CHAPTER 5

TREND AND COMPOSITION OF POWER SECTOR INVESTMENT IN KARNATAKA

5.1 Introduction

Power sector investment is central to economic growth of an economy, as it determines the rate of addition of physical capital stock, thereby impacting the economy's long term growth. In macroeconomics, investment is defined as the flow of spending that augments the physical stock of capital. Power sector is one of the core sectors of the economy which requires massive amount of investment to install sufficient capacity for generation, build transmission facilities, in order to efficiently distribute sufficient electricity to all consumers. Its importance is reiterated by the economic cost resulting from the absence of electricity.

Lack of good quality power supply results in loss of revenues for enterprises and harms the welfare of household consumers. To mitigate power outages, additional costs are incurred by the enterprises and revenues are lost. The revenue loss for small and medium enterprises ranged from Rs 1000 per day (Gujarat, Karnataka, and Maharashtra) to Rs 40000 per day (Andhra Pradesh, Tamil Nadu, Odisha) in 2012, as computed by Federation of Indian Chambers of Commerce and Industry (FICCI). The study also found that to avail reliable and uninterrupted power supply, 61 percent of the firms was willing to pay more.

Karnataka still faces acute power shortage as evident from the rampant power cuts all over the state. The cost of unserved energy in manufacturing industries for Karnataka ranged from Rs 3.7/kWh to Rs 24.7/kWh at 1999 prices (TERI, 2001). To minimize such losses and ensure sufficient electricity supply in the state, there should be, firstly, adequate, timely and appropriate investment in the sector, both from public and private sector. Presence of effective competitive markets could further encourage more efficient investment and long term system reliability (OECD, 1999).

Investment in power sector is made both at central and state level. The Central government allocated about 10% of the total plan outlay for power sector in the 12th Five Year plan (Planning Commission, 2013-14). In addition, loans and advances are also extended to this sector for capital formation. Since independence, public sector
had taken the responsibility of electricity supply, however, due to resource constraints by 1980s, the private sector was invited to participate in electricity generation. Private sector generation began in the late 1990s in Karnataka and continued to rise. The 1999 reform in Karnataka bifurcated the vertically integrated KEB into KPTCL and VVNL for more efficient functioning, along with formation of the regulator, KERC.

Besides the public and private sectors, the power utilities in Karnataka, namely, KPCL, KPTCL, and ESCOMs, also contribute to capital formation from their internal resource generation. In view of the rapidly growing electricity demand in the state, it is important to examine the trend and composition of power sector investment over time. Whether the investment is adequate to fully eliminate power shortage in the state and whether it is being allocated and spent efficiently are critical questions which remain to be answered. It would also bring to light the issue of subsidy burden on the government, as major amount of government funds are spent on power sector for free electricity supply to agriculture and BJ/KJ consumers. The present chapter examines the trend and composition of the investment in Karnataka power sector, in order to assess its adequacy, allocation, and efficiency.

The chapter is divided into five sections. Section 5.1 gives a brief introduction of the significance of investment in power sector, Section 5.2 presents the review of literature in this area, while the variables, data sources and methodology used in the study are provided in Section 5.3. Section 5.4 shows the empirical observations, and the conclusions are given in Section 5.5.

5.2 Literature Review

In macroeconomics, investment is defined as the spending flow that augments the physical stock of capital. Capital is a stock, while investment refers to the spending flows. The capital stock has been formed by past investment and is continuously being reduced by depreciation. Hence, some investment spending is also needed to keep the capital stock from declining.

Investment spending is generally categorised into business fixed investment, which is business spending on machinery, equipment, and structures, such as factories; residential investment, which is investment in housing; and inventory investment, which adds to inventory stocks (Dornbusch, Fischer, 2005). Most of the theories are
based on fixed investment. According to John Maynard Keynes and Irving Fisher, investment is made until the present value of expected future revenues equals the opportunity cost of capital, that is, until the net present value becomes zero. Keynes termed the return on investment as the marginal efficiency of capital, while Fisher called it the internal rate of return.

