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**Power Sector Reforms  
in Andhra Pradesh :  
Their Impact and Policy Gaps**

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# **Power Sector Reforms in Andhra Pradesh: Their Impact and Policy Gaps**

**B. Saranga Pani, N. Sreekumar and M. Thimma Reddy**

## **I. Introduction**

India made spectacular progress in the power sector after Independence. This became possible because of four major policies pursued by the Government of India. These are budgetary support and ownership of the power utilities by the Government, development of a centralized supply system, technological self reliance and subsidization.

These four major policies enabled the power sector to achieve a commendable growth in terms of capacity addition, generation, per capita consumption, electrification of villages and hamlets. However, over a period of time, the policies pursued also led to a number of problems. The demand for power outpaced the supply of power leading to severe power shortages in several states. The transmission & distribution (T&D) losses increased over a period of time and the State Electricity Boards (SEBs) failed to contain them. A lot of electricity supplied and consumed went un-metered. The SEBs suffered heavy financial losses since 80s. Several factors contributed to the functional and financial deterioration of the SEBs.

To come out of the all round crisis that crippled the sector, there were several policy initiatives which led to changes in the ownership and structure of the power sector since 90s. The process began with the permission given for private generation in early 90s. This was followed by the introduction and implementation of the far reaching reforms in the power sector of Orissa in mid 90s. The third phase of reforms started with the enactment of the Electricity Act 2003, in June 2003.

The following phases are identified in the evolution of Indian Power Sector Policy:

**Phase. I : (1950s & 60s - Era of state patronage)**

- Enactment of Electricity (Supply) Act, 1948.
- Establishment of State Electricity Boards, to generate, transmit and distribute power.
- Predominantly state ownership of electricity utilities.
- Professional management of State Electricity Boards and establishment of BHEL.

**Phase. II: (1970s & 80s - Era of subsidization and populist policies)**

- AP started giving electricity at a flat rate for agriculture from 1982. Other states followed AP. Non - metering of agricultural consumption began.
- Concealing of theft and T & D losses under agricultural consumption figures began.
- Deterioration of State Electricity Boards.
- Establishment of Central sector generation companies like NTPC

**Phase. III: (1990s - Era of liberalization)**

- Increasing role of Central government and International Financial Institutions in the sector policies
- Stage. I (early 90s): Focus on generation through private sector - IPP policy which proved to be counter productive due to poorly negotiated contracts (High capital cost, unfair incentives, wrong fuel choice etc).
- Stage. II (mid 90s) : Focus on restructuring of SEBs and introduction of Regulatory Commissions
- Stage. III (late 90s): Enactment of Electricity Regulation Act, 1998, creating the Central Regulatory Commission and providing legal framework for constituting State Regulatory Commissions.

**Phase. IV: (2003 till date - Era of far reaching changes)**

- The number and reach of policy changes introduced are unprecedented. Consolidation of increased role of Central government in sector policies.
- Enactment of Electricity Act, 2003
- Restructuring of SEBs, de licensing of generation, open access and competition in distribution, cost reflective tariffs, limiting cross subsidies etc., are the implications of the Act.

The model followed before the implementation of the E-Act 2003 was the 'single buyer model'. All the generators, both public and private sell to a single transmission company which in turn sells power to the many distributing companies. Thus the single transmission company is the single buyer of the generated power. The E-Act enables the evolution of other models such as the 'bulk competition model' and 'retail competition model'.

Against this background, the present study is an attempt to look at the reforms introduced in the power sector in Andhra Pradesh. The second section deals with the evolution of the reforms in the power sector in Andhra Pradesh. The focus of the third section is on generation while the fourth section deals with distribution. The fifth section examines certain policy issues in the light of the reform experience in AP.

## **2. Power sector reforms in Andhra Pradesh**

Until its unbundling in February 1999, the Andhra Pradesh State Electricity Board (APSEB) was responsible for electricity generation, transmission, distribution and supply in the state. The APSEB was formed on 01 April 1959 and similar to other SEBs in the country, it had a monopoly in the power sector. It functioned under the overall guidance of the state government, interacting with the central power agencies for planning and co-ordination. At the time of unbundling, APSEB controlled 100 per cent power distribution and around 70 per cent of the generation capacity in the state.

On many technical aspects, APSEB enjoyed a good reputation amongst the other utilities in India – some of the features continue even now. For example, the Plant Load Factor (PLF) of State owned generation stations in AP has been much higher than the national average. Other aspects of good performance include fast erection of power stations, and low employee/consumer ratio. Though APSEB's performance on generation side was far better compared to other State Electricity Boards, performance on distribution and financial aspects proved to be very poor.

### **2.1 Crisis in the power sector**

The APSEB began incurring heavy losses in the mid 90s. Reasons for losses of such magnitude are still debated. One third of the Board's income was going to meet interest payments. The APSEB had been increasingly dependent on the government budgetary support, which the state government found difficult to provide. High Transmission and Distribution (T&D) losses, inefficiency in metering & collection, very low tariff to agricultural consumers, changes in the hydro-thermal energy mix, and increased reliance on thermal power, change in load mix and high average cost of power supplied from private generators were some of the factors that have contributed to the deterioration of the financial health of the APSEB. Consequently, APSEB was unable to raise finances for the required investments in generation and T&D (*Sankar 2003*).

## **2.2 Hiten Bhayya Committee recommendations**

In the background of the deteriorating situation on the power front and the new initiatives by the Government of India to attract private investment, the then State Government of Andhra Pradesh contemplated to restructure the power sector. As a first step, it constituted a high level Committee under the chairmanship of Sri Hiten Bhayya, a former chairman of Central Electricity Authority, to suggest reforms to be introduced in the power sector. The Committee had to review the existing policy of private participation in generation and also examine the issues relating to greater private involvement in T&D. The Committee was asked to provide guidelines and recommendations on the restructuring of the power sector, in addition to the formulation of an appropriate tariff policy. This Committee which was constituted in January 1995, submitted its report in June 1995.

The Committee considered carefully various demand projections and came to the conclusion that during the Tenth Plan period, generation capacity would need to be augmented at least by about 1000 MW every year. The Committee recommended that APSEB should be restructured on a functional basis to promote efficiency and functional specialization by unbundling the APSEB and constituting separate companies for each function. These would be wholly owned subsidiaries of the residual statutory body APSEB.

The Committee recommended the constitution of a Regulatory Commission to fix retail tariffs and to protect the interest of the distributing licensees as well as the consumers. It also recommended that tariff should reflect costs. The Committee did not recommend outright privatization of public utilities and cautioned that substitution of private monopoly in the place of public monopoly would only make the situation worse. The Committee felt that privatization initiative should start initially with management contracts in the distribution business. Further steps were dependent on the working of the management contracts. The Committee suggested unbundling but important functions like licensing and regulation were to be kept with state government.

## **2.3 World Bank agenda of reforms**

After Chandrababu Naidu became the Chief Minister in September 1995, the Government of Andhra Pradesh (GoAP) approached the World Bank for a structural adjustment loan to tide over the unprecedented fiscal crisis that engulfed the state Government. As a response to this, the World Bank brought out a comprehensive report 'A.P-Agenda for Economic Reforms', in January 1997, outlining its approach to reforms including power sector.

The World Bank report states, "if tariffs reflect costs and efficiency and are determined by an independent regulatory body, and distribution is privatized to reduce revenue leakage

and improve collection - capital markets and private developers will react positively. To establish credibility, the initial policy measures have to be bold, making a sharp break with the past, and explicitly endorsed by the government". The thrust of the report is towards privatization and globalization of the sector with minimal role for the state.

According to the World Bank, the root cause of this crisis "is the pervasive politicization of most decisions affecting APSEB's operations and expansion, and the resulting lack of a commercial orientation in its functioning. This has led to evolution of an organizational culture that does not promote accountability or provide incentives to the managers and staff for performance". Further it states that "while theoretically possible, it is very difficult to introduce, in the public sector at the state level in India, the required management and operational autonomy and performance incentives, that are essential to successfully address the fundamental issues in power distribution in India" (*World Bank 1999*, p. 7).

Hence, the Bank suggested comprehensive reforms in the power sector going beyond the recommendations of the Hiten Bhayya Committee. Some important components of the reforms proposed by the World Bank are:

- Defining a structure for the sector consistent with privatization of distribution and private sector development in generation.
- Corporatizing the power utilities and ensuring that they operate without Governments' interference.
- Creating an independent and transparent regulatory system for the sector with broad range of responsibilities including granting of licenses and enforcing them.
- Enacting comprehensive reform legislation to establish the new regulatory framework and implement the restructuring measures.
- Increasing the tariff rate to agriculture to at least 50 paise/kWh in the near term and continuing to adjust tariffs to cover costs and reduce cross subsidies.

There is a basic difference between the Hiten Bhayya Committee and the World Bank in their approach to reform. Hiten Bhayya Committee's suggestions were towards improving the performance of a sector under public ownership and management. The Bank's approach was driven by the idea of changing the ownership from public to private in a span of 8-10 years.

## **2.4 Policy mile stones**

Within six months of the World Bank recommendations, on 14th June 1997, The GoAP released a power sector policy statement indicating proposed policy and structural changes in the power sector. The policy statement went along the lines of the World Bank report

and made similar recommendations. This marked a paradigm shift in power policy - state ownership to private ownership, budgetary support to private capital, self-reliance to globalization and cross subsidy to cost based tariff.

In order to give a concrete shape to this policy, the GoAP enacted Electricity Reforms Act of 1998. The Reform Bill was introduced in the legislative assembly on April 27, 1998 and was passed on April 28<sup>th</sup>. It was notified on 29<sup>th</sup> October 1998 and made effective from February 1999. The Reform Act was nearly a carbon copy of the Orissa Reform Act. With its enactment, the GoAP fulfilled one of conditionalities of the World Bank loan.

Soon after the Reform Act, the World Bank released its project appraisal document (PAD) for loan under the Andhra Pradesh Power Sector Re-structuring Program (APSRP) in January 1999. The Project Appraisal Document (PAD) reflects several conditionalities laid down by the World Bank.

The reform programme is to be implemented over a 10-years period, starting from February 1999. The Adaptable Program Loan (APL) scheme was planned in 5 stages, APL-1 to APL-5. The total loan amount is US \$ 4660 million with World Bank contributing 22 per cent of the amount. Interestingly, World Bank's contribution is 36 per cent in APL-1 and goes down to 13 per cent in APL-5. The other international lending agencies include DFID and OECF. The Indian agencies include Government of Andhra Pradesh, Power Finance Corporation and Rural Electrification Corporation. At each stage, some conditionalities have to be satisfied so that the utility becomes eligible for the next stage loan. These include privatization of distribution & generation, average annual tariff hikes of 15-20 per cent, implementing cost based tariff and reducing government subsidy to zero.

As per the reform time table, thirty per cent of the distribution system is expected to have private sector participation by 2002 and hundred per cent by 2007. At least one distribution company has to be privatized by the end of the financial year 2003. An investment of US\$ 103 million is planned as part of the first phase of reform project in the distribution area to strengthen the distribution system, providing single-phase transformers and installing VHF based communication system.

Both the World Bank and the GoAP considered the reform in the power sector as the single most important aspect of structural and fiscal reform in the state. "The underlying broader development objective of the APPSRP is to bring about a permanent shift in public expenditure in the power sector, from a major drain on the budget to a contributor of funds for social sectors and other priority areas for public investment. This fiscal dimension links the program to the broader APERP. Taken together, APERP and the proposed APPSRP would make a major contribution to modernizing the state's infrastructure and social sectors,

and they would be fundamental to the restructuring of the state's finances and for the acceleration of economic growth and longer term human development" (World Bank 1999, 3). "The power sector specific development objective of APPSRP is to ensure that by the financial year 2007, the energy requirements of the state are met, and consumers are provided with reliable, high-quality and cost-effective electrical supply by creditworthy and commercially operated power utilities, functioning in the competitive and appropriately regulated power market, with significant private ownership and participation".

The two important reasons given for restructuring APSEB were the dwindling finances of APSEB and the need to find additional resources for capacity addition. Both these two grounds are questionable. The losses suddenly appeared in the books of APSEB in 1995-1996 and from then onwards they increased each year by thousands of crores. Nowhere justifiable reasons were given for these losses. The losses were mainly explained in terms of a substantial increase in agricultural consumption (after the introduction of slab rate in 1982) rather than major factors like theft, pilferage, under billing, non collection of revenue, corruption and mismanagement. Both the GoAP and World Bank argued that state required an additional capacity of 8,500 MW by the end of 2002. It was estimated that a whopping investment of Rs 50,000 crores was required. As neither the APSEB nor the GoAP was in a position to mobilize resources, private capital had to be promoted in the power sector. The additional requirements of capacity are also questionable. Reform legislation was pushed through on the basis of these arguments and restructuring was undertaken as the corrupt politicians found a gold mine in it (*Srikumar et al., 2003*).

The APSEB was unbundled into APGENCO and APTRANSCO in February 1999. In April 2000, the APTRANSCO was further unbundled into a transmission company and four distributions companies (DISCOMs) managing distribution in four zones of the State, Central, Eastern, Northern and Southern. In March 2001, State Government signed a MOU with the Ministry of Power, Government of India on reform and restructuring which has the road map for reform, plans for tariff rationalization, metering and maintaining grid discipline. As part of the distribution sector reforms, the four DISCOMs have been issued independent licenses for distributions in April 2001.

The Electricity Reform Act provided for the constitution of Andhra Pradesh Electricity Regulatory Commission (APEREC). The independent regulation is intended and designed to serve the interests of the service providers and the consumers. Prior to the establishment of independent regulation, tariff setting was subject to political whims and compulsions. Tariffs seldom covered the costs of the utility. Setting appropriate tariffs that cover cost of supply is a key regulatory function. This takes care of the interests of the service providers. In the pre-reform period, the utility was a distant entity inaccessible to consumers. The regulator has to protect the interests of the consumers by providing a credible and

authoritative interface between the consumers and service provider. The APERC started functioning since April 1999. The first tariff order was issued by the APERC on May 27, 2000. So far 7 tariff orders have been issued by the Regulatory Commission.

