrastructure in order to bring India amongst the group

of developed nations. But the development and growth of infrastructure would be a nightmare unless power sector become technically efficient and financially viable in short and long run across India. On the basis of the present study, following measures are suggested that can be adopted and implemented-

- 1) As economic growth is causing electricity consumption in India after liberalization, it highlights that economic growth led by economic reforms has made India a high energy demanding economy. This is really alarming. Policy makers or the GOI must commensurate economic growth targets with adequate power supply, else the situation may reverse; and sweet fruits of economic reforms would disappear.
- 2) Since thermal power units in India are working almost at full efficiency, there is no possibility for further improvement. Therefore, it is the need of the hour that policy makers and the GOI must focus sincerely on establishment and innovation in hydro power units and other sources of electricity generation to meet the supply deficit.
- 3) Cost is an important factor to fulfill the demand of electricity. The cost structure varies across India. It is due to dissimilarity in the availability of natural resources required for the power generation. Some states are rich in coal while some are rich in water. Production of electricity from a particular source need to be paid heavy amount of money to full fill the electricity requirement. It is far better to produce electricity in the region that is based on their own resources. Electricity generation unit, based on their own availability of resources, should be established at regional level. It would reduce the transportation cost as well as cost of purchasing of raw materials for the electricity generation.
- 4) There is significant gap between cost of electricity supply and revenue generated from it. It leads to severe loss. In some categories as in agriculture, heavy subsidy on price is

granted by the government. This creates burden on the aggregate economy. To minimize or eliminate such burden, the GOI should offer subsidy on power generating equipments e.g. community solar power equipments instead giving subsidy on specific consumption. Similarly, the GOI can promote advancement and application of power saving technologies and equipment e.g. manually operated irrigation pumps.

- 5) Prime resource of thermal power is coal which is none renewable resources while renewable recourse like water, wind, solar, tidal and wave and is can be utilize for the purpose of power generation. There should be development of such infrastructure to promote the generation of power by these renewable resources. Making dams for such purpose will not only help for the power generation but also it would help for problem of flood and droughts also.

8.3. Limitations and Future Scope of the Study

Although the study has fulfilled its objectives with appropriate results successfully, there are certain areas that need to be address in the future research and are the limitations of this study. The limitations of the study includes following points-

- 1) The study has only analysed the causality between two variables- economic growth and electricity consumption; and evaluated the direction of the cause and effect relationship. The study does not provide any model to establish the quantitative relationship between the variables. The study can further be enlarged by developing model with incorporating other relevant variables to enable the findings of the study for the forecasting.
- 2) This study has taken only two input variables for the analysis of technical efficiency. Among these, one is thermal power and another is hydro power. The study could not take other possible inputs like wind and solar power units.

- 3) The present study is based on only SEBs owned thermal and hydro power units in India, but several privately owned units of electricity generation can also be included in the further study.
- 4) State wise technical efficiency and financial performance of power sector can also be analysed in further study which was not under the scope of the present study.
- 5) The present study has taken the time series data from 2000-01 to 2013-14 for the purpose of entire analysis. This time frame can be extended for revealing the better picture of the power sector in India.