Another theory is the acceleration principle which basically states that the investment expenditures are primarily governed by changes in sales/outputs. This principle was first suggested by Clark (1917) (Eklund, 2013) and used by many writers like Samuelson, Tinbergen, Chenery, Manne, Koyck to explain changes in investment levels, and was greatly developed by Eisner (Paul and Rangarajan, 1974). The Neo-Classical theory of optimal accumulation by Jorgenson propounds maximisation of the present value of the firm. Maximising profits in each period will yield an optimal capital stock. Both the accelerator theory and the neoclassical theory of investment assume that the capital stock adjusts instantaneously to the desired level, and expectations play no role. Alternately, the Funds Approach states that the internal funds available to companies play a crucial role in determining their investment expenditure.

Investment models followed in expanding electricity generation capacities have both engineering and economic underpinnings. Generation plants have different investment and operation costs. For capacity expansion, the mix of plants that minimizes the total cost of meeting demand over a long period of time should be selected (Murphy and Smeers, 2005).

A study by International Energy Agency (1999) explored the electricity reform in OECD countries in context of investment and power generation cost. The study states that investment decisions in competitive electricity markets are determined by current and expected prices, mainly the price of electricity, the capital cost, and input prices. A relatively high electricity prices, and less business risk should increase total investment, while fluctuations in fuel prices would diversify investment in different types of fuel. The government has the crucial role to ensure an effective market with competition, to address market entry barriers, and to create an overall favourable investment climate by creating reliable regulatory structure.
In the past model of vertically integrated utilities, investment decisions were, in theory, made based on optimising the entire supply system, that is, minimising total system cost. An example which follows such approach is the former UK Central Electricity Generating Board (CEGB). However, such a model works under ideal circumstances, and the reality often differs. Forecasting errors in electricity demand resulting in over-investment could lead to higher electricity rates, for which the regulators or utility should be accountable for. The government can influence investment decisions through investment control, like the "prudency reviews" in United States, which mandates the utilities to submit elaborate investment plans to prove the prudence of the investment incurred.

Liberalisation was expected to lower the average electricity price due to more accurate costs, and increase the capital cost for capacity addition due to competition. It was recommended to attract more private sector investment, and to enhance investment prospects by creating a comprehensive framework of national law, with effective administrative implementation, ensuring enforceability of contracts and debt recovery mechanisms.

A large quantum of capital is necessary to finance the development of power sector in India, for which private sector contribution is crucial. To induce private investment, power sector should be market-driven with sound regulatory framework, where the utilities have robust financial condition, requiring tariffs to be set based on the cost of supply (Chaudhury, 1998).

Private sector contribution to installed capacity is indeed growing sharply in India and Karnataka, in contrast to the moderate growth of public sector share. It is also observed that India is becoming one of the most favoured destinations for investment, particularly in renewable energy, which has roped in over $42 billion in the past four years (Economic Times, 2018).

Karnataka faced energy and capital resource shortage (Balachandra, 2006). The options to meet the demand-supply gap include generating from existing installed capacity, importing from central utilities and other states, and using rationing methods, like power and energy cuts, and load shedding.
Overall, there is dearth of studies dealing with the power sector investment, and expenditures in the electricity industry of Karnataka. Hence, this chapter aims to study this aspect to fill the gap.

5.3 Variables, Data Sources and Methodology

5.3.1 Variables

Investment is defined, in this chapter, as the spending flow that adds to the physical stock of capital. Hence, the power sector investment is represented by the sum of the total capital expenditures, and the loans and advances given to the sector, as they are extended only for the purpose of addition of capital stock. The capital inflow comes from both public and private sector. However, the data is available only for the public sector expenditure. The aggregate private sector investment data\(^{25}\) is unavailable, and thus, could not be studied in detail.

The public sector investment in Karnataka power sector is made mainly by the state government and the utilities, namely, KPCL, KPTCL, and ESCOMs. The state governments allocate certain outlays for power sector which are utilised in different ways. In addition, the utilities make their own expenditures to augment the capital stock through their own internal revenue generation. The investment from the two sources are studied separately, because the utilities incur the capital expenditure from the common pool of the government funds and the internal resources.