The table below gives the chronology of events leading to the restructuring of the power sector in Andhra Pradesh:

1995 June	Hiten Bhayya Committee Report
1996 September	World Bank's Agenda for Economic Reforms in Andhra Pradesh
1997 March	AP State Government's Policy Statement on Power Sector Reforms
1998 April	Passing of AP Electricity Reforms Bill in the State Legislative Assembly
1998 May	World Bank's PAD on AP Economic Restructuring Project
1999 January	World Bank's PAD on AP Power sector Reforms Programme (APPSRP)
1999 February	AP Electricity Reforms Act 1998 comes into force
1999 February	APSEB unbundled into APGENCO and APTRANSCO
1999 March	Agreement between the World Bank and GoAP on APERP signed
1999 April	AP Electricity Regulatory Commission starts functioning
1999 November	First Public hearing conducted by the APERC on Tariff Philosophy
2000 March	APTRANSCO further unbundled into APTRANSCO and four DISCOMs
2000 May	First Tariff Order by APERC
2000 May	People's Movement against tariff hike starts
2000 August	Police firing on demonstrators in the centre of Hyderabad city
2000 October	High Court Judgment upholding the APERC order on tariff hike
2001 April	Regular licenses to DISCOMs
2002 April	Financial autonomy to DISCOMs
2002 August	Employee division (option process) among APGENCO, APTRANSCO and DISCOMs on permanent basis
2003 June	Enactment of Electricity Act, 2003.
2003 August	Suspension of the World Bank loan after the first stage itself quoting high interest rate and unacceptable conditions.
2004 May	Change in Government and the announcement of free power to the agricultural sector.
2004	Direction by the APERC to APTRANSCO to review the PPAs with IPPs
2005 June	Transfer of PPAs to the four DISCOMs.

## **Conclusion**

Far reaching reforms have been introduced in AP in different sectors of the economy under the Telugu Desam Party (TDP) regime. This applies to power sector as well. Pace of reforms in AP was high compared to many other states due to the combination of three factors – national agenda of Liberalisation, Privatisation, Globalisation (LPG), push by the World Bank and the ready acceptance of the reform agenda by the TDP regime. The eagerness shown by the then Chief Minister in rushing through the reform agenda by bulldozing all opposition in the State made the major difference.

It has been stated that the ultimate objective of the reforms initiated is to withdraw from the power sector, as far as the government is concerned as an operator and regulator of utilities. However, as on today, private sector participation is only in the area of generation. The distribution and transmission businesses are being handled by the state owned public utilities.

There has been a slow down of the reform process in the last phase of the TDP regime. This could be traced to the strong popular opposition to the reform agenda, failure of the World Bank led reform process in Orissa and the national level re-thinking on the World Bank led reforms. Signs of this slowdown included suspension of the World Bank loan after stage-I itself, no attempt to privatize distribution, limited tariff changes after the first tariff order. In May 2004, the Congress government came to power in the place of TDP. It announced free power to agriculture and promised to review the reforms including power purchase agreements (PPAs) with private generators.

Mainstream perception of the AP power sector continues to be upbeat, as can be seen by media comments and ratings. For example, CRISIL and ICRA (two major credit rating agencies) have been mandated by the Power Finance Corporation Limited at the instance of the Ministry of power, Government of India to carry out a performance rating of the state power sector across all the states. The rank of Orissa fell from 14 in 2003 to 21 in 2006 while that of Delhi improved from 6<sup>th</sup> in 2003 to 3<sup>rd</sup> in 2006. AP stood first in 2003, second in 2004, first again in 2005 and 2006. The performance rating scores and the resultant ranking have remained stable for Andhra Pradesh for the year 2006 inspite of tightening of the benchmarks and introduction of negative scores.

## **3. Impact of the Reforms**

The purpose of this section is to assess the impact of the reforms on the generation and distribution sectors. The entire study period between 1980-81 and 2005-06 has been divided into 3 sub-periods. The first period (1980-81 to 1990-91) consists of the pre-reform years. The second period (1991-92 to 1999-2000) refers to the introductory phase of reforms. It

starts with the introduction of LPG policies including the entry of IPPs. During this period, power sector reforms started including the enactment of Reform Act in AP. The third period (2000-01 to 2005-06) is the ongoing phase of reforms. This includes functioning of State Electricity Regulatory Commission, complete unbundling of the sector and implementation of E-Act 2003.

### **3.1 Impact on Generation**

The impact of the reforms on the generation side is examined in this section. In the generation sector many changes took place even before the reforms are introduced. The specific issues examined in this section are the trends in the installed capacity, burden of capacity addition in the private sector, power purchase costs from the private sector, and the discrimination against the APGENCO. The next section examines the impact of the reforms on the distribution sector.

#### **3.1.1. Trends in the installed capacity**

Up to 1990, the APSEB had a monopoly in power generation. Private participation in generation started from 1991 after the establishment of APGPCL as joint venture. The state had an installed capacity of 10,693 MW at the end of 2006. Out of this, the APGENCO accounts for 62 per cent with an installed capacity of 6550.86 MW. The share of the private sector is 14.52 per cent. The state has a share of 2212 MW capacity in the central generating stations. This is from NTPC plants at Ramagundam, Simhadri and Talcher, NLC plants at Neyveli and NPC plants in Tamil Nadu.

Total installed capacity in the state increased by 3.68 times between 1980-81 and 2005-06 (Annexure 1) and the installed capacity in the state sector increased by 2.84 times. It increased at an annual rate of 7 per cent during the first period, 4.25 per cent during the second period and at a much lesser rate of 2.71 per cent during the third period. Much of the increase in the capacity during the third period came through the private sector. Between 1996-97 and 2003-04, it rose by 470 per cent or by 58.75 per cent per annum.

Because of the encouragement given to the private sector, the share of the public sector has decreased from 100 per cent to about 80 per cent and that of private sector increased to around 20 per cent. The reforms have resulted in a substantial increase in private sector generation capacity and only a sluggish increase in public sector generation capacity.

#### **3.1.2. Capacity addition in the private sector**

The establishment of Andhra Pradesh Gas Power Corporation at Vijjeswaram, a joint venture of Andhra Pradesh State Electricity Board and 22 industries participating, marked the entry

of the private sector in power generation. The APGPCL was originally permitted only to generate, but later it was permitted to transmit, distribute and supply power either directly or through the facilities of APSEB to the participating industries and other consumers. The private sector was successful in getting the approval for this joint venture as a captive generation plant of the participating industries. Not only that, they also secured low wheeling charges of around 13 paise per unit. The first stage was commenced in 1991, and the second stage in 1997. The share of Andhra Pradesh State Electricity Board in the first stage was 15 per cent and in the second stage was 25 per cent. The participating industries have the remaining share. To the extent they drew the power from this plant, they curtailed power purchases from the APSEB and consequently APSEB lost an important source of income which contributed significantly to the cross subsidy.

Subsequent to the opening of the power sector to private generation by the central government in 1991, many IPP projects were planned in Andhra Pradesh. The Government of India offered 16 per cent return on equity, tax holiday and an attractive debt-equity ratio to the private generators. There was overwhelming response to the IPP policy of the government. MoUs were signed for 95 projects by the end of 1995. From these, 8 plants were selected for special treatment and called 'fast track projects'. Of these, 4 companies chose to setup their plants in the state. These were - GVK industries at Jegurupadu (Gas-based), Spectrum Technologies at Kakinada (Gas-based), BPL Ramagundam project (Coal based) and Hindujas Thermal Plant at Visakhapatnam (Coal based). They entered into Power Purchase Agreements with Andhra Pradesh State Electricity Board. The first two plants started generation. The BPL and Hinduja Plants have yet to take off. Annexure 2 shows the trends in the Installed Capacity in the Private Sector.

The first unit of GVK Jegurupadu was commissioned in July 96. All the 4 units of GVK were commissioned by July 97. The four units of Godavari Spectrum at Kakinada were fully commissioned by the end of 98. After 95, the Government of India enforced competitive bidding process for the selection of the IPPs. The Lanco Unit at Kondapalli and BSES at Samalkota came through the competitive bidding route. All the 3 units of Kondapalli Lanco plant were commissioned by the end of 2000. The two units of BSES were commissioned by the end of 2002.

The gas based GVK, Spectrum, Lanco, and BSES plants had a combined capacity of 999 MW. Thus, even before the start of the present phase of the reforms, these IPPs were given permission and they were fully commissioned at various dates between 96 and 2002.

Even before studying the report of the Hiten Bhayya Committee which had to give clear guidelines regarding private sector investments, the GoAP gave permission to a number of mini hydel plants, wind farms, cogeneration units, bio-mass projects and mini power plants.

By the end of 2004, 42 mini hydel plants, 23 wind farms, 4 mini power plants, 19 cogeneration plants, 29 bio-mass projects, 4 industry waste based plants, 4 isolated gas wells and one waste heat recovery cogeneration plant were commissioned. They had a combined capacity of 651.32 MW. These additions to the capacity were not based on proper demand projections. The private investors obtained approvals for their proposals with the willing co-operation of the political leadership.

The APERC, after its formation, gave permission to the PPAs of 4 gas based plants – GVK Extension, Gowthami power, Konaseema EPS Oakwell, Vemagiri Power and BPL Thermal Plant. They are expected to be connected to the grid by 2007 as per the original schedule. Except BPL, all these plants are gas based. They have a combined capacity of 1499 MW.

### **3.1.3. Burden of capacity addition in the private sector**

The capacity additions in the private sector are based on over projections of demand. Different Agencies have estimated different capacity requirements. For example the Hiten Bhayya Committee projected a capacity requirement of 18051 MW by the end of 2005; the cabinet sub committee projected a requirement of 12854 MW. Based on these projections, the private sector has been encouraged indiscriminately to install additional capacities. The capacity additions, instead of helping the power sector, have become an unbearable burden to all the stakeholders because of the preferential treatment given to the private sector – IPPs, Mini Power Plants and Non Conventional Energy units in matters of fixed costs, returns, taxes, fuels, incentives etc.

### **Independent Power Producers**

The IPPs were allowed to charge higher fixed costs. The fixed costs of a power plant typically include operation and maintenance costs, return on equity, corporate income tax, costs of insurance, depreciation and working capital. Initially, the private projects were allowed to have a return between 12-30 per cent on equity. This has been recently reduced to around 12-14 per cent. Besides, the IPPs are also provided performance linked incentives. These costs are passed on to the consumer. The consumer pays not just the profits of the utility, but also tax on profits. In their anxiety to attract private investment, the APSEB agreed to bear all the important risks of the private promoters – fuel cost variation, currency variation and demand variation.

A comparison of IPP plants with the NTPC Simhadri coal based thermal plant clearly brings out the higher fixed cost of the IPPs. The table below presents the details. The four IPPs - BSEs, Spectrum, GVK and LANCO together have a capacity of 999 MW. They were paid Rs. 846.8 crores as fixed charges, where as the 1000 MW NTPC Simhadri Plant

was paid Rs.541.3 crores towards fixed cost. Thus the IPPs were paid Rs.300 crores more than the amount paid to the NTPC.

**Table 1**  
**Comparison of fixed costs**

<b>Particulars</b>	<b>IPPs</b>	<b>NTPC-Simhadri</b>
Plant Capacity (MW)	999	1000
Units Purchased (MU)	6149	6170
Fixed Costs (Rs. in crores)	846.8	541.3
Total Costs (Rs. crores)	1455.8	1055.1

Figures relate to 2004-05

Source: [www.pmger.org](http://www.pmger.org) and ARR submissions by the utilities

Even among the IPPs, there is wide disparity in per MW cost of the plant and per unit cost of power generated in these plants. Table 2 below presents the details.

**Table 2**  
**Fixed cost variations**

<b>Company</b>	<b>Fixed charges per MW (crores)</b>	<b>Cost of power per kWh</b>
APGPCL	0.42	1.50
BSES	0.73	1.80
Spectrum	0.86	2.08
GVK	0.87	2.18
LANCO	0.90	2.72

Source: [www.pmger.org](http://www.pmger.org) and ARR submissions by the utilities

Payments made to the IPPs towards fixed charges were higher when compared to the APGPCL and BSES. The fixed charges, particularly paid to the LANCO, were 115 per cent higher than those paid to the APGPCL and 4 per cent higher than those paid to BSES. Consequently, power purchase costs were higher with the IPPs. LANCO was paid 83 per cent higher than that paid to APGPCL per unit and 51 per cent higher than that paid to the BSES.

Besides, the GVK and Spectrum are being paid heavy incentives based on the old benchmarks. They are paid incentives if PLF is more than 68.5 per cent. In the case of new gas projects, the benchmark is a PLF of 80 per cent. Not only that, Spectrum has two levels of incentives, one upto 85.5 per cent and another above 85.5 per cent. The Comptroller and Auditor General (CAG) severely criticized the PPAs entered with these companies as they are resulting in excessive expenditure. Both GVK and Spectrum came through the MoU route. Power tariff from these stations are not determined through transparent process of bidding. Hence, there is every case to renegotiate the PPAs with them.

The issue of availability of natural gas for power projects has not been considered scientifically and seriously. Without looking at the availability estimates of gas and firm commitments of supply of the same, APTRANSCO has entered into PPAs with GVK extension, Gowthami, Vemagiri and Konaseema. These units have not yet started commercial production of energy. Once they start commercial operation, without having required supply of natural gas, huge fixed costs to the tune of Rs.1020 crores per annum have to be paid.

The APTRANSCO has to collect liquidated damages from the gas projects which could not achieve financial closure as per the provisions of the PPAs with those projects. The liquidated damages amount to nearly Rs. 500 crores. No attempt has been made by the APTRANSCO to collect the liquidated damages. Moreover, the APTRANSCO justified the non recovery of liquidated damages on the pretext that these gas projects reduced their fixed costs through the revision of their PPAs and there by TRANSCO got some savings. However, collection of liquidated damages because of the failure to achieve financial closure as per the provisions of the PPAs and reduction of fixed costs through a revision of PPAs are two separate issues. Hence, there is no justification for TRANSCO not to collect liquidated damages from the gas projects. Even otherwise, unlike other gas projects, Lanco did not reduce its fixed costs on par with Gautami. In spite of this, TRANSCO did not collect liquidated damages from Lanco. Non recovery of liquidated damages from Lanco and other IPP projects is an uncalled for burden on the consumers and the state.

Private sector investment through IPP route has turned to be costlier than necessary because of a combination of factors like high risk premium, higher profits and rents and regulatory failure. PPAs with IPPs are designed in such a way that developers do not bear any of the risks relating to fuel price, supply and payment default. They were rife with instances of rent seeking if not outright fraud. Hence there is a strong case to review the PPAs with the IPPs.

