CHAPTER – 5

TECHNICAL EFFICIENCY
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5.1. INTRODUCTION:

In this chapter an attempt is made to understand the technical efficiency of power sector in Andhra Pradesh, during the pre-reform period and after the reforms. Technical efficiency is concerned with the performance of power sector with respect to use of real resources in generation, transmission and distribution of power. Improvement of efficiency has been an important motivation for reforms in the power sector. Its one component, namely technical efficiency is addressed in this chapter.

HYPOTHESES:

The following hypotheses were formulated for examination:

$H_5$ = Changes in the organizational structure have helped in improving technical efficiency.

$H_6$ = The rural electrification has improved in the post reform period.

During the pre-reforms period, the power sector was highly centralized. Transmission, generation and distribution were managed by single authority, i.e. Andhra Pradesh State Electricity Board. There was heavy increase in the cost of production and distribution without a commensurate increase in the revenue. Power pilferage, malpractices and power theft were also prevalent. Hence, it was not able to achieve the desired efficiency. There was also considerable government subsidization of the sector.

In order to change this scenario, the government divided APSEB into three independent organizations based on transmission, generation and distribution. This was
aimed to reduce the cost of production, reduce the power theft and pilferage, and eliminate other malpractices and also to increase the revenue.

As a part of reforms strategy, private entrepreneurs were invited to invest in the power sector. Assistance of international organization like the World Bank was sought to facilitate the restructuring. Consequently, the management of power sector has become more decentralized which is expected to help achieve higher technical efficiency through efficient transmission, generation and distribution.

The indicators considered for technical performance are:

- Auxiliary consumption
- Availability factor
- Thermal and hydel efficiency
- Special oil and coal consumption
- Plant load factor
- Transmission and distribution losses

5.2. PATTERN OF INSTALLED CAPACITY FOR POWER GENERATIONS IN ANDHRA PRADESH:

Table 5.1 shows the installed capacity under private and public sectors in Andhra Pradesh. Of the total installed capacity, Andhra Pradesh State Electricity Board contributed about 84 % share in 1990-91 the rest coming from the central sector. But the share significantly declined to about 60 % in 2005-06. The installed capacity of hydel, thermal and gas also declined during the study period. Hydel share in the total installed capacity declined from 50.21 % in 1990-91 to 32.16 % in 2005-06. Even though the share of hydel power declined in total installed capacity during the study period, the capacity under the sub sector recorded positive growth of 6.02 % in post reform period. Similarly during the reform period, the installed capacity under the state thermal sector also had a marginal growth (0.15%) through its share declined from 32.90 % to 26.57 %. Gas and
wind power has recorded meagre share in the total installed capacity, which has not increased since 1997-98.

As can be seen from the table 5.1, the private sector also participated in the power generation processes since 1995-96. Among the private power generating sources gas is the most important. The share of gas based installed capacity significantly increased from 3.44 % in 1996-97 to 8.94 % in 2005-06. While the pre-reform period witnessed a growth of 34 % in the gas based installed capacity of power (all in the private sector), the growth has decelerated to11.88 % during the post-reform period. Moreover the share of private sector in total installed capacity has increased from about 4 % in 1996-97 to about 14 % in 2005-06. It indicates the increased role of private sector in the power generation process.

The central sector contributes substantial share to the installed capacity in the state. The share of central sector in total installed capacity had increased from 15.55 % in 1990-91 to 23.47 % in 2005-06. During the post reform period remarkably the installed capacity of central sector registered 21.01 % annual growth up from 1.6 % annual growth in pre reform period. The overall data from the table reveals that the installed capacity of that state level has increased significantly during the reform period and registered 7.46 % annual growth compared to 5.9 % in pre reform period.