In order to observe the trend of overall public investment in Karnataka power sector by the state government, it is defined in the study as follows:

\[
\text{Public investment by state government} = \text{Capital expenditures} + \text{Loans and advances to the power sector by the state government}
\]

The trend and composition of revenue expenditures by the government are also observed. Due to unavailability of data on private sector spending, the private sector investment is indicated by the total installed capacity by private sector.

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\(^{25}\) Considerable effort has been made by the author to find private sector data from different sources, nonetheless, it was not available.
5.3.2 Data sources

The data of public expenditures on Karnataka power sector is taken from the Finance Accounts, Government of Karnataka for various years. Data on power sector outlays and expenditures is taken from the Working of State Power Utilities & Electricity Departments, published by Planning Commission, Government of India. The data source for Gross State Domestic Product (GSDP) at factor cost at current and constant prices for Karnataka, used for calculating GDP deflator, is National Accounts, Central Statistics Office (CSO), Ministry of Statistics and Programme Implementation. Other data sources include Central Electricity Authority (CEA), Government of India, annual reports of Karnataka Power Corporation Limited (KPCL), Karnataka Power Transmission Corporation Ltd (KPTCL), and Electricity Supply Companies (ESCOMs).

5.3.3 Methodology

The methodology used in the study includes descriptive and time series analysis. The trend and composition of important variables are observed. The capital expenditures of KPCL and KPTCL are deflated using WPI-machinery and machine tools, as majority of the capex pertains to buying machinery and tools. The Gross Profit Margin of the utilities are calculated using the following formula:

\[
\text{Gross Profit Margin} = \frac{\text{(Profit before tax)} \times 100}{\text{Total Revenue}}
\]

5.4 Empirical Observations

5.4.1 Outlays and Expenditures on power sector

After independence, the Indian government took charge of the electricity industry and allocated outlays for the sector development. Investment from private players came in after the 1991 policy, nonetheless, the plan outlays for power sector are still made in the Five Year Plans (FYP). The actual expenditures often vary from the outlays. The power sector outlays and expenditures in Karnataka (Table 5.1) provide the overview of the investment made in the sector from the government.
Table 5.1: Outlays and expenditures on Karnataka power sector

<table>
<thead>
<tr>
<th>Five year plans</th>
<th>Rs crore</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Outlay</td>
<td>Expenditure</td>
</tr>
<tr>
<td>7th Plan [1985-90]</td>
<td>800</td>
<td>873.6</td>
</tr>
<tr>
<td>9th plan [1997-02]</td>
<td>3650</td>
<td>4375</td>
</tr>
<tr>
<td>10th plan [2002-07]</td>
<td>2207</td>
<td>7247</td>
</tr>
<tr>
<td>11th plan [2007-12]</td>
<td>15866</td>
<td>15360</td>
</tr>
<tr>
<td>12th plan [2012-17]</td>
<td>20365</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: Working of State Power Utilities & Electricity Departments, by Planning Commission, Government of India

It is observed that the outlays sharply increased in the Eight FYP and continued to rise till the Ninth FYP. The outlays declined in the Tenth FYP, however, the actual expenditures were exceedingly higher. It is probably because the actual cumulative capacity by the end of plan period (7026.6 MW) was considerably higher than the target amount (5949 MW), which was about 118% achievement. The outlay during the Eleventh Plan increased more than five times, perhaps because of higher target of capacity addition (1925 MW) during the plan period and larger proportion of thermal plants to be built, compared to earlier plan period (Government of Karnataka, 2007).

Further, the share of power sector outlay and expenditure in total outlays and expenditures on all sectors in Karnataka, as compared to some major Indian states are shown in Table 5.2.
The table shows that the power sector outlay share in Karnataka declined sharply from 15.6% in Ninth plan to 5.1% in the Tenth plan, after which it increased in the next plan period. However, the share of power sector expenditure in the state continuously declined from about 22.1% in the Seventh plan to 11.4% in Eleventh plan. It reflects the greater emphasis given on private investment, with public sector taking a backseat. The outlay share in Karnataka in the Twelfth plan is, however, higher than the other states, except for Tamil Nadu and Uttar Pradesh.