### **Mini Power Plants and NCE Units**

Mini Power Plants were to be based on residual fuel and were expected to be implemented within 12 to 18 months. These were permitted to overcome the stipulation that large plants costing more than Rs. 100 crores require the clearance of the Central Electricity Authority. These units cater directly to the requirements of the industrial consumers. If there is surplus power, it will be purchased at a price higher than the pooled cost. Had all of the proposed mini plants materialized, they would have taken away the industrial consumers from the APSEB and would have resulted in its imminent collapse. Fortunately, only a few of the proposed plants materialized. Fixed costs being allowed for these MPPs, are more than one crore rupees per MW of capacity. This is more than that paid to the IPPs. These are increasing the fixed cost burden. Presently, two mini plants LVS and Srivatsa are operational. They continue to present a scandalous picture.

The Non-Conventional Energy units are being encouraged to produce energy using non-conventional sources. A number of incentives are provided by the Government to these units. However, they were permitted without proper assessment of the resources available. As in the case of gas projects, availability of fuel is an important issue for the NCE units. However the entire policy regarding the NCE units needs a review because of the following reasons. Firstly, studies have shown that there is not enough biomass to support the biomass projects. Consequently, these units are felling trees indiscriminately and causing harm to the environment. Secondly, there is not enough bagasse feed stock to run the bagasse based plants. In recent times, the area under sugar cane cultivation has declined and there has been no substantial addition to the capacity in the sugar mills. Thirdly, as a consequence of a reported reaping of super normal profits by the mini hydel units, those who have obtained licenses earlier, but not started, have started making additions to the existing unviable capacity.

Besides, while calculating tariffs, capital cost for each category of NCE units has been considered as the same, though there are differences in the normative costs adopted by APTRANSCO. For Bagasse plants, the normative cost adopted was Rs.3 crores per MW, for wind firm Rs.4 crores per MW, for Waste to Energy Plants Rs.6 crores per MW. The uniform capital costs are leading to higher unit costs and are benefiting the old plants unduly. While there is a need to promote non conventional sources of power, the question is at what cost?

It has been pointed out that the number of interface meters which measure the pumping of power into the grid are lesser than the number of NCE units. It is not clear how the NCE units are regularly monitored and how the dispatch of the power is coordinated. There are doubts regarding the amount of power being pumped into the grid by these units.

### 3.1.4. Power Purchase Costs

Power purchase costs account for 85 per cent of power supply cost to the consumers. As a consequence of capacity addition based on unrealistic demand projections and adverse terms in PPAs, power purchase costs have been increasing year after year in the state and are becoming a burden both on the consumers and on the finances of the licensees. Table below presents demand projections, availability and purchases of power.

**Table 3**  
**Demand Projections, Availability and Purchases of power**  
(MU)

	2001	2002	2003	2004	2005	2006
Assembly committee	42628	47148	51333	NA	NA	NA
APTRANSCO	44260	44046	44515	NA	NA	NA
Power available	42628	45413	48482	NA	NA	NA
Power Purchased	42189	40788	41333	46544	51150	51338

Source: [www.pmger.org](http://www.pmger.org) and ARR submissions by the utilities

It is clear from the above table that the power projections are more than power available and power purchases are lesser than power available. However, the licensees have to pay not only for the purchased but also for the surplus power. As a consequence of this, fixed costs to be paid to the IPPs have been increasing year after year though total power purchases have been declining. The power available is also more than the projections of APTRANSCO. In spite of this, APTRANSCO is asking for additions to capacity at huge cost for which there is no justification.

Table 4 gives details regarding Power purchases, purchase cost and fixed cost.

**Table 4**  
**Power purchases, purchase cost and fixed cost**

Year	Power purchased (MU)	Purchase cost (Rs. crores)	Fixed cost (Rs. crores)
2005-06	51338	8651	3376
2004-05	51150	8859	3536
2003-04	46544	8416	3506
2002-03	41333	7425	3445
2001-02	40788	7296	2737
2000-01	42289	7262	2505

Source: [www.pmger.org](http://www.pmger.org) and ARR submissions by the utilities

In 2003, 41333 MU were purchased. When compared to the power purchased in 2002, it was an increase of 545 MU. Consequently, the power purchase cost increased by Rs.128 crores and fixed cost by Rs. 708 crores. This position becomes starker when we compare between 2001 and 2003. Power purchased decreased by 956 MU, but power cost increased by Rs.163 crores and fixed cost by Rs.940 crores. Though power purchased decreased when compared to 2001, both power purchase cost and fixed cost increased abnormally. This is because of the obligation to purchase power from the IPPs on the basis of PPAs signed with them.

However, in 2005-06, though power purchased increased by 188 MU, power purchase cost decreased by Rs. 208 crores and fixed cost also decreased by Rs. 130 crores. This is the first instance when there has been such a reduction both in power purchase and fixed costs after initiation of the reforms.

Table 5 shows the per unit cost of power from different sources between 1998-99 and 2005-06.

**Table 5**  
**Purchases from Different sources and power purchase costs**

Source of Power	Available Capacity (MW)		Units Purchased (MU)		Total Cost (RS. in Crore)		Per Unit Cost (Rs. Per Unit)	
	1998-99	2005-06	1998-99	2005-06	1998-99	2005-06	1998-99	2005-06
APGENCO	5910	6551	25127	26270	2925	3795	1.16	1.44
IPP*	482	1526	4128	7973	824	2139	2.00	2.58
OTHERS**	885	2617	8237	17096	1141	2716	1.38	1.59
TOTAL	7277	10694	37492	51339	4890	8650	1.30	1.69

\* IPPs include mega and mini power plants in the private sector and APTRANSCO's share of APGPCL.

\*\* Others include central generating stations and other SEBs.

Source: ARRs for the year 2000-01 and 2006-07.

As it is clear from the above table, while between 98-99 and 2005-06, the proportion purchased from the APGENCO declined from 67 per cent to about 51 per cent. At the same time, the proportion purchased from the IPPs increased from 11 per cent to about 16 per cent while the proportion purchased from the Central Generation Stations and other SEBs increased from 22 per cent to about 33 per cent.

Between 99 and 2006, the purchases from APGENCO increased from 25,127 MU to 26,270 MU - an increase of about 5 per cent. The purchases from IPPs increased from 4,128 MU to 7,973 MU - an increase of 93 per cent in just 7 years. The purchases from the Central Generation Stations and other SEBs increased by 108 per cent.

The power purchase costs increased by 77 per cent. APGENCO's share in the power purchase cost was 44 per cent in 2005-06 which was less than its share of 51 per cent in the power supplied. The IPPs' share in the power purchase cost was 25 per cent. It was more than its share of 16 per cent in the power supplied. The share of central stations was 33 per cent in power purchases and 31 per cent in power purchase cost. Thus the substantial increase of 77 per cent in the power purchase cost was attributable to the high cost of the power purchased from the IPPs.

This position becomes further clear when we examine the unit cost of power supplied by different sources. The unit cost of power supplied by the APGENCO worked out to Rs 1.44 by the end of 2005-06, while the per unit purchase cost from Central Power Stations stood at a comparable level of Rs. 1.59. However, the per unit purchase cost of power from the IPPs worked out to be Rs. 2.58. It was higher by Rs. 1.14 per unit than that purchased from the APGENCO. As power purchased from IPPs increased by 93 per cent between 99 and 2006 at higher unit costs, it is not surprising to have a 77 per cent increase in the power purchase costs of APTRANSCO.

During 2004-05, 6149 MU were purchased from the four IPPs put together at a total cost of Rs 1455.80 crores at the rate of Rs.2.37 per unit. The total purchases from the NTPC stood at 6170 MU at a total cost of Rs.1055.1 at the rate of Rs.1.71 per unit. The four IPPs charged Rs 821.1 crores as fixed charges while the fixed costs of the NTPC were Rs 485.4 crores. When compared to the NTPC, the four IPPs received Rs 335.7 crores more towards fixed costs and Rs 400.7 crores more towards their power sales to APTRANSCO. Thus IPP power is costlier than GENCO or NTPC power. This has also been pointed out by the Comptroller and Auditor General in his report.

The APERC in its tariff order for the year 2003-04 directed the APTRANSCO to renegotiate the PPAs that were concluded before the constitution of the Regulatory commission. The APTRANSCO has written letters to the IPPs and has sat back. The Congress Government has appointed a Committee to review the PPAs under the Chairmanship of Sri K.Rosaiah, the Finance Minister. The Committee has not shown much progress.

The experience of Maharashtra, and Gujarat was there to reduce power purchase costs. The Maharashtra Electricity Regulatory commission asserted its power to review the PPA with the Dabhol power Company, which was upheld by the Bombay High Court. The Gujarat

Government successfully renegotiated with IPPs and brought down the fixed costs by more than Rs. 500 crores. A closer and detailed examination of the Gujarat exercise is needed to reduce the burden of the inflated fixed costs of the IPPs in Andhra Pradesh.

In the cost plus regulation, in determining a fair return, it is important to balance between competing interests of the consumers, investors and utilities. Investments are needed, but they should not be so expensive or arbitrary, that it becomes impossible to recover them. Hence there is need for evolving transparent, objective methodology to determine fair returns.

#### **b) Purchases from the Non-conventional Units**

Table 6 shows power purchases from the non conventional sources. Total quantity of power purchased from the non conventional sources has been increasing year after year. Between 2002 and 2005, it has increased by almost 6 times. The cost per unit has also been increasing year after year. Combined together, the total outgoes on this account are staggering. This is the costliest power purchased by the APTRANSCO.

**Table 6**  
**Power purchases from non conventional units**

<b>Year</b>	<b>Power Purchased (MU)</b>	<b>Cost per Unit (Rs.)</b>	<b>Total cost paid (Rs. crores)</b>
2002	313	2.89	90.30
2003	733	3.20	234.70
2004	1262	3.47	437.00
2005	1802	2.30*	415.30

Source: [www.pmger.org](http://www.pmger.org) and ARR submissions by the utilities

\* Rate proposed by APTRANSCO as part of its bulk tariff proposals.

The APERC reduced the unit cost of purchase from NCE units to Rs.2.81 in 2005. There is scope to bring down this price further. The normative fixed costs and the fuel charges allowed for different types of NCE units are generally considered to be higher. Hence, there is scope for reducing them. Besides, tariff to the NCE units can be differentiated on the basis of their contribution to the system peak (peak and non peak energy charges).

The government at present is collecting water royalty at the rate of 39 paise per unit of power generated from the mini hydel units. This is nearly equal to the variable cost of some thermal power stations like NTPC's Talcher plant. As the mini hydel units are using water in a non-consumptive way, the water royalty may be withdrawn. This will benefit the power consumers with lower tariffs.

### **3.1.5. Discrimination against APGENCO**

Total energy generated in the state sector increased by about 3.6 times between 1980-81 and 2005-06 (Annexure 3). During the first period, energy generated in state sector increased at an annual rate of 13.57 per cent and during the second period at the rate of 6.94 per cent per annum. However, energy generated in the state sector showed a negative growth rate of 9.2 per cent (declined by 9.2 per cent) per annum during the third period.

As power has been increasingly purchased from the IPPs, power generated by APGENCO declined. Some of its units are operating much below their potential levels and are producing lesser than what they were doing before.

The state owned APGENCO is being discriminated in several ways. Firstly, as pointed out earlier, the proportion of power purchased from APGENCO has been coming down year after year. Secondly, there is no level playing field between the state owned GENCO and the IPPs. APTRANSCO so far has not entered into a long term PPA with APGENCO. This makes the future of GENCO uncertain. Thirdly, the incentive norms are different for the GENCO and the IPPs. The incentives are being added to the variable cost in the case of GENCO where as they are shown separately in the case of IPPs (Incentives when added to the variable costs affect the merit order of GENCO). Fourthly, GENCO is not allowed to have a minimum rate of return on equity while the IPPs are allowed 16 per cent rate of return on equity. Lastly, the Letter of Credit and escrow facility available to the IPPs are not available to the GENCO. Though the GENCO must have the first claim over the revenues of TRANSCO and DISCOMs, as the first generator in the state, it has become a residual claimant. APTRANSCO is delaying payments that are due to the GENCO while it is making advance payments to the IPPs.

Not only that, the asset transfer scheme at the time of unbundling of the APSEB also imposed an undue and unbearable burden on the APGENCO. As per the original schedule of the reforms, the DISCOMs have to be privatized by this time. Hence, in order to make them attractive to private investors, all the debt of erstwhile APSEB towards the terminal benefits of the Board employees, even after their allotment among the unbundled entities, was completely placed on the GENCO. The debt amounted to Rs 450 crores. At the same time, no provision was made for the payment of the principal and the interest on this debt burden. As these amounts relate to the period preceding the reforms, it is the responsibility of the GoAP to bear this burden. The four DISCOMs and the APTRANSCO should also share a part of the burden in proportion to the number of personnel working with them. There is no justification for making APGENCO to bear the entire burden of the lopsided asset transfer.

The Thermal units of GENCO are facing the biggest ever threat of closure. The purchase of thermal power from the APGENCO has been declining year after year. Thermal power purchased declined from 20,752 MU in 2002-03 to 17,066 MU in 2004-05 – a fall of about 18 per cent.

Because of the large decline in the purchase of thermal power, the most efficiently run Rayalaseema Thermal Power Plant (RTPP) at Kadapa was severely affected. Not a single unit was purchased from RTPP during 2004-05. RTPP received several awards in recognition of its efficient functioning. In the ARR for 2004-05, the variable cost of RTPP was shown as increased to Rs. 1.41/kWh from Rs. 1.19/kWh. The variable cost is the basis for categorizing the plants on merit list. The variable cost of Vijayawada Thermal Power Station (VTPS) remained the same between 2003-04 and 2004-05 while that of Kothagudem Thermal Power Station (KTPS) was shown as declined. It is necessary to probe why the variable cost of efficiently run RTPP increased. Efficient thermal stations like RTPP should not be left to decay as they have a key role in stabilizing power supply and voltage in areas which are far away from the generation stations.

The discrimination against APGENCO has led to the decision to close down the Nellore Thermal Station. The closure is not justifiable and not in the interests of the consumers and also APGENCO. It is the result of the irrational merit order procedure taking only variable cost into consideration for dispatch of energy from generation stations. Any one can reap huge profits by taking over NTS and operate it as captive / merchant plant taking advantage of the provisions of the EA 2003. The entire merit order procedure has to be reviewed at the earliest to save the GENCO units.

Table 7 shows the projections of the profitability of APTRANSCO, DISCOMs and APGENCO prepared by the State Government in 2003.

The table is extracted from the Letter of Development Policy of GoAP dt 29.12.2003 to the World Bank through the GOI as part of its commitment to the Second AP Economic Reforms loan/credit from the World Bank.