Table 5.2 shows the pattern of power generation in Andhra Pradesh through different ways since 1991 to 2006. It could be seen from the table that among all the generating systems, Hydel and Thermal are more important. The share of hydel in total generated power has been declining (with some fluctuations) from 48 % in 1991-92 to 14.97 % in 2005-06. It is attributed due to the low rain fall and less availability of water in power generating plants. Thermal power occupied major share in the total plants generated power. During the study period, share of thermal power in total power generated in state sector increased from 38.90 % in 1991-92 to 51.43 % in 1998-99, and afterwards it has declined to 35.06 % in 2005-06. The power generated through gas and wind occupied very small percentages in the total generated power. The power generated
through private sector has significantly increased from 1.52 % in 1996-97 to 14.70 % in 2005-06. The state is also getting power from central sector and its share in total generated power has increased from 13.10 % to 30.38% during 1991-92 to 2005-06. It is interesting to note that after the reform (reform period 1999) in Andhra Pradesh the power generated through different segments of state sector has declined significantly. However the power generated through hydel registered negative growth rates both during pre and post- reform periods, whereas power generated through thermal sources registered 13.46 % annual growth in pre-reform period and then sharply declined to a negative (-2.03 %) growth annually in the post-reform period. A comparison is also made for the power generated through gas, which observed positive growth rates in pre and post-reform periods. But the growth rate in post-reform period is sluggish compared to the pre-reform period. The power got from the central sector registered 11.37 % annual growth in post-reform period compared to 9.25 % growth in the earlier period. Where all sectors are taken together, the power generation has declined during the post-reform period (2.78%) compared to the pre-reform period (7.94%). It seems that the reforms in power sector at state level could not bring up the capacity of power generation at state level. The power generation declined in post-reform period in Andhra Pradesh. It is largely because of the abandoning of Nellore Thermal Station which was one of the important power generation stations. It is also suggested that the failing of power generation plant frequently in the post-reform periods also caused sluggish power generation.

5.3. CONTRIBUTION OF PRIVATE SECTOR :

Table 5.3 gives data on the power generated by private sector, if shows that the private sector contributes significant percentage of power to the total generated power at Andhra Pradesh State Level. The private sector generates power through gas, hydel, wind and other methods. The data presented in table 5.3 shows that among different sources of power generation by private sector gas occupied major share in the total generated power. It is interesting to note that the power generated by private sector has increased from 2.93 MU in 1994-95 to 1681.85 MU in 2004-05. The volume of power...
generated by gas remarkably increased from 232.70 MU to 998.88 MU. The other sources also contribute significantly. Among the other sources hydel, wind, biogases, biomass and mini power plants also contribute notable percentage to the total power generated by private sector. It can be clearly seen from the table that the private sector had a significant prominent share in the total power generated and its to share had to increased significantly during the study period.

The power generation at Andhra Pradesh State has declined in the post-reform period, which is mainly due to the increase of inputs prices, like coal and oil. It is observed from tables 5.4 and 5.5 that due to the strict regulation of coal prices by the Electricity Regulation Commission has resulted in declining trend of coal prices in 2006 compared to previous year i.e., 2005, The rayalaseema thermal power project (RTPP) is paying highest cost (Rs.832.84 /mt) among the major thermal power stations, followed by RTS (B), VTPS and KTPS,. Even the declining tendency of coal prices per metric tonne could not surpass the increasing tendency of the oil prices. A significant increase is observed in the prices of oil. The details of oil prices during 2005 and 2006 can be seen in the table 5.5. In the table total oil used is classified into three sub groups such as furnace oil, high speed diesel and low speed diesel. It is interesting to note that the LSD oil prices doubled in 2006 compared to 2005. More or less same increasing tendency has been observed in case of remaining oil types. The increase of oil prices is the main reason for the declining tendency of power generation.

Table 5.6 explains the gross and net generation of power and auxiliary consumption at state level since 1990-91 to 2005-06. It is seen from the table that the gross power generation increased from 21103 MU in 1990-91 to 40574 MU in 1998-99. But after wards it steeply declined and reached to 28573.92 in 2005-06. Moreover during the pre- reform period the power generation remarkably increased and recorded 8.2 % annual growth, where as in post-reform period it steeply declined and recorded -0.88 % annual growth. It is not so much a case of declining trend in gross generation as of a one time sharp fall in gross generation from 40574 MU in 1998-99 to 29632 Mu in 1999-2000. Due to increase of auxiliary consumption, the net power generation also declined
during the study period. Moreover during the post-reform period even auxiliary consumption declined after 1999-2000, though only marginally. Thus net generation declined more sharply than gross generation. It is interesting to note that in the pre-reform period the state used to export power to other neighbour states like Karnataka, Orissa, Madhya Pradesh and Pondicherry. Among these states major percentage of power was exported to Pondicherry and Orissa. The exported power during the pre-reform period registered 7.95 % of growth. The state had some "excess" amount of power after the domestic consumption. But after the reforms only in the initial period it has exported very meagre percentage of power from the state sector. This may be attributed to low generation of power and increasing tendency of power demand during the post-reform period (Table 5.9).