In general, the plan outlays from the state governments have substantially declined over time, basically because the utilities are expected to operate on commercial principles and generate revenues. Thus, the State government contribution is towards
the equity contribution in most of the cases, and the commercial borrowings made by the utilities are not included in the plan outlays shown in the table.

5.4.2. Investment in Karnataka power sector

The three main types of expenditures made by the state government towards power sector are revenue expenditures, capital expenditures and loans and advances. Figure 5.1 depicts the trend of total revenue expenditure, total capital expenditure, and total loans and advances (Values in Appendix 5.1).

Figure 5.1: Trend of state government expenditures on power sector (Rs lakhs)

![Graph showing trend of state government expenditures on power sector](image)

Source: Finance Accounts, Government of Karnataka, various years

It is observed that dominant proportion of the expenditures is made as revenue expenditures on power sector (Values given in Appendix 5.1). Capital expenditures have been negligible during mid-1990s to late 2000s, after which there have been substantial increase in the recent period. Nonetheless, in 2014-15, the revenue expenditure was about 27 times the capex, and 117 times the loans and advances. Large fluctuations are observed in the trend of loans and advances, with meagre share in the recent years.

The fluctuations could be because large capital expenditures are required for construction of power plants at intervals, which takes a long period of time to complete. Similarly, loans and advances are also provided to the sector for the purpose of capital addition. In addition, the private sector has been encouraged and
expected to contribute to power sector investment since the 1991 policy. Thus, there is departure of public sector from making capital expenditures.

On the other hand, the revenue expenditures exceed the other two components substantially and have continued to rise since mid-1980s, albeit with fluctuations. It is also reflected in terms of the percentage shares of each type of expenditure in total expenditure (Figure 5.2). The loans and advances share, which was very high in the 1980s, declined drastically in the 1990s, during which the government started making capital expenditures. The share of revenue expenditures show a prominent rise since the late 1980s, which is probably attributable to the beginning of the ‘free’ power policy to IP sets as a political tool to gain vote banks.

**Figure 5.2: Composition of government expenditure on Karnataka power sector (%)**

On investigating the composition of the revenue expenditure, which forms the highest share of the total expenditure, it is found that 90-100 % of it is made towards 'Assistance to Electricity Boards' (Figure 5.3).
The 'Assistance to Electricity Boards', in turn, is dominantly constituted of 'Subsidy for supply to IP sets and BJ/KJ consumers'.

In 2014-15, the revenue expenditures constitutes about 95.6% of the total expenditures by state government in power sector, while capital expenditure and 'Loans and Advances' form about 3.5% and 0.8%. In this, 99.7% of the revenue expenditures is on account of 'Assistance to Electricity Boards' (Rs. 6703 crore in nominal terms), out of which 92.5% (Rs. 6200 crore) went towards 'Subsidy for IP sets' (Finance Accounts, 2014-15). This clearly highlights that major portion of the revenue expenditures, and thus, also the total government expenditures on power sector are incurred to provide subsidy for supplying power to IP sets and BJ/KJ consumers.

Such expenditures do not contribute in capital formation in the sector. Thus, lesser proportion of the expenditures from the state government is spent on the actual capital formation process in Karnataka power sector. Majority of the public expenditures in the sector are incurred by the public utilities, namely, KPCL, KPTCL and ESCOMs from their own internal resources, as they are supposed to be commercial entities.

It is expected for the government to be spending lesser on the capital formation in power sector, as the reforms envisaged for greater participation from the private
sector, as well as for internal resource generation from the utilities. It is also reiterated by the minimal share of power sector in the total capital expenditure and total 'Loans and Advances' in all the sectors of Karnataka since the mid-1990s (Figure 5.4)

The 'Loans and Advances' in power sector plummeted from about 68% in 1989-90 to 0.6% of that in all sectors in 1990-91. This is perhaps due to conversion of Rs 200 crores loans outstanding to end of March 1990 to equity in KEB (Finance Accounts, 1992-93).