**Table 7**  
**Profitability Projections of DISCOMS, TRANSCO, and GENCO**

<b>Year</b>	<b>DISCOMS profits</b>	<b>TRANSCO profits</b>	<b>GENCO Losses</b>	<b>Total profits of all the entities</b>
2003	2	10	41	29
2004	29	137	133	33
2005	267	170	277	159
2006	290	259	321	228
2007	283	342	177	449

It is clear from the above table that the Government has projected that DISCOMS and TRANSCO would be able to make higher and higher profits, while the GENCO would incur increasing losses year after year. According to these projections, by 2004, the accumulated losses of GENCO would be at Rs. 1101 crores which is 50 per cent of its equity. And by 2007, the losses would grow to Rs. 2436 crores, wiping its equity completely. For all practical purposes, the GENCO has become sick industry even by the projection of the Government. Unless remedial measures are not taken immediately, it will collapse soon.

### **3.1.6 Conclusion**

Reforms have led to a neglect of capacity addition in the state sector. Much of the addition to the capacity has come through the units of the private sector. Because of the higher fixed charges allowed, high risk premium given and attractive incentives provided to the private sector, capacity addition through the private sector has become a costlier proposition.

Both power purchases and power purchase costs are increasing with the private sector units. Because of the provisions of the PPAs, power procurement has become costlier from the private sector units, ignoring the claims of the cheaper sources of the power. Power procurement from APGENCO, APGPCL, and central stations has been declining year after year. Thus reforms seem to have adversely affected the fortunes of the public generation utilities. Besides, purchase of power at prohibitive costs is also not in the interests of the consumers. Hence, there is a strong case to review all the PPAs and renegotiate with the private sector units to bring down power purchase costs and protect the interests of both public utilities and consumers. There is no rational justification for the discrimination meted out against the APGENCO. The declining power purchases from GENCO are a reflective of the crisis surrounding it. The thermal stations of GENCO are bearing the

brunt of this discrimination against GENCO. While the immediate need in the case of private sector units is to bring down power purchase costs, the urgent issue in the case of GENCO is how to save it from imminent collapse because of the reform policies.

The prices of gas and coal are going to affect the power purchase costs from the IPPs and other units. The APSEB agreed to bear the fuel price variation risk while entering into PPAs with the private sector. Hence, the IPPs are unconcerned about the fuel prices. Hitherto, both gas and coal are under administrative price regime. In the context of market driven regime, fuel prices would increase and power purchase costs soar up with the dismantling of administrative price mechanism. This adversely affects the interests of the consumers. Enough attention so far has not been paid to this problem.

#### **4. Impact on Distribution**

The power sector's key problems are in distribution. Reforms are advocated and considered necessary by many to improve the quality and reliability of power sector on the premise that the public distribution sector has been incurring heavy losses due to ever increasing subsidies, rampant theft and corruption and hence not in a position to raise the necessary capital for capacity addition and investment in T& D system.

The purpose of this section is to examine the impact of the reforms on the distribution front. Transmission and distribution losses, collection efficiency, and arrears of revenue, consumer interface etc are some of the performance indicators. The focus of the reforms has been on improving financial performance of the public utilities. The specific issues examined in this section are the trends in the T&D losses and investments, changes in the consumption pattern and financial performance of the DISCOMs.

##### **4.1 Distribution Sector Reforms**

The following are the key elements of the distribution sector reforms being implemented.

- Rationalization of tariffs through gradual elimination of subsidies and cross subsidies
- Reducing the T&D losses through investment in T&D network and containing theft and pilferage.
- Improving the financial performance of the utilities.

These reform elements can be introduced with or without privatization of distribution business. However, the World Bank gives importance to ownership change. It argues that

privatization would alone reduce political interference, address issues relating to the non performing public utilities and corruption, establish more efficient pricing and reap efficiency gains. Thus improved performance, reduction of losses and streamlining of operations are possible only with privatization in the opinion of the World Bank. Accordingly the World Bank formulated a time table for privatization of DISCOMS in Andhra Pradesh as part of conditionalities under AP Power Restructuring Programme.

As per the reform time table, AP has to privatize the distribution business in a phased manner - privatization of 30 per cent of the business by December 2002 and the entire distribution business by the end of 2007. But nothing has happened. The Government did not attempt to privatize the distribution business so far as stated in the Power Policy Statement of 1997. In fact, the Government suspended the utilization of the World Bank loan after the first stage itself because of the stringent conditions imposed.

In April 2000, the APTRANSCO was unbundled into APTRANSCO, managing the transmission system and four distribution companies (DISCOMs), managing distribution in four zones. The four DISCOMs were issued independent licenses for distribution in April 2001. As per the provisions of E-Act 2003, the bulk supply business or the trading function has to be separated from the transmission function. Consequently, the GOAP has transferred all the PPAs to the DISCOMs, instead of having a separate trading company.

#### 4.2 Allotment of generation capacities

With the implementation of Multi Buyer Model (MBM) in the state from June 9<sup>th</sup>, 2005, each DISCOM has been allocated a certain share of the generating stations contracted by APTRANSCO. Non-conventional Energy sources have been allocated to the DISCOMS based on their locations while the two mini-power plants LVS and Srivatsa have been allocated to EPDCL. The allocation percentages for the different DISCOMS are presented in Table 8.

**Table 8**  
**Allocation of generational capacities**

S.No.	Name of the Distribution Company	Allocation Percentage
1	EPDCL	16.70
2	SPDCL	22.90
3	CPDCL	43.48
4	NPDCL	16.92

Source: ARR filings of the utilities – 2005-06

The actual energy availability for each DISCOM is simply the total generation availability for each source (except NCEs and the mini-power plants) multiplied by the percentage allocation as per MBM.

#### **4.3. Energy handled & sold**

Annexure 4 shows the trends in the Energy Handled and Energy sold.

Total energy handled by the system increased by more than 7 times between 1980-81 and 2005-06. It is by no means a small achievement. During the first period, energy handled increased at an annual rate of 17.5 per cent, while during the second period, it increased at an annual rate of 9.7 per cent. During the third period, energy handled increased at an annual rate of 3.84 per cent only. Thus energy handled by the system increased at a lower annual rate during the third period.

During the first period, energy sold increased at an annual rate 19.57 per cent, whereas, in the second period it increased at an annual rate of 5.04 per cent only. During the third period energy sold increased at an annual rate of 8.2 per cent. When compared to the second period the growth rate is higher, but when compared to the first period, the growth rate is significantly lower.

#### **4.4. Pattern of Electricity Consumption**

Annexure 5 shows the changes that have taken place in the pattern of electricity consumption in the State.

Before the start of the reforms, agricultural consumption stood at 41 per cent, industrial consumption at 24 per cent and domestic consumption at 21 per cent. By the end of 2006, domestic consumption stood at the same level, while agricultural consumption fell to 34 per cent and industrial consumption went up to 30 per cent.

In 1980-81, 63 per cent of the electricity sold in the state was consumed by the industry (both LT&HT together). The industrial consumption has declined over a period of time. It fell to 39.3 per cent by the end of 1991 and further to 20.94 per cent by the end of 2002. During the last four years, the consumption by the industry gradually increased and by 2006, it stood at 30.17 per cent.

Agricultural supplies were metered upto 1982. The slab based tariff in the place of metered tariff led to an enormous growth in the consumption by the agricultural sector. By 1990, agricultural sector became an important sector of consumption but contributed very little to revenue realization. The APSEB has shown that the consumption by agricultural sector rose to about 51 per cent in 1995-96.

As the power supplied to agricultural sector was not metered, it was arrived at after deducting power consumed by the industrial and household sectors from the total supplied and distributing the remaining power between the agricultural sector and T&D losses. In order to show improved performance, the power utilities used to show lesser and lesser T&D losses and more and more agricultural consumption. Thus, a proportion of T&D losses are shown as agricultural consumption. Even after the introduction of reforms, reliable data are not available regarding agricultural consumption and T&D losses.

#### **4.5. Sale of energy category wise**

Annexure 6 shows the trends in the category wise sales of energy. Over a period of time, the proportion of energy consumed by the LT consumers increased. In 1980-81, the LT consumption was 42.46 per cent. By the end of the first period, it rose to 62.25 per cent and it further increased to 73.55 per cent by the end of the second period. However, it fell to around 69 per cent by the end of 2006.

The consumption mix of power in the state has certain adverse consequences. The high proportion of LT consumption and low proportion of HT consumption limited the scope for cross subsidization. The bulk of increase in the purchase of power was to meet the growing demand of low tension, domestic and farm sectors. There being no corresponding increase in the consumption of industry, the burden of cross subsidization fell on the existing industries. They resorted to captive generation to avoid cross subsidization burden.

As the consequence of the reforms, there has been a change in the pattern of consumption. The HT consumption improved during the last two years. For example, during the first period, the sale of energy to the LT increased by more than 4 times while to the HT by 2 times. During the second period, LT sales increased by 71 per cent, while HT sales by 28 per cent only. During the reform period the sales to LT increased by 34.4 per cent, while sales to the HT increased by as much as 84 per cent. Thus, reforms have led to a perceptible increase in HT consumption.

#### **4.6. Transmission and Distribution Losses**

T&D loss consists of transmission loss, which takes place in the transmission system and the distribution loss in the distribution system. Part of the T&D loss is attributable to technical reasons like transformer losses while stepping up or stepping down the voltage and line losses which depend on the length, cross section, etc of the line and the voltage at which the power is carried by the line.

The other part is attributable to the non technical or commercial losses, which arise out of theft of energy as well as non-billing and under-billing. Until fairly recently there has been under-reporting of T&D losses and no proper segregation of technical and non-technical losses. It is only after the initiation of the reforms, the total losses are being reported.

T&D losses directly depend on the precise point in the T&D network with reference to which the loss is computed. Reference point can be the interconnection point at which generated / purchased power is received or at which the distribution system receives the power at 33 kV.

The reform scheme envisaged a two pronged strategy for loss reduction:

- Substantial capital outlay to strengthen the T&D system to overcome the problem of technical inadequacies
- Installation of working meters, energy auditing, billing and collection.

Adequate funding was provided for both. However, there is information asymmetry regarding T&D losses because of the following reasons.

- Non metering of agricultural loads
- Faulty metering at consumer premises
- Continued existence of illegal connections, where there is consumption but not metering
- Average billing practices not yet being fully eradicated.

Consequently, the utilities can report a higher level of consumption by the lower tariff category like agriculture and underreport the T&D losses.

The T&D losses are worked out as the difference of units of power handled and the units of power sold. As the farm sector is not metered, it is not known what part of it is actual consumption by the farm sector and what part of it is on account of theft and other reasons. This means that it is not possible to arrive at a firm figure of T&D losses in A.P.

In 1980-81, the T&D losses stood at 26.19 per cent. By any standard, the T&D losses of this order were very high. During the pre-reform period they were varying between 22 to 28 per cent. They were shown as declining and under control from about 21 per cent in 1990 to about 19 per cent in 1996. However, in the very next year they were shown at 33.33 per cent. They climbed up to 38.95 per cent in 1999-2000. After the initiation of the reforms, they were shown as consistently declining. They fell from 32.92 per cent in 2000-01 to 21.36 per cent in 2005-06 - a fall of 14.26 per cent in just six years. (Annexure 4)

As mentioned earlier, in Andhra Pradesh, all sectors except the farm sector were metered. Metered sales were about 37 per cent only in 1999-2000. They gradually rose and in 2005-06 they stood at 55.21 per cent. Consequently, the percentage of agricultural sales and losses came down from 63.11 per cent to 44.79 per cent. The progress made in metered sales was a post reform achievement.

Table 9 gives details regarding the progress made in metered sales.

**Table 9**  
**Progress in Metered Sales**

Particulars	2000	2001	2002	2003	2004	2005	2006 (Estimate)
	1	2	3	4	5	6	7
Metered Sales (MU)	15581	16037	17247	19137	21409	22785	26601
Agricultural Sales (MU)	10222	10692	12155	12468	11703	11450	13534
Percentage of Metered Sales in (%)	36.89	38.44	40.93	42.49	46.74	50.85	55.21
Percentage of Agri Sales (%)	24.20	25.63	28.84	27.68	25.55	25.55	28.09
Percentage of Agri Sales and losses (%)	63.11	61.56	59.07	57.51	53.26	49.15	44.79

Source: APERC Tariff order – 2004-05, P-169, Table 57

If T&D losses are put under control, it is not necessary to purchase the power on a larger scale from the IPPs at prohibitive cost. In certain years, the T&D losses and units of power purchased from IPPs were almost equal.

### **Investment in the Transmission System**

The T&D system is being modernized to bring down the T&D losses and improve the technical performance of the system. A number of financial institutions like World Bank, OECF/JBIC, DFID, REC and PFC are lending money for this purpose. Under the first power sector restructuring loan under the adaptable loan program of the World Bank (APL-1), funds are provided for financing high priority investments in T&D System. The total project cost of APL-1 was US \$ 281 million, of which US \$ 210 million were financed by the World Bank. The project was implemented from FY 99 to FY 2002. “The

transmission sub project was expected to improve voltage, reduce transmission losses, increase transformer capacity and system reliability. All these benefits are estimated to result in additional energy availability of 1300 gWh. Rehabilitation and expansion of sub transmission and distribution system is expected to reduce technical and non technical losses in the distribution system, improve voltage profile system reliability, efficiency and customer service. These investments are estimated to result in about 1400 gWh of additional sales by FY 2002. The net economic benefits of the project are estimated to be Rs.12 billion and the financial and economic rate of return at 33 per cent and 38 per cent respectively” (World Bank, 1999). The capital assets added on improving the transmission system is shown in Table 10.

**Table 10**  
**Investment (capital assets added) in Transmission system**

<b>Year</b>	<b>Amount spent (Rs crores)</b>	<b>Transmission loss (% reduction)</b>
2001-02	518.90	0.50
2002-03	428.70	0.25
2003-04	311.00	1.00
2004-05	564.00	0.25
Total	1822.60	2.0

Source: [www.pmger.org](http://www.pmger.org), ARR filings of utilities

A total of Rs 1822.6 crores were spent on the transmission system between 2002-05. The transmission losses, however, were reduced marginally from 8.5 per cent in 2002 to 6.5 per cent in 2005. According to the TRANSCO and the GoAP estimates, reduction of 1 per cent losses required an investment of Rs.890 crores. Viewed from this angle, reduction in losses is not commensurate with investment made.

### **Investment in the Distribution System**

Table below shows the Capital assets added on improving the distribution system under the 4 DISCOMs.