Table 5.7 shows the plant load factor since 1992-93 to 2004-05. The generation of the power increased from 9114.18 MU to 19833.62 MU during 1992-93 to 1998-99. In this period plant load factor has generally increased and quite significantly from 65% in 1992-93 TO 82 % is 1997-98 before declining to 78 % in 1998-1999. After reforms the power generation increased 21499.10 to 23359.71 during 1999-2000 to 2004-05 respectively. In its generating capacity the plant load factor, increased further from 83.18 % to 89.79 % during the same period. It can be seen that the pre-reform period itself saw significant improvement in PLF and it is creditable that it increased further from that high base in the post-reform period.

Table 5.8 explains that the installed capacity and relative demand of power since 1991 to 2006. It is observed from the table that the installed capacity has recorded 8.25 % of growth during pre-reform period but during the post-reform period its slows down and records 7.47 % annual growth. On the other hand, the peak demand for power registered 7.62% of growth in the pre-reform period and only 2.94 % of growth in the post-reform period. Even though the installed capacity and demand of power has registered positive growth rates during post-reform period but it was comparatively lower than the pre-reform period. Due to the progress electrification in remote areas by state government resulted in relatively lower demand for power in relation to installed capacity.
during post-reform period. It may be noted that electrification of remote (rural) areas may not generate commensurate demand and peak demands in such areas and urban areas may be staggered thus lowering rate of growth of overall peak demand. This table suggests that the electrification performance is impressive in the post-reform period.

5.4. RURAL ELECTRIFICATION:

Progress of rural electrification under Five Year Plans can be seen from the Table 5.10. The study period here is from 1990-1999 and 1999-2006. Hence, to examine the impact of power reforms, the data has been taken only from The Seventh Five Year Plan to Tenth Five Year Plan. Increase in transmission, distribution is one of the indicators for progress of electrification. From Seventh Five Year Plan to Eighth Five Year Plan the transformers distribution recorded 35.67% of growth. But during the post-reform period it recorded 23.50% of growth. The number of towns and villages electrified are constant during all study five year plans, indicating majority of villages in Andhra Pradesh have electricity. However the growth of electrified hamlets is recorded at 15.01% during the pre-reform period and 2.83% during and post-reform period. The electrified dalit wadas have increased form 29899 to 51254 indicates the progressive development. It is interesting to note that the agriculture connections have remarkably increased from 11.12 lakh to 24.40 lakh during the study period. One can understand from the data presented in the table that under the five year plans the progress of electrification is significant. However it is slower in post-reform period compared to the pre-reform period.

The electrification of villages and towns in Andhra Pradesh State can be seen in Table 5.11. The services of electricity to towns and villages has significantly increased during the post-reform period (7.48% of growth) compared to pre-reform period (4.84% of growth). However, the growth in connected load to the towns and villages has slightly declined in the post-reform period. (7.21% of growth) compared to the pre-reform period (10.92% of growth). Thus it is seen from this data that, on the one side the expansion of electrification is significant and on the other hand the load capacity has grown at a slower
pace. It does indicate the government’s interest towards the electrification of development in the rural Andhra Pradesh.

Table 5.12 presents the data on electrification of hamlets, towns and villages and dalits wadas. During the period of 1991 the total number of electrified hamlets was 16578. This increased at 4.9% annually to reach 27209 hamlets in 1999. In the post-reform period number of electrified hamlets was 27391. In year 2000, it increased at a slower growth rate (2.7) annually to reach 31533 electrified hamlets in 2006. Thus, during the pre-reform period the average annual growth rate was 4.86 and it has slowed down to 2.72% during the post-reform period.

There is no change in number of towns and villages because the entire villages and towns were already electrified by 1991. The electrification of dalit wadas, before reforms grew at an annual compound growth rate of 2.8%. It has increased after reform with an annual compound growth rate of 4.38% almost twice as fast compared to the pre-reform period. Thus, we see that government has become more serious in the post-reform period regarding electrification of dalit wadas.

The data in Table 5.13 presents the agricultural services connected to farmers. In pre-reform period it was 1193363 connections in 1991 and grew in 1999 to 1884686 connections. After reform period from 1932913 connections in 2000 it increased to 2440823 connections in 2006. Looking at annual compound growth rates before and after reforms compound growth rate was 5.99 before reform and slowed down to 4.2% in post-reform period. Supply of electricity to the farmers has remained an important issue at this period.