Figure 5.4: Power sector share in total capital expenditure and total Loans and advances in all sectors in Karnataka (%)

Source: Finance Accounts, Government of Karnataka, various years

As per the Finance Accounts documents, the major components of the 'Loans and Advances' in power sector include:

- Hydel generation: loans given to KPCL for various purposes
- Rural Electrification: loans given to KEB
- Transmission and Distribution: loans to KEB/KPTCL
- Other Loans.

The capital expenditure in power sector by the state government is mainly incurred on:

- Hydel Generation
- Investment in Public sector and other undertakings
• Thermal Power generation, and
• General expenditure.

The capital expenditures rose from 1989-90, due to increase in 'Investment in Public sector and other undertakings'.

After studying the individual expenditures, we observe the trend of 'Public Investment'\textsuperscript{26} by the state government on power sector, defined as:

\textit{'Public Investment' by the state government} = \textit{'Capital Expenditure'} + \textit{'Loans and Advances' in power sector by the State government}

Figure 5.5 shows that the public investment by the government decreased from 1990-91 and remained meagre till 2007-08 except in 2003-04. This is reflective of the fact that state government took a back seat after encouraging the private players to contribute more.

\textbf{Figure 5.5: Public Investment and Revenue expenditure in power sector by state government (Rs in lakhs)}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure5.5.png}
\caption{Figure 5.5: Public Investment and Revenue expenditure in power sector by state government (Rs in lakhs)}
\end{figure}

\textit{Source: Finance Accounts, Government of Karnataka, various years}

In 1999, the Karnataka Electricity Board was unbundled and corporatized to form Karnataka Power Transmission Ltd (KPTCL) for transmission and ESCOMs for distribution. For electricity generation, KPCL has been functioning as a corporation

\textsuperscript{26} This term used hereafter in the chapter entails this definition throughout.
since 1970, which incurs its own capital expenditures through the internal revenue generation.

The public investment has remained meagre during late 1990s till late 2000s, except for few years. However, it is observed that the installed capacity by public sector in Karnataka steadily grew, even though the public investment by the state government was meagre in many years (Figure 5.6).

**Figure 5.6: Public sector Installed Capacity in Karnataka (MW)**

![Graph showing public sector installed capacity in Karnataka](image)

*Source: Central Electricity Authority, Government of India, various years*

This is because KPCL makes its own capital expenditure from the resources internally generated in the corporation. It generates revenue from sale of energy. For 2014-15, the revenue from sale of energy is estimated at Rs 7472.56 crores, out of which Rs 703.16 crores (9.41%) is from hydel stations, Rs 4.33 crores (0.06%) from the Kappadagudda Wind Farm, Rs 14.04 crores (0.19%) from Solar PV Generating plant and the balance revenue of Rs 6751.03 crores (90.34%) from the Raichur Thermal Power Station, RTPS and Bellary Thermal Power Station, BTPS. To develop the transmission and distribution infrastructure in the state, KPTCL and ESCOMs also incur expenses from their revenues.

In the case of private sector investment, the total private sector installed capacity is used as an indicator, due to lack of data on expenditures. The private installed capacity shows significant increase since the late 1990s (Figure 5.7). The capacity addition by private sector is through thermal and renewable sources. About 28.3% of
the total private investment is contributed by thermal source, while 71.7% by RES in 2016 (CEA, 2017). Thus, the private players are increasingly drawn to renewable sources for capacity addition, perhaps because of their attributes of long term sustainability, naturally available inputs which can be tapped with ease, and incentives.

**Figure 5.7: Private sector Installed Capacity in Karnataka (MW)**

![Private sector Installed Capacity in Karnataka (MW)](image)

*Source: Central Electricity Authority, Government of India, various years*

The state encouraged private sector to make large amounts of investment for new capacity addition through many reforms and incentive packages. The government provided many incentives to private players to attract them to this sector, nonetheless, which added huge cost burden to the state government, although increasing private investment is a welcome move.