A total of Rs 6651.93 crores were spent on improving the distribution system. But the reduction of losses in T&D system is not commensurate with the investment made in the system. Annexure 7 shows the investment in metering, sub stations and transformers between 2000-2005. In spite of all these investments, there has been no respite from huge transmission and distribution losses.

**Table 11**  
**Investment (Capital assets added) in the distribution system**  
(Rs. Crores)

Discom	2001	2002	2003	2004	2005	2006	Total
EPDCL	185.70	198.97	151.48	197.79	222.42	167.17	1123.53
SPDCL	261.32	171.11	194.52	193.91	283.25	276.50	1380.61
CPDCL	404.16	397.11	444.92	426.47	456.19	483.00	2610.85
NPDCL	326.54	206.55	194.58	193.56	287.19	328.52	1536.94
Total	1177.72	973.74	984.50	1011.73	1249.05	1255.19	6651.93

Source: [www.pmger.org](http://www.pmger.org), ARR filings of utilities

The DISCOM wise T&D losses are shown in the following Table.

**Table 12**  
**DISCOM Wise T&D Losses**  
(Percentage)

DISCOM	2001	2002	2003	2004	2005
EPDCL	20.9	17.44	17.0	15.4	15.0
SPDCL	23.79	22.3	21.3	19.34	18.0
CPDCL	33.2	30.2	25.0	22.33	19.86
NPDCL	28.9	23.3	21.3	20.24	19.60
Average	28.5	25.12	22.2	20.14	18.62

Source: [www.pmger.org](http://www.pmger.org), ARR filings of utilities

Among the 4 DISCOMs, the CPDCL is in the limelight as it could bring down its T&D losses by a higher percentage between 2001-05. It became possible because of extensive IT enabled services with large consumers being monitored through web based inter connection, payment of bills through E-Seva counters, easier communication between the consumers and the company and booking of a number of theft cases and recovery of arrears.

Between 2001 and 2005, the distribution losses declined from 28.5 per cent to 18.62 per cent. For a massive investment made in T&D network, it has to be examined whether the loss reduction was commensurate. Besides, the T&D loss figures are not still reliable, since a substantial portion of the T&D losses are being shown as agricultural consumption.

This gives rise to several questions. Whether the investments in T&D network are leading to negative returns? To what extent the investments are necessary and are optimally utilized? Has the potential of reducing non-technical losses through better governance measures been completely explored? It is true that part of the T&D investments is meant for improving the quality and reliability of power supply. There is a need to quantify these. The situation warrants a cost benefit analysis of investments made in the T&D system.

It was assumed that it would be possible to achieve 38 per cent ERR of economic return and 33.3 per cent of ERR of financial return as result of investments made under APPRSP. However, the achievements are far from satisfactory. Besides, the performance of utilities on the capital outlay front has been discouraging. Time overruns are leading to cost over runs by way of increased interest and service payments and also foregone services. According to the CPDCL, considerable reduction in distribution losses have been possible “on account of efficiency improvement measures such as reduction in metering losses, theft by consumers, regulation of agricultural supply and improvement in service provided to the customers”. Then what is the contribution of these investments in bringing down the distribution losses? Even in Orissa, where similar reform programmes are underway, there is no improvement in the T&D system. The losses have increased in spite of massive investments in the T&D system in Orissa.

APCDCL provided circle wise data regarding distribution losses for the period between April and September 2003. Distribution losses were the highest in Hyderabad South at 44.22 per cent, followed by Hyderabad Central at 23.09 per cent. Both these two circles do not have any agricultural loads. In circles like Ananthpur and Nalgonda, where agricultural loads are substantial, the distribution losses were significantly lower at 17.63 per cent and 14.60 per cent respectively.

Metered sales in Hyderabad South Circle were reported to be around 56 per cent. But the distribution losses were around 44 per cent. Where as in Mahaboobnagar District, the metered sales were only 26 per cent, but distribution losses stood at 21 per cent. This means that there had been large-scale theft and pilferage of power in the capital city of Hyderabad in spite of progress made in metering. Thus, there are limits to technical solutions to control T&D losses and focus should be to attend to theft and pilferage. Large-scale theft and pilferage are possible only with the connivance of the employees of the utilities.

In the absence of full metering and full consumer reading, any loss figure will only be approximate. The major contribution of avoidable losses seems to be basically non technical in nature. This would require a strong political will to curb theft. At both TRANSCO and DISCOM levels, technical and commercial losses need to be separated and special efforts have to be made to prevent commercial losses. A MW saved is more than a MW generated, at a much lower cost.

#### 4.7. Financial Performance

The experience of public utilities in Andhra Pradesh seems to be unique in India. They have been performing well in the post reform period even with considerable T&D losses and supply of free power on a large scale to the agricultural sector.

**a) Tariff fixation:** Historically, the social and political considerations outweighed the economic or cost considerations, while fixing the tariffs. In the era of subsidization and populist politics during 70s and 80s, tariffs have become a political expediency. Electoral politics largely determined the tariffs and their announcements. There has been no periodic revision of tariffs to compensate for the increase either in the cost or in the rate of inflation. With the result, the burden of subsidies and cross subsidies increased and the financial health of the SEBs deteriorated.

Rationalization of tariffs has been one of the important objectives of the reforms. The tariff design, according to APERC document on tariff philosophy, has to address itself ensuring the viability of TRANSCO, by reducing external subsidy from the government, establishing the basis for full compensatory tariff and balancing the base structure to reduce cross subsidy. The APERC has been employing the “cost to serve” model using embedded cost for designing the tariffs. Cost to serve includes generation, transmission and distribution costs along with the cost of T&D losses.

The consumers are differentiated on the basis of different critical aspects of electricity consumption such as voltage levels, time of consumption, patterns of usage, number of consumers etc. The above differentiation is captured under the classification of energy consumption, peak demand consumption and customer services.

Energy consumption denotes the amount of energy consumed at a specified voltage level. Voltage levels determine the T&D losses that a particular consumer category is subjected to. Demand factor represents the contribution of consumer category towards the peak demand on the system. Costs incurred by the licensee for meeting the peak demand are allocated in proportion to the contribution of the respective consumer categories to the peak demand. The servicing costs such as reading the meters, billing, collection of revenue etc depend upon the number of consumers in a particular category.

After differentiating the consumers into different categories, the cost components are allocated among the categories and the cost to serve for each category is estimated. The Fully Allocated Cost divided by the sale of that category gives the cost per unit for the concerned consumer category.

The commission has fixed a reasonable ceiling on tariff increases in respect of those categories which are already cross subsidizing other consumer categories. The supplies to agriculture are considered to be interruptible and off-peak supplies. Since it contributes only marginally to the system peak, its cost to serve is low. In fact it is the only category whose cost of service is even lower than the bulk supply tariff.

The main problem with the cost of service estimation is the non-availability of reliable consumer category-wise consumption data as all agricultural consumption is un metered. Some are assessed because of non-existence of quality meters. In one of the DISCOMS, almost 20 per cent of the billed units were on assessed basis. Most other state regulators have used the average cost of supply to determine tariffs and calculate cross subsidies. Tariff and cross subsidy calculated in this manner will be lower than those obtained by using the cost of service model. (Siddhartha Sinha, 2005)

Category wise increase of tariffs from 01-02-1992 onwards was presented in the following table.

**Table 13**  
**Power Tariff - Category Wise Increase from 01-02-1992 Onwards**

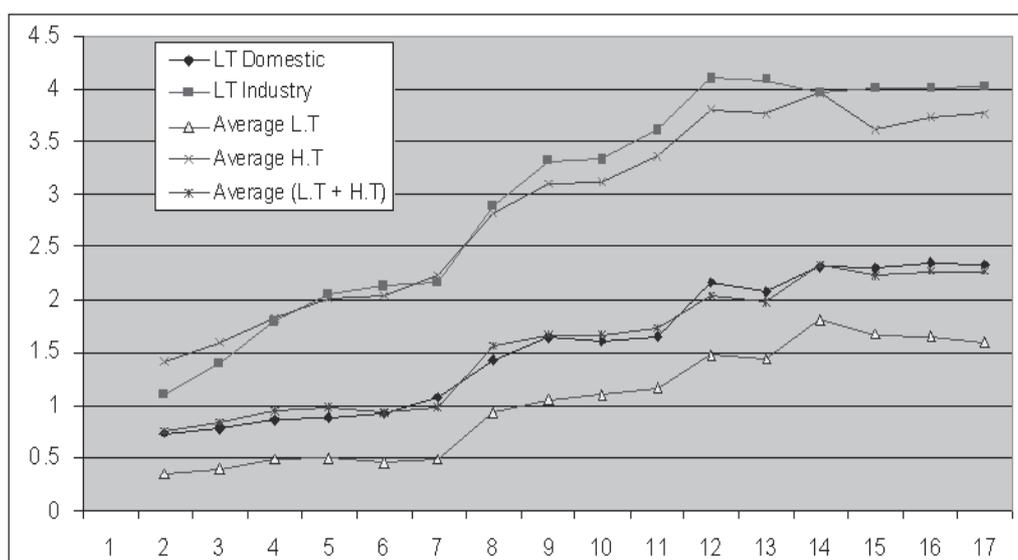
Category	Purpose	Average Realisation Ps/ Unit / Percentage increase over earlier tariff				
		01-12-1992	02-08-1995	01-08-1996	01-01-1999	04-06-2000
LT Cat-I	Domestic	90	119 (32%)	152 (28%)	160+7 (6%)(*)	213 (27%)
LT Cat-II	Non-domestic	190	274 (44%)	356 (30%)	433 (22%)	475 (15%)
LT Cat-III	Industrial	207	252 (22%)	299 (19%)	360 (20%)	418 (13%)
LT Cat-IV	Agricultural	75 to 400 / HP/ Year	50 /HP/ Year	150 to 400 / HP/ Y DPAP: 100 to 400 /HP/Y	150 to 400 / HP/Y DPAP: 100 to 400 /HP/Y	250 to 600 / HP/ Y DPAP: 200 to 550 / HP/Y 35 ps/U (Optional)
HT Cat-I&III	Industrial	226	265 (17%)	331(25%)	400 + 8 (23%)	462 (5%)
HT Cat-II	Non-Industrial	251	315 (25%)	376 (19%)	500 + 8 (35%)	518 (5%)
HT Cat-V	Railway Traction	212	265 (25%)	340 (28%)	420 + 8 (26%)	454 (6%)
LT & HT	Overall Average	102	122 (20%)	162 (33%)	198 (20%)	227 (14.5%)
(*) The increase upto 300 units/ month is		Nil				
(*) The increase for 0 to 400 units/ month is		21%				
(*) The increase for 0 to >400 units/ month is		28%				

Source:- [www.aperc.org](http://www.aperc.org), Power sector status and tariff in Andhra Pradesh, APERC Table No.47

Tariffs were revised on 01-01-1992, 01-12-1992, 02-08-1995, 01-08-1996 and 01-01-1999. APERC after its formation gave its first order on 04-06-2000. Thereafter, there has been revision of tariffs regularly in each financial year. The APERC affected a steep increase of 14.5 per cent in its first order. In subsequent years, the tariff hike has not been as much as the reform plans. The average tariff increased by 0.67 per cent in 2001-02 and 0.71 per cent in 2002-03. However, the average tariff declined by 0.71 per cent in 2003-04 and 1.5 per cent in 2004-05 (Table 15).

The APERC prepared Long Term Tariff Principles (LTTP) in 2002, which envisage a multi year tariff plan. This approach has been incorporated in the E-Act as well. The chief motivation behind this initiative was to reduce regulatory uncertainty and give confidence to utilities or investors. Under this regime, most of the factors which determine tariff are categorised as predictable and fixed at the beginning of a 3-year period. These are typically power purchase costs, capital investment, operation & maintenance etc. These constitute the major items influencing tariff. The factors which are categorised as un-predictable factors are un-foreseen fuel cost changes, policy shifts etc. The impact of these on tariffs is comparatively less. Once the multi-year tariff plan is finalised, there is little role for the regulator or public to influence tariff decisions. With limited regulatory capability and information asymmetry, there are genuine doubts regarding the efficacy of the LTTP. The first tariff order based on multi-year tariff principles issued in March 2005, fixed tariff for the years 2005-6, 2006-7 and 2007-8.

**b) Average Tariff Rates:** Average tariff rates for each category of consumers were obtained by dividing the total sales revenue for each category of consumers by the total units of energy sold to that category. These are presented in Annexure 8



Average rates in Andhra Pradesh have been increasing over the years. Average tariff rate increased at an annual rate of 6.63 per cent during the first period, 11.9 per cent during the second period and 1.79 per cent during the third period. Graph above shows the trend in tariffs between 1991-92 and 2005-06. Major changes can be seen in 1996-97 and 2000-01.

It can be seen from the graph that average tariff increased substantially in 1997 and 2001. There has been a decline in the average tariff from 2004 onwards. The LT domestic tariff and average tariff moved more or less in the same fashion and they were closer to each other. Both LT industry tariff and average HT tariff were higher than average tariff. They were closer to each other and moved in the same fashion. After a significant fall in the HT tariff in 2004, there has been a slight increase in 2005 & 2006. The LT industrial tariff remained stagnant after 2004. The average LT tariff has been much lower than the average tariff. This is mainly because of subsidized tariffs for agriculture.

### **c) Revenue Receipts and Expenditure**

Annexure 9 shows the trends in the revenue and expenditure.

During the first period, the gap between revenue and expenditure was very small. Between 1987 and 1991, the APSEB could eliminate its revenue deficit and made a small profit. This trend continued up to 1993-94. It could make a profit of Rs.87 crores in that year. The very next year, it incurred a huge loss of Rs.857 crores. Thereafter the revenue deficit consistently increased and reached to its peak level of Rs.2418 crores in 1999-2000.

The stated reasons for the huge deficits were heavy subsidization of power to agricultural and domestic consumers and high T&D losses. The agricultural sector which consumed about 40 per cent contributed very little to the revenues. Tables 14 and 15 present data on the expenditure, revenue, subsidy and tariff revision.

The deficit amount at that time was covered partly by cross subsidization during tariff fixation and partly by the Government subsidy. The subsidy provided by the Government was substantial and increasing year after year. In 94-95, Rs. 944 crores was given as subsidy. It rose to Rs. 2672 crores by the end of 2000. Though, the Government had been providing subsidy to the extent of about 30-35 percent of total expenditure to meet the revenue deficit as well as the statutory 3 per cent return on the net fixed assets to the Board, the subsidy amount was mostly adjusted against the Government loans. The Electricity Board did not receive any amount in cash to cover the revenue deficit, resulting in cash crunch and liquidity problems.