5.5 OTHER INDICATORS:

The data given is Table 5.14 shows that the length of transmission lines and distribution lines was 1571484 KM in 1991 and it increased to 209156 KMs in 1999 in the pre-reform period. On the other hand in the post-reform period the length of lines
was 216527 KMs in 2000. It increased further to 278015 KM in 2006. The annual compound growth rate was 3.4% in pre-reform period and it improved to 4.2% in the post-reform period. Clearly, the transmission and distribution network has seen further and faster expansion in the post-reform period

Similarly, when we examine the state of consumers served by Andhra Pradesh Transco we find significant improvement in growth of consumers. In pre-reform period there were 6659 (thousand) consumers in 1991, which increased to 10583 (thousand) consumers. In the post-reform period, the number of consumer was 11104 (thousand in 2000 and it increased to 17235 (thousand) consumers in 2006. Annual compound growth rate has substantially increased from 5.9% during the pre-reform period to over 6.8% in the post-reform period. So year by year the consumer utilization has increased faster and it should contribute to increase in revenue.

The development of 11KV and low tension lines can be seen in Table 5.16 since 1991 to 2006. The length of 11 KV lines has increased during pre and post-reform periods. But compared to the pre-reform period the growth rate at about 4%, is much higher in post-reform period in case of 11kv lines. It was only 3.16% in during the pre-reform period. When we came to the length of low tension (LT) lines it has remarkably declined to 2.9% of growth during post reform period. The declining tendency of LT lines in post-reform period resulted in the decline in growth rate of total length of lines and registered only 3.2% growth. It is noted that after the reforms the electricity board of Andhra Pradesh mostly concentrated on the development of high tension (HT) lines due to its high ceiling rates (tariff rates).

Table 5.17 provides a synoptic view of power sector in Andhra Pradesh in terms of indicators of electricity development. Overall we get a mixed picture from this view. There is no doubt that installed capacity per 1000 persons has continued to increase in more or less similar way in both the pre-reform and post-reform periods. Likewise, actual energy consumed per 1000 person has continued to increase but at a slower growth rate. As already seen, transmission and distribution line network has continued to expand in
the post-reform period. The picture is the same when considered in terms of these lines per Sq. Km of area. Proportion of electricity sold to agriculture has remained more or less close to 40% in both the periods, except for more recent years, when it has declined to nearly 36%.

Some factors which can be seen to be indicative of improvement or otherwise in technical efficiency, it can be seen that electricity generation (in KWH) per unit of installed capacity (in KW) has improved in the post-reform period though only marginally. Length of transmission lines per 1000 units generated is relatively smaller in the pre-reform period. Finally, there is significant and substantial increase in customers served per employee in the post-reform period. This certainly is a positive and welcome development.

5.6. CONCLUSION:

Technical efficiency concerns evaluating the performance of power sector with respect to use of real resources in generation, transmission and distribution of power. The analysis has indicated that the installed capacity at the state level has increased significantly during the reform period and registered 7.46% annual growth compared to 5.9% in pre-reform period. It seems that the reforms in power sector at state level could not boost the power generation capacity at state level. A factor contributing to this problem is the abandoning of Nellore Thermal Station which was one of the important power generation stations.

Power generated by gas remarkably increased from 232.70 MU to 998.88 MU. Within the private sector, other sources also contribute significantly after gas. Among the other sources hydel, wind, biogases, bio-mass and mini power plants also contribute notable percentage to the total power generated by private sector.

The exported power during the pre-reform period registered 7.95% of growth. The state had excess amount of power after the domestic consumption. But after the
reforms only in the initial period it has exported very meagre percentage of power from the state sector. This may be attributed to low generation of power and increasing tendency of power demand during the post-reform period. Due to the progress of electrification in remote areas by state government resulted in relatively lower demand for power in relation to installed capacity during post-reform period. It may be noted that electrification of remote (rural) areas may not generate commensurate demand and peak demands in such areas and urban areas may be staggered thus lowering rate of growth of overall peak demand.

The electrification performance is impressive in the post-reform period. The services of electricity to towns and villages has significantly increased during the post-reform period (7.48 % of growth) compared to pre-reform period (4.84 % of growth). The annual compound growth rate was 3.4 % in pre-reform period and it improved to 4.2 % in the post-reform period. Clearly, the transmission and distribution network has seen further and faster expansion in the post-reform period. The declining tendency of LT lines in post-reform period resulted in the decline in growth rate of total length of lines and registered only 3.2 % growth. It is noted that after the reforms the electricity board of Andhra Pradesh mostly concentrated on the development of high tension (HT) lines due to its high ceiling rates (tariff rates). Finally, there is significant and substantial increase in customers served per employee in the post-reform period. This certainly is a positive and welcome development. Thus the main hypotheses that Changes in the organizational structure have helped in improving and technical efficiency and the rural electrification has improved are in the post reform period.