### 5.4.3 Expenditures and Profits of the Utilities in Karnataka

The utilities in Karnataka involved in electricity generation, transmission, and distribution are Karnataka Power Corporation Limited (KPCL), Karnataka Power Transmission Corporation Limited (KPTCL), and the 5 Electricity Supply Companies (ESCOMs) respectively. The expenditures made by the utilities are from the pool of the investment from the state as well as the internal resource generated. The capital expenditures of KPCL and KPTCL are shown in Figure 5.8.
Figure 5.8: Capital expenditures of KPCL and KPTCL (Rs. crore)

Source: Annual Reports of KPCL and KPTCL

The capex of KPCL are higher than that of KPTCL, which is justifiable because of the huge amount of investment required for developing power plants, as compared to transmission lines and transformers. The KPCL capital expenditures rose till 2013-14 and fell in 2014-15, while for KPTCL, it fell continuously till 2014-15.

Figure 5.9: Gross profit margin (%) of KPCL and KPTCL

Source: Annual Reports of KPCL and KPTCL
On the other hand, the gross profit margin of KPCL fell till 2014-15 after which it slightly rose, while that of KPTCL rose from 2013-14. The gross profit margin (GPM) of KPCL had a sudden decline in 2011-12, because the operating expenditure and financial charges, depreciation & prior adjustments increased tremendously by about 38% and 56% respectively, as against the rise in total income by 24% in that year. It has remained steady thereafter around 3% till 2015-16. On the other hand, the GPM of KPTCL has risen substantially in 2015-16 from about 4% to 8%, probably because of the increase in total revenue by about 20% and a fall in total expenditure by 2.8% in that year.

The gross profit margins differed greatly across the 5 ESCOMs in Karnataka from 2010-11 to 2014-15. MESCOM had positive gross profit margin in all the 5 years, BESCOM also exhibited positive profit, except in 2012-13, CESCOM had mostly negative profit margins, HESCOM and GESCOM showed mixed results.

**Figure 5.10: Gross profit margins of 5 ESCOMs in Karnataka (%)**

![Gross profit margins of 5 ESCOMs in Karnataka (%)](source)

*Source: Annual Reports of ESCOMs*

### 5.5 Conclusions

The power sector outlays and expenditures share in the total outlays and expenditures for all sectors in Karnataka have come down significantly over time, from Seventh plan to Twelfth plan, which is consistent with other major Indian states which also witnessed falling power sector share. This reflects the greater emphasis on private
sector investment for electricity industry development, with public sector taking back seat. In addition, the utilities are expected to function as commercial entities, which generate resources and incur expenditures.

The expenditures made by the Karnataka government on power sector are mainly towards revenue expenditures. The expenditures on capital formation have come down tremendously since mid-1990s, compared to the revenue expenditures. A major proportion of the revenue expenditures goes to 'Assistance to Electricity Boards', which, in turn, primarily constitutes of subsidy for IP sets and BJ/KJ consumers. Thus, much of the public spending is on behalf of the subsidy payment for agricultural electricity supply. Maximum electricity consumption is by the IPS category, nonetheless, the agricultural consumption is not found to have any causal relation with agricultural GSDP, as shown in Chapter 3. Thus, it is time to reconsider the principle and justification for spending tremendous amount of subsidies on this consumption, where there is lack of corresponding outcome.

The 'Loans and Advances' extended by the state government, mainly for schemes and capital formation, also remained meagre, compared to revenue expenditure. Although the growth of overall public investment faced fluctuations over the years, the total installed capacity grew at a steady rate. This is reflective of the fact that the corporations incur their own capital expenditure from the internal revenue, plus other sources.

On the other hand, the private sector installed capacity, which mirrors the private investment, is growing at a fast pace since late 1990s. Private investment, primarily made on RES and thermal plants, augments the electricity supply by public sector, although at the cost of the incentives. The huge government spending in power sector of Karnataka goes to the 'unproductive' activity of meeting subsidy burden for agricultural consumption. Although it is towards political and social motives, it does not contribute to capital formation in the sector, which is economically and financially unviable for the sector. The gross profit margin of KPCL is positive and rising, and while that of KPTCL is positive and fluctuating from 2013-14 to 2015-16. The profit margin for ESCOMs, however, varies widely across the utilities during 2010-11 to 2015-16.