**Table 14**  
**Expenditure-revenue-subsidy-tariff Revision**

(Rs. crores)

Description	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000
1	2	3	4	5	6	7
Expenditure	3133	3572	4280	5498	7036	7375
Revenue						
Recovered	2276	2443	3558	4363	4629	4957
Revenue						
Deficit/loss	857	1129	722	1135	2407	2400
3%ROR on Net	87	130	129	122	112	172
Fixed Assets						
Total Subsidy	944	1259	851	1256	2519	2672
Subsidy paid	Equity	Adjusted	Adjusted	Rs.483Cr.	Cash loan	Cash grant of
Adjusted by	written off	against	against	Adjusted	of Rs.545	Rs.105+for
GOAP		loan	loan	against	Cr. Bonds	of Bonds
				loans	Rs.1100Cr.	Rs.3013.24Cr.
					Total	Raised
					Rs.1645Cr.	
Tariff Revision	-	19%	32%	-	10%	-
	-	02.08.95	01.08.96		31.12.98	

Source: [www.aperc.org](http://www.aperc.org), Power Sector Status and Tariff in Andhra Pradesh, Table No: 1

For example, in 94-95 against the subsidy claim of Rs. 944 crores, the equity of the Government in the Utility was written off. In 95-96 and 96-97, the subsidy claims were adjusted against the loans given by the Government to the Board. In 97-98, out of a subsidy claim of Rs. 1256 crores, Rs. 483 crores were adjusted against the loans and Rs. 733 crores were paid as subsidy. The same trend continued in the next two years. Thus before the third period, the subsidy amount was mostly adjusted against the loans. This created problems to the APSEB.

After 2000, the APERC has the responsibility of tariff fixation. The process of tariff fixation and determination of amount of subsidy has become more transparent and participatory. The utilities in each year come to the Regulatory Commission with Tariff proposals, which give their revenue requirements. The APERC scrutinizes them and conducts public hearing on the proposals. The earlier practice of arbitrary fixation of tariff and adjusting subsidy amounts against equity and loans are done away with.

**Table 15**  
**Expenditure-revenue-subsidy-tariff Revision**

(Rs. Crores)

Particulars	20001	2002	2003	2004	2005	2006*
Expenditure						
Expenditure filed by the Licensees	9519.53	8966.94	8578.62	9773.52	10289.11	11812
Expenditure after efficiency gains	7865.31	7783.8	7943.75	9485.7	9354.43	10482
Revenue	6239.39	6222.37	6433.96	7972.27	8052.53	8882
Overall Tariff increase as a %	14.50	0.76	0.71	-0.71	-1.50	-
Cross Subsidy	2177.38	1938.54	1970.93	2109.87	1754.54	2215
Government Subsidy	1626.26	1561.41	1509.38	1513.49	1301.86	1599
Percentage of Cross Subsidy	27.68	24.90	24.81	22.24	18.76	21.13
Percentage of Subsidy	20.68	20.06	19.00	15.96	13.92	15.25

Source: APERC Tariff Orders (2004-05), Pg: 170, Table No.58

\* Tariff Order (2005-06)

Starting from 2001, there has been considerable reduction in the expenditure of TRANSCO and the 4 DISCOMs because of the discipline imposed and monitoring by the Regulatory Commission. There has also been a gradual decline in the cross subsidy from about 28 per cent in 2000-01, to about 19 per cent in 2004-05. The percentage of subsidy has also come down from about 26.68 per cent to 13.29 per cent in 2004-05. As the gap between revenue and expenditure is coming down, there has been a reduction in both subsidy and cross subsidy up to 2004-05. However, both showed an increase, in absolute and relative terms during 2005-06.

In 2001-02, only 75 per cent of the consolidated expenditure other than non cash items like depreciation and extraordinary expenses was recovered through revenues other than subsidies. The recovery ratio has improved above 100 per cent since 2002-03 indicating complete self reliance for cash expenditure. However, power sector subsidies still continue to contribute significantly to the revenue deficit in the state. According to CRISIL report, state revenue deficit in 2004-05 could have been lower by 77 per cent in the absence of such subsidies. But the large size of the state budget and the strong fundamentals are helping the state to sustain power sector subsidies at the current levels.

### **Average revenue realized, and Average cost of power supplied**

Average revenue realized is the total revenue divided by total units sold. Average cost of power supplied is the total expenditure divided by the energy sold.

Annexure 10 and 11 show the trends in the average revenue realized, and average cost of power supplied. The financial health of the utility improves only when the average revenue realized is higher than the average cost of power supplied per kWh. Throughout the study period, the average cost of power supplied per kWh had been higher than the revenue per kWh. During the first period, the average cost of power supplied was slightly higher than the revenue per kWh. During the second period, the gap between the two increased substantially. In 1994-95, the gap between the two stood at 42.88 paise per kWh. It went upto 117.39 paise per kWh in 1998-99 and to 103.18 paise per kWh in 1999-2000.

During the third period, the gap between the average cost of power supplied and the average revenue realized has been coming down. It came down from 89.01 paise in 2000-01 to 17.29 paise in 2002-03. Again it rose to 53.18 paise in 2003-04. However, it fell to 31.65 paise in 2004-05. The gap increased to 40.57 paise in 2005-06.

The average cost of power supplied per kWh increased at an annual rate of 5.8 per cent during the first period while the average revenue realized increased at an annual rate of 6.63 per cent. During the second period, the situation changed. The average cost of power supplied per kWh increased at annual rate of 23.04 while the average revenue realized increased only at the rate of 10.11. During the third period, the average cost of power supplied per kWh in fact declined during the first 3 years of the reform period. Thereafter it rose. On an average, the average cost of power supplied showed a 0.78 per cent decline during the third period. Average revenue realized improved during the third period. It increased at annual rate of 2.58 per cent.

### **Cost recovery from sales**

Unless the gap between the average cost of power and average tariff is filled, the financial viability of the utilities can not be improved. The following figures supplied by APERC provide information regarding cost recovery from sales both before and after the introduction of reforms.

**Table 16**  
**Cost recovery from sales**

Description	Rs/kWh					
	1995	1996	1997	1998	1999	2000
Average cost of unit	1.34	1.51	2.03	2.29	2.78	2.91
Cost recovered from sales	0.98	1.03	1.68	1.82	1.83	1.97
Percentage	72	68	83	79	66	66

Source: [www.aperc.org](http://www.aperc.org), Power Sector Status and Tariff in Andhra Pradesh, Table No. 8

**Table 17**  
**Cost recovery from sales**

Description	2001	2002	2003	2004	2005
Average cost of service (Rs/kWh).	3.24	3.05	2.96	3.03	2.82
Average Revenue Realization (Rs/kWh)	2.09	2.00	2.19	2.34	2.35
Cost Coverage (%)	64	66	74	77	83

Source: [www.aperc.org](http://www.aperc.org), Tariff order (2004-05), P-171, Table No.60

After the introduction of the reforms and regular annual revision of tariff, the cost coverage increased from 64 per cent in 2001 to 74 per cent in 2003 and further to 83 per cent in 2005.

### Collection Efficiency

The Distribution Companies are encouraged by the Regulatory Commission to improve their collection efficiency. With the result, they are able to collect 100 per cent billed revenue over the years. Table 18 gives the details.

**Table 18**  
**Collection Efficiency**

Particulars	2001	2002	2003	2004	2005
Revenue Billed (Rs.Cr)	5987.87	6298.9	7396.83	7666.12	8051.18
Revenue collected (Rs.Cr)	5678.95	6336.59	7260.59	7078.33	8051.18
Percentage of Revenue collection	94.84	100.60	98.16	92.33	100.00

Source: APERC Tariff Order 2004-05

The DISCOMs made lot of progress in collection efficiency. This became possible due to better management practices, governmental support and extensive use of information technology. The DISCOMs are claiming that they have achieved collection efficiency of over hundred per cent. In spite of these claims, the arrears receivable by the DISCOMs are a matter of concern and they are increasing year after year. Arrears Receivables and Payables by the 4 DISCOMs are presented in Table 19 and 20.

**Table 19**  
**Arrears Receivables by DISCOMs** (Rs. Crores)

DISCOM	2001	2002	2003	2004	2005
EPDCL	225.54	201.89	202.31	133.97	164.72
SPDCL	300.28	267.62	316.07	314.41	373.59
CPDCL	904.01	850.38	914.23	993.18	1363.75
NPDCL	322.88	306.65	368.30	490.23	606.52
TOTAL	1752.71	1626.54	1800.91	1931.79	2508.58

Source: ARR filings of utilities

**Table 20**  
**Arrears Payables by DISCOMs** (Rs. Crores)

DISCOM	2001	2002	2003	2004	2005
EPDCL	4.71	74.42	42.13	83	129
SPDCL	0.22	95.23	42.18	42	107
CPDCL	235.56	244.70	252.90	849	1011
NPDCL	82.01	86.67	101.05	197	204
TOTAL	322.50	501.02	438.56	1171	1451

Source: ARR filings of utilities

As it is clear from the above table, the receivables of the DISCOMs are several times higher than their payables. DISCOMs are prompt in their payables, but they are not showing equal interest to collect the arrears due to them. In order to bridge the gap between their cash inflows and outflows, they are resorting to market borrowing which are increasing their burden of interest. The interest payments of DISCOMs are increasing year after year from Rs. 331 crores in 2003 to Rs 456 crores in 2005. The arrears of DISCOMs increased from Rs. 1752.71 crores to Rs. 2508.58 crores between 2001 and 05 i.e., an increase of about 43 per cent. It is reported that more than half of the arrears were due for more than one year and a substantial proportion of arrears were due from the HT consumers whose

number is small. Hence the DISCOMs have to pay attention to collect the huge amount of arrears due to them and thereby reduce their burden of interest payments.

#### **4.8 Rural Electrification**

Village electrification, pump set energisation and rural household electrification are three simple indices to measure rural electrification. AP had achieved 100 per cent electrification of villages even before reforms started. Release of connections to agriculture pump sets is being taken up on a rationed basis, since the agriculture tariff is low. Duration of power supply to pump sets has also been restricted as per the convenience of the utility. The reform program had no special focus on rural household electrification. Even though AP is one of the 10 states to have achieved 100 per cent village electrification, only 59.65 per cent rural households (numbering to 1.27 crores) have been electrified (2001). Projects to electrify the remaining have been taken up only recently under the Rajiv Gandhi Grameen Vidyutikaran Yojana, a scheme initiated by the Central government.

#### **4.9 Free Power to Agriculture**

Irrigation under wells with pumpsets energised by electricity has come to have an important place in Andhra Pradesh, particularly since mid-80s when HP slab based tariff was introduced and billing on the basis of meter reading was done away with. Pumpset irrigation was promoted in order to enhance agriculture production and achieve food security (Now it has come full circle with rice cultivation during rabi is prohibited under well irrigation). Well irrigation has become an important source of irrigation in the state. 43.34 per cent of irrigated area in AP is under wells. Canal irrigation with 32.27 per cent comes next. In the dry areas of Telangana and Rayalaseema, where scope for surface irrigation is limited, it has become the main source of irrigation.

According to the published figures, the total number of electrified pumpsets number more than 23 lakhs. The same sources also claim that since the announcement of free power supply to agriculture more than 3 lakh unauthorised pumpsets are added to the agriculture load. More than two million families are having stakes in pumpset irrigation. During the general elections in 2004, free power to agriculture had become an important poll plank for Congress and its allies. The fact that the file on free power was the first one signed by the newly elected Chief Minister Dr. Y.S.Rajasekhara Reddy shows the importance bestowed on it by the new government.

Opponents of this measure and proponents of reforms contended that this would lead to collapse of the sector in the absence of credit/financial sources, and predicted that electric lines would be used to dry clothes. But nothing like such a situation materialised. As mentioned in other part of this paper GoAP withdrew from the World Bank project during

Telugu Desam regime as the utilities could source funds at lower interest rates compared to the World Bank. During the present Congress regime also the utilities are able to access required funds. AP utilities continue to be rated one of the best in the country despite supply of free power to agriculture.

One important question that surfaced at the time of introduction of free power was how to meet its expenditure. All the four DISCOMs together were receiving nearly Rs. 400 crore as revenue from agricultural connections. The Congress leadership claimed that it would save that much by renegotiating the PPAs with the four IPPs in the state. Immediately after government formation a Committee with Mr. K. Rosaiah, Finance Minister as Chairman was formed to renegotiate PPAs. But nothing significant has come out of this.

Instead, the number of hours of supply to agriculture are reduced from 9 hours to 7 hours. With the reduction of hours of supply, effective consumption by agriculture might have come down. To that extent on the one hand subsidy burden might have come down and on the other the scope for cross subsidy might have increased. This may be one of the reasons for the absence of a commensurate increase in the government subsidy because of free power to agriculture.

In spite of reduced hours of power supply, DISCOMs have been showing increased power consumption under agriculture connections. This only shows that T&D losses continues to be shown as a part of agricultural consumption in the same way APSEB had done before 1999. This implies that a part of government subsidy goes to meet T&D loss expenditure.

An important argument against free power supply to agriculture is that it does not address equity considerations. This subsidy is accessible to only those who own pump sets. The same argument shall apply to surface irrigation also. The public funds were used to create surface irrigation infrastructure. However in the case of well irrigation, all the expenditure was borne by the farmers themselves. A large number of small and marginal farmers also have taken up well irrigation. As if to address some of these issues and also to limit the expenditure on this, the GoAP introduced some conditionalities. Some of them fall under DSM measures. Pump set farmers are required to install capacitors and friction less foot valves by March 2006 and HDPE pipes and ISI standard motors by March 2008. These measures were expected to lead to considerable saving in power consumption in the agricultural sector. Along with this, those who have more than 3 pumpsets, those whose pumpsets are located in command areas and corporate farmers were made to pay tariff.

Farmers are taking up bore well irrigation as an escape from uncertainties of dry land agriculture. But with indiscriminate exploitation of ground water in the absence of proper regulation, this also proved to be a wrong solution. The uncertainties of dry land agriculture

also began to haunt bore well irrigation as both depend on rain fall and bore well water extraction exceeded water recharge capacity. A large number of farmers who committed suicide were those who borrowed heavily to drill bore wells. Over exploitation of ground water has its environmental impacts as well. Many bore wells used for drinking water have begun to yield water with fluoride. The presence of fluoride water has spread to many districts with extensive bore well irrigation apart from the districts that are traditionally affected by fluoride like Nalgonda and Prakasam. Regulation of free power supply may be needed more because of its impact on the environment rather than on the financial health of the power sector.

#### **4.10 Conclusion**

At the time of initiation of the reforms, privatization of distribution was considered both by the World Bank and the State Government as the best option, if not the only solution to reduce the high non technical losses which plague the sector and improving the quality and reliability of power supply and customer services.

According to the original time table, the DISCOMs have to be fully privatized by this time. The Naidu regime which initiated the reforms and believed in the privatization did not attempt to privatize the DISCOMs. Moreover, it suspended the utilization of the World Bank loan after the first stage itself in 2003 – the utilization of further loan facility might have forced the Government initiate steps towards privatization. The popular opposition to the World Bank induced reforms and the adverse experience of Orissa with private power distribution companies might have forced the policy makers to have second thoughts about the efficacy of privatization.

In the meanwhile, the performance of the DISCOMs in the state improved. The achievements made in metered sales and collection efficiency coupled with considerable reductions in expenditure due to ‘efficiency gains’ have improved the financial performance of the DISCOMs. Reforms have also led to a perceptible increase in HT consumption. All these factors have had a positive impact. Consequently, the subsidy levels both in gross terms and as a percentage of revenues of the utilities and the state budgets have declined considerably. Now the major challenge before the DISCOMs is how to sustain these gains.

However, there are some important areas of concern. Firstly, in spite of massive investment in T&D system, the losses continue to be on the higher side. Even today, there are no reliable information and data regarding the exact levels of T&D losses. They are at best approximations only. Secondly, the reforms initiated had no specific focus on rural electrification. Thirdly, the DISCOMs are unable to supply power regularly as promised for 7 to 9 hours to the agriculture. Farmers, mostly the small and marginal ones are affected

due to the irregular and low quality supplies of power. Fourthly, the transfer of PPAs to the DISCOMs is defeating the very purpose of functional specialization sought to be achieved through the reforms. Fifthly, though the consumer interface improved during the post reform period, the power utilities have yet to gain the public confidence. Sixthly, the focus of the reforms implemented so far has been on improving the technical and financial performance. They have not addressed the issues relating to the continuing problems of access, environment and improved governance.

## **Policy Issues**

### **5.0 Privatization of Distribution**

Privatization of distribution has been advocated by the World Bank to achieve rationalization of tariffs, reduce T&D losses and improve the performance of the utilities. Even without privatization, there has been significant progress on all these fronts in the state. The A.P. Electricity Regulatory Commission, since its establishment has been seriously engaged in the exercise of rationalization of tariffs and evolving and introduction of cost based tariffs. Similarly, regulatory intervention forced the DISCOMs to prune their expenditure levels and improve their collection efficiency. The financial performance of the DISCOMs improved considerably during the post reform period. As pointed out by the rating agencies, AP power utilities outperformed their counterparts in other states continuously in a row for four years – 2003, 2004, 2005 and 2006.

Another important element of reforms is achieving marked reduction in T&D loss levels. In this context, it is necessary to carefully examine the competitive advantage of private ownership over public ownership in containing theft and reducing technical losses and bring in more transparency and accountability in the functioning.

The experience of privatization of distribution in Orissa and Delhi has not been inspiring confidence. In both the states, there is no large scale or significant part of agricultural consumption. Even without problems generally associated with rural electrification and agricultural consumption, the performance of the distribution companies in the two states is far from satisfactory, even from a limited financial angle.

The experience of Orissa which privatized the entire distribution business is revealing in this context. According to the Kanungo Committee on power sector reforms in Orissa, “billing and collection efficiency under privatized DISCOMs far from improving actually worsened and rampant theft of electricity continued unabated”. Bills received often were erroneous and what is worse the complaints in this regard hardly get prompt response. In the post reform period there has been a significant increase in the number of consumers in Orissa, but for want of follow up in billing and collection, the increase in the number of consumers have not contributed significantly to the revenues of the distribution companies,

though there has been significant increase in tariffs for domestic and commercial consumers. The private sector neither brought superior management skills nor did they arrange financial support by way of strengthening working capital for the companies, according to the Kanungo Committee. (Kanungo Committee Report, 2001)

Not only, that in the process of privatization, various structural flaws crept into the power sector of Orissa. Distribution companies in three regions were sold to a single company – Bombay Suburban Electricity Supply (BSES) and the fourth one was sold to AES, an American electricity generation company. Thus, the process of privatization has led to the emergence of horizontal monopoly by BSES in three regions and vertical monopoly in electricity generation and distribution by AES in the central region. Privatization reforms in Orissa ultimately led to the emergence of private monopolies in the place of public monopoly. Yet, the functioning of the utilities has not improved.

In contrast to this, AP could successfully bring down the T&D loss levels from the past unsustainable levels to the present levels under the oversight of the regulator. The billing and collection efficiency have also improved considerably when compared to the past. Maharashtra also achieved the same fete. Among the southern states, Tamilnadu is doing the best albeit without reforms, AP next and Karnataka the worst, although the latter two are the most reforming states. Hence, one has to be sceptical about the claim that ownership change would alone improve the performance of the distribution sector.

### **5.1 Limitations of the World Bank Model**

There is a view point that the World Bank reforms are a must, and they will succeed if sufficient testing, caution and insurance against design errors are there. The World Bank model is being criticized by many on the ground, that unbundling and privatization have no empirical justification anywhere in the world and they are insisted and imposed upon purely on ideological grounds.

Electricity industry has been considered as a natural monopoly until recently. In order to increase efficiency in the power sector, the standard prescription is to separate the natural monopoly elements so that competition can be introduced in generation and retail supply. However, electricity has certain unique features which distinguishes it from other industries–electricity can not be stored and there should be continuous demand supply matching. Demand is largely price inelastic and supply can be switched on and off easily by the supplier.

An integrated system can handle the above features more effectively. However, in principle, an unbundled system can also establish systems to tackle the problems of integrated operation of the whole system. But the challenge is different for unbundled system and requires special attention.

Privatization has been advocated by the World Bank as a panacea for all the ills of the power sector. Private sector will not have any incentive or compulsion to bring down their costs and prices in the absence of either effective competition or regulation (Amol Phadke & Sudheer Chella Rajan, 2003).

The experience of restructuring has come from countries and systems with surplus capacity. Deregulation has not proved to be a success under conditions of shortage. Hence one has to be careful about the World Bank prescriptions. A strong role for the state and regulation is there because of the unique characteristics of electricity.

Effective regulation of the utilities (private or public) is a daunting challenge in the Indian context. The limited experience with generation privatization and regulatory processes has revealed the limitations of regulation in disciplining the private sector in effecting cost reductions. The effectiveness of regulation depends upon the independence of the regulator, regulatory capacity within the Commission, transparency and effective public participation. Hence, development of regulatory and public participation capacity needs to be at the forefront of further reforms.

There can be competition without privatization. Privatization is a separate agenda by itself. If privatization is pursued as a goal by itself as advocated by the World Bank, we may move from inefficient public ownership towards rent extracting private oligarchies with painful costs all the way. Moreover, economic efficiency (as advocated as the primary objective in this model) can not alone be the sole objective of reforms in the power sector. There are other equally important objectives such as equity, access, self reliance, environmental soundness, and long term sustainability.

The AP experience shows that irrational licensing of too many gas based power projects (without proper gas linkages) and excessive investments in T&D system can become a burden on the consumer. The experience also shows that public utilities can improve performance, given the right kind of environment. The cases of APTRANSCO and DISCOMs highlight this aspect. Given the right support (instead of neglect), the generation sector can also perform under the public ownership. Reviewing the Power Purchase Agreements and reducing commercial losses further are necessary to improve the performance of the utilities in the state to serve the consumers efficiently.

Given a level playing field, supporting environment and required resources, public sector can improve performance. Presence of checks and balances through public pressure, and the attitude of the state to accommodate them can play a key role in avoiding gross mistakes and introducing pro-public steps by these utilities.

## Annexure 1

**PROGRESS OF INSTALLED CAPACITY IN THE STATE SECTOR  
INDEX NUMBERS**

*(MW)*

	Year	Hydel	Index	Thermal	Index	Index	Index
	1	2	3	4	5	6	7
Pre Reform Period	<b>80-81</b>	<b>1043</b>	<b>100</b>	<b>1260</b>	<b>100</b>	<b>2303</b>	<b>100</b>
	81-82	1043	100	1260	100	2303	100
	82-83	1495	143.34	1248	99.05	2743	119.11
	83-84	1660	159.16	1248	99.05	2908	126.27
	84-85	1971	188.97	1193	94.68	3164	137.39
	85-86	2182	209.2	1193	94.68	3375	146.55
	86-87	2411	231.16	1193	94.68	3604	156.49
	87-88	2431	233.08	1193	94.68	3624	157.36
	88-89	2431	233.08	1193	94.68	3624	157.36
	89-90	2431	233.08	1403	111.35	3834	166.48
	90-91	2461	235.95	1613	128.02	4074	176.9
Reform Period	<b>91-92</b>	<b>2462</b>	<b>236.05</b>	<b>1613</b>	<b>128.02</b>	<b>4075</b>	<b>176.94</b>
	92-93	2524	241.99	1613	128.02	4137	179.64
	93-94	2605	249.76	2033	161.35	4638	201.39
	94-95	2665	255.51	2453	194.68	5118	222.23
	95-96	2666	255.61	2453	194.68	5119	222.28
	96-97	2666	255.61	2703	214.52	5369	233.13
	97-98	2666	255.61	2953	234.37	5619	243.99
	98-99	2666	255.61	2953	234.37	5619	243.99
	99-2k	2681	257.05	2953	234.37	5634	244.64
Post Reform Period	<b>2000-01</b>	<b>2682</b>	<b>257.14</b>	<b>2953</b>	<b>234.37</b>	<b>5635</b>	<b>244.68</b>
	2001-02	2982	285.91	2953	234.37	5935	257.71
	2002-03	3432	329.05	2963	235.16	6395	277.68
	2003-04	3586	343.82	2973	235.95	6559	284.8
	2004-05	3587	343.91	2973	235.95	6560	284.84
	2005-06	3588.36	344.42	2962.5	235.12	6550.86	284.45

Source1: Power Development In Andhra Pradesh (Statistics) 2003-04, APTRANSCO Page No.68 B  
Tariff Orders for different years

## Annexure 2

## PROGRESS OF INSTALLED CAPACITY IN THE PRIVATE SECTOR

(MW)

Co-Generation									
Year	Gas	Hydel Mini	Wind	Bio-Gas	Bio-Mass	Bio-Mass Project	Mini Plants	Others	Total
1	2	3	4	5	6	7	8	9	10
96-97	232.7	3.75	51.24		1.5				289.19
97-98	423.9	15.75	52.74		1.5				493.89
98-99	423.9	27.25	58.74	9	1.5	1		41	562.39
99-00	423.9	43.45	84.99	14	1.5	1	40.31	43.7	652.85
2000-01	778.9	62.35	88.74	15.5	6.7	29	40.31	43.7	1065.2
2001-02	918.9	76.95	90.43	37.5	9.7	73.5	78.11	62.1	1347.19
2002-03	998.9	80.26	90.43	89.5	16.7	119.5	93.5	65.1	1553.89
2003-04	998.9	84.26	90.43	114.5	20.43	165.5	93.5	82.7	1650.22

Source: Power Development In AndhraPradesh (Statistics) 2003-04, APTRANSCO Pg. No.33

## Annexure 3

ENERGY GENERATION- STATE SECTOR  
INDEX NUMBERS

(MU)

	Year	Hydel	Index	Thermal	Index	Index	Index
	1	2	3	4	5	6	7
Pre Reform Period	<b>80-81</b>	<b>3680</b>	<b>100</b>	<b>3596</b>	<b>100</b>	<b>7276</b>	<b>100</b>
	81-82	3984	108.26	5093	141.6296	9077	124.75
	82-83	4684	127.28	5562	154.6719	10246	140.82
	83-84	5092	138.37	5909	164.3215	11001	151.2
	84-85	6716	182.5	5835	162.2636	12551	172.5
	85-86	5453	148.18	6772	188.3204	12225	168.02
	86-87	6517	177.09	7282	202.5028	13799	189.65
	87-88	5864	159.35	7986	222.0801	13850	190.35
	88-89	6878	186.9	7263	201.9744	14141	194.35
	89-90	7802	212.01	7222	200.8343	15024	206.49
90-91	10017	272.2	8102	225.3059	18119	249.02	
Reform Period	<b>91-92</b>	<b>9516</b>	<b>258.59</b>	<b>8726</b>	<b>242.6585</b>	<b>18242</b>	<b>250.71</b>
	92-93	8758	237.99	9114	253.4483	17872	245.63
	93-94	9633	261.77	9639	268.0478	19272	264.87
	94-95	9687	263.23	10842	301.5017	20529	282.15
	95-96	6662	181.03	15103	419.9944	21765	299.13
	96-97	7970	216.58	16720	464.9611	24690	339.33
	97-98	7245	196.88	19019	528.8932	26264	360.97
	98-99	7189	195.35	19834	551.5573	27023	371.4
	99-2k	8133	221.01	21499	597.8587	29632	407.26
Post Reform Period	<b>2000-01</b>	<b>7231</b>	<b>196.49</b>	<b>21934</b>	<b>609.9555</b>	<b>29165</b>	<b>400.84</b>
	2001-02	5757	156.44	22245	618.604	28002	384.85
	2002-03	3337	90.68	23033	640.5172	26370	362.42
	2003-04	2959	80.41	22455	624.4438	25414	349.29
	2004-05	5283.46	143.56	21176.40	588.89	26459.86	363.66
	2005-06	8031.6	218.45	18238.35	229.09	26269.95	361.04

Source: Power Development In Andhra Pradesh (Statistics) 2003-04,  
APTRANSCO Page No.68c, and Tariff orders for different years

## Annexure 4

## TRENDS IN THE ENERGY HANDLED AND ENERGY SOLD

	Year	Energy handled MU	Energy Sold MU	T & D Losses MU	T & D Losses as % of Energy handledEnergy
	1	2	3	4	5
Pre Reform Period	<b>80-81</b>	<b>6915</b>	<b>5104</b>	<b>1811</b>	<b>26.19</b>
	81-82	8551	6093	2458	28.75
	82-83	9647	7099	2548	26.41
	83-84	10520	7717	2803	26.64
	84-85	12717	9231	3486	27.41
	85-86	13730	10312	3418	24.89
	86-87	15217	11761	3456	22.71
	87-88	14872	11669	3203	21.54
	88-89	16305	13050	3255	19.96
	89-90	18342	14435	3907	21.3
	90-91	20233	16093	4140	20.46
Reform Period	<b>91-92</b>	<b>22549</b>	<b>17750</b>	<b>4799</b>	<b>21.28</b>
	92-93	24416	19227	5189	21.25
	93-94	26863	21204	5659	21.07
	94-95	28629	23095	5534	19.33
	95-96	29149	23562	5587	19.17
	96-97	31600	21067	10533	33.33
	97-98	35818	23944	11874	33.15
	98-99	37612	25224	12388	32.94
	99-00	42238	25803	16435	38.9
Post Reform Period	<b>2k-01</b>	<b>41716</b>	<b>26729</b>	<b>14987</b>	<b>35.4</b>
	2k1-02	42142	29402	12740	30.23
	2k2-03	45042	31605	13437	29.83
	2k3-04	45806	33112	12694	27.71
	2k4-05	51150	37623	13527	23.6
	2k5-06	51338	39885	11453	21.36

Source: Figures Upto 1994-95 Power Development In Andhra Pradesh (Statistics) 2003-04, , APTRANSCO, Pg:159 and Tariff orders for different years

## Annexure 5

## PATTERN OF ELECTRICITY CONSUMPTION(%)

	Year	Domestic	Commer- cial	Agri- cultural	Industrial (L.T+H.T)	Railway Traction	Others	Total
	1	2	3	4	5	6	7	8
Pre Reform Period	<b>80-81</b>	<b>10.7</b>	<b>4.23</b>	<b>18.44</b>	<b>63.07</b>	<b>0.98</b>	<b>2.59</b>	<b>100</b>
	84-85	11.34	3.47	26.44	54.89	1.97	1.9	100
	85-86	11.59	3.3	25.28	54.78	2.03	3.03	100
	86-87	11.92	3.19	28.79	50.89	2.29	2.92	100
	87-88	13.13	3.38	34.43	43.25	2.01	3.8	100
	88-89	13.43	3.18	34.45	43.28	2.1	3.56	100
	89-90	13.36	3.09	36.83	41.08	2.22	3.42	100
	90-91	12.79	3.16	38.62	39.03	2.18	4.22	100
Reform Period	<b>91-92</b>	<b>14.05</b>	<b>3.18</b>	<b>40.37</b>	<b>38.95</b>	<b>2.17</b>	<b>1.28</b>	<b>100</b>
	92-93	14.69	3.17	41.28	34.83	2.4	3.63	100
	93-94	15.04	3.18	42.8	32.41	2.59	3.98	100
	94-95	14.01	2.93	47.81	29.17	2.59	3.49	100
	95-96	14	3.01	48.85	27.55	2.7	3.89	100
	96-97	18.17	3.8	37.57	32.42	3.28	4.76	100
	97-98	19.1	3.9	39.46	26.41	3.58	7.55	100
	98-99	20.34	4.17	39.59	26.46	3.39	6.05	100
	99-2k	20.93	4.35	40.79	23.54	3.4	6.99	100
Post Reform Period	<b>2k-01</b>	<b>21.71</b>	<b>4.54</b>	<b>40.78</b>	<b>22.84</b>	<b>3.39</b>	<b>6.74</b>	<b>100</b>
	2001-02	22.89	4.78	41.53	20.94	3.28	6.57	100
	2002-03	22.06	4.85	39.42	21.39	3.38	8.43	100
	2003-04	21.12	4.87	37.07	25.9	3.32	7.72	100
	2004-05	20.71	4.87	34.73	27.97	3.12	8.6	100
	2005-06	21.4	5.19	33.93	30.17	3.05	8.26	100

Source: Power Development In AndhraPradesh (Statistics)  
2003-04, AP TRANSCO Page NO.89 and Tariff orders for different years

## Annexure 6

SALE OF ENERGY CATEGORY WISE  
INDEX NUMBERS

(MW)

	Year	Total L.T	Index	Total H.T	Index	Total	Index
	1	2	3	4	5	6	7
Pre Reform Period	<b>80-81</b>	<b>2167</b>	<b>100</b>	<b>2937</b>	<b>100</b>	<b>5104</b>	<b>100</b>
	81-82	2336	107.8	3757	127.92	6093	119.38
	82-83	2979	137.47	4120	140.28	7099	139.09
	83-84	3357	154.91	4360	148.45	7717	151.2
	84-85	4405	203.28	4826	164.32	9231	180.86
	85-86	4876	225.01	5436	185.09	10312	202.04
	86-87	5925	273.42	5836	198.71	11761	230.43
	87-88	6756	311.77	4913	167.28	11669	228.62
	88-89	7573	349.47	5477	186.48	13050	255.68
	89-90	8701	401.52	5734	195.23	14435	282.82
90-91	10018	462.3	6075	206.84	16093	315.3	
Reform Period	<b>91-92</b>	<b>11110</b>	<b>512.69</b>	<b>6640</b>	<b>226.08</b>	<b>17750</b>	<b>347.77</b>
	92-93	12565	579.83	6662	226.83	19227	376.7
	93-94	14188	654.73	7016	238.88	21204	415.44
	94-95	16172	746.29	6923	235.72	23095	452.49
	95-96	16796	775.08	6604	224.86	23400	458.46
	96-97	14009	646.47	7058	240.31	21067	412.75
	97-98	16554	763.91	7390	251.62	23944	469.12
	98-99	17695	816.57	7144	243.24	24839	486.66
	99-2k	18978	875.77	6824	232.35	25802	505.53
Post Reform Period	<b>2k-01</b>	<b>20464</b>	<b>944.35</b>	<b>6743</b>	<b>229.59</b>	<b>27207</b>	<b>533.05</b>
	2001-02	22709	1047.95	6840	232.89	29549	578.94
	2002-03	23791	1097.88	7840	266.94	31631	619.73
	2003-04	24607	1135.53	9839	335	34446	674.88
	2004-05	26448.12	1220.49	11178.35	380.6	37626.47	737.19
2005-06	27503.47	1269.17	12382	421.59	39885.47	781.45	

Source: Power Development In Andhra Pradesh (Statistics)

2003-04, APTRANSCO Page No: 128 and Tariff orders for different years

## Annexure 7

## INVESTMENTS IN METERING, SUBSTATIONS AND TRANSFORMERS

Particulars	2000-01	2001-02	2002-03	2003-04	2004-05
Investments					
Investments in the sector(Rs.Crs)	937.91	982.46	1317.11	1137.51	1435.72
Total Investments in 5 years					5810.71
Average Investments in 5 years (Rs.Crs)					1162
Meters installed					
No.New Meters installed	1784508	506612	610207	609952	N.A.
No.of Defective Meters replaced	2218630	511846	719713	519483	N.A.
Transformers					
Total Transformers	201801	216453	242668	295313	N.A.
Transformers failed	58661	52663	47224	31338	N.A.
Transformers failures%	29.07%	24.33%	19.46%	10.61%	N.A.
Sub-Stations					
400KV	200.00%	300.00%	3	300.00%	4
220KV	6300.00%	6900.00%	73	7500.00%	77
132KV	18000.00%	18700.00%	191	19900.00%	208
33KV	186200.00%	194100.00%	2123	226700.00%	2318
Theft Cases					
No.of Theft cases Detected	18505	35536	108869	84774	N.A.
No.of Cases prosecuted	18505	35536	108869	84774	N.A.
Losses in the system	35.93%	30.23%	29.83%	27.71%	23.60%

Source: Tariff order 2004-05, Pg.169, Table no.56

## Annexure 8

## Average Tariff Rates

(Rs.)

YEAR	L.T											Average H.T	Average (L.T + H.T)
	Category I	Category II	Category III	Category IV	Category V	Category VI	Category VII	Category VIII	Average L.T				
	1	2	3	4	5	6	7	8	9	10	11		
1983-84	0.52	1.01	0.57	0.37	0.09	0.50	0.67	1.05	0.37	0.58	0.49	0.58	
1984-85	0.47	0.97	0.60	0.41	0.06	0.51	0.65	1.00	0.31	0.75	0.54	0.75	
1985-86	0.47	0.96	0.62	0.35	0.06	0.50	0.66	1.15	0.31	0.72	0.53	0.72	
1986-87	0.47	0.97	0.63	0.36	0.05	0.50	0.65	1.75	0.28	0.71	0.49	0.71	
1987-88	0.52	1.08	0.78	0.39	0.05	0.53	0.75	1.70	0.30	1.01	0.6	1.01	
1988-89	0.54	1.15	0.82	0.37	0.04	0.52	0.86	1.70	0.31	1.04	0.62	1.04	
1989-90	0.63	1.29	0.97	0.45	0.04	0.60	1.06	1.56	0.34	1.19	0.67	1.19	
1990-91	0.73	1.35	1.1	0.53	0.03	0.64	1.16	2.05	0.36	1.42	0.75	1.42	
1991-92	0.78	1.55	1.4	0.64	0.03	0.69	1.23	6.80	0.40	1.59	0.84	1.59	
1992-93	0.86	1.80	1.8	0.76	0.08	0.74	1.12	16.2	0.49	1.83	0.95	1.83	
1993-94	0.89	1.90	2.06	0.76	0.06	0.75	1.45	12.00	0.50	2.01	0.99	2.01	
1994-95	0.92	1.96	2.14	0.87	0.05	0.76	1.46	4.07	0.46	2.04	0.93	2.04	
1995-96	1.07	2.32	2.16	0.93	0.03	0.87	1.65	6.35	0.49	2.23	0.98	2.23	
1996-97	1.43	3.28	2.88	1.29	0.13	1.13	2.11	6.33	0.94	2.83	1.56	2.83	
1997-98	1.65	3.69	3.31	1.39	0.16	1.54	2.14	10.25	1.06	3.10	1.68	3.10	
1998-99	1.62	3.81	3.33	1.44	0.43	1.19	2.25	5.12	1.10	3.12	1.67	3.12	
1999-2K	1.66	4.43	3.61	1.37	0.15	1.19	2.56	5.39	1.17	3.36	1.74	3.36	
2000-01	2.16	5.59	4.1	1.78	0.21	1.89	3.71	6.29	1.48	3.81	2.05	3.81	
2001-02	2.07	5.84	4.08	1.95	0.17	1.95	4.1	6.36	1.45	3.77	1.98	3.77	
2002-03	2.32	5.87	3.96	1.87	0.66	2.01	4.1	6.80	1.81	3.96	2.34	3.96	
2003-04	2.31	5.95	4.01	1.95	0.33	1.94	4.18	6.48	1.67	3.61	2.22	3.61	
2004-05	2.35	5.8	4.01	1.86	0.3	1.75	4.12	7.03	1.66	3.73	2.28	3.73	
2005-06	2.34	5.74	4.03	1.95	0.03	1.71	4.06	6.22	1.59	3.76	2.27	3.76	

Source: Figures Upto 2003-04 Power Development In Andhra Pradesh (Statistics), 2003-04, APTRANSCO  
For 2004-05 & 06 - APERC Tariff Orders

## Annexure 9

## Revenue Receipts, Expenditure, Revenue deficit/loss

(Rs. Crores)

	Year	Revenue	Expenditure	Rev.Deficit/loss
	1	2	3	4
Pre Reform Period	<b>83-84</b>	<b>395</b>	<b>400</b>	<b>-5</b>
	84-85	520	471	49
	85-86	569	579	-10
	86-87	615	669	-54
	87-88	737	708	29
	88-89	833	786	47
	89-90	1016	1013	3
	90-91	1263	1221	42
Reform Period	<b>91-92</b>	<b>1563</b>	<b>1549</b>	<b>14</b>
	92-93	1936	1856	80
	93-94	2303	2216	87
	94-95	2276	3133	-857
	95-96	2443	3572	-1129
	96-97	3559	4280	-721
	97-98	4363	5498	-1135
	98-99	4629	7036	-2407
99-2k	4957	7375	-2418	
Post Reform Period	<b>2k-01</b>	<b>6239</b>	<b>7865</b>	<b>-1626</b>
	2001-02	6222	7784	-1562
	2002-03	6434	7944	-1510
	2003-04	7972	9486	-1514
	2004-05	9762	10953	-1191
	2005-06	10087	11705	-1618

Source: Power Development In AndhraPradesh (Statistics)

2003-04, APTRANSCO Page No.115 and Tariff orders for different years

## Annexure 10

## AVERAGE COST OF POWER AND AVERAGE REVENUE REALISATION

	Year	Energy Available (MU)	Energy Sold MU (MU)	Revenue by Sale of power (Rs. Crores)	Expenditure (Rs. Crores)	Average cost of power (Ps/kWh)	Average revenue realised (Ps/kWh)
	1	2	3	4	5	6	7
Pre Reform Period	<b>80-81</b>	<b>10.7</b>	<b>4.23</b>	<b>18.44</b>	<b>63.07</b>	<b>0.98</b>	<b>2.59</b>
	83-84	9647	7717	379	400	51.83	49.11
	84-85	10520	9231	495	471	51.02	53.62
	85-86	12717	10312	542	579	56.15	52.56
	86-87	13730	11761	581	669	56.88	49.4
	87-88	15217	11669	701	708	60.67	60.07
	88-89	14872	13050	797	786	60.23	61.07
	89-90	16305	14435	999	1013	70.18	69.21
	90-91	18342	16093	1210	1221	75.87	91-92
	Reform Period	<b>91-92</b>	<b>20233</b>	<b>17750</b>	<b>1531</b>	<b>1549</b>	<b>87.27</b>
92-93		22549	19227	1887	1856	96.53	98.14
93-94		24416	21204	2173	2216	104.51	102.48
94-95		26863	23095	2145	3134	135.7	92.88
95-96		28847	23562	2288	3572	151.6	97.18
96-97		29457	21067	3286	4280	203.16	155.98
97-98		32092	23944	3990	5498	229.62	166.64
98-99		36357	25224	4184	7036	283.26	165.87
99-00		38721	27523	4535	7375	267.95	164.77
Post Reform Period		<b>2k-01</b>	<b>43747</b>	<b>25538</b>	<b>5592</b>	<b>7865</b>	<b>307.97</b>
	2k1-02	45059	29549	5870	7784	263.42	198.65
	2k2-03	44890	31631	7397	7944	251.14	233.85
	2k3-04	46079	34446	7654	9486	275.38	222.2
	2k4-05	51150	37623	9762	10953	291.12	259.47
	2k5-06	51338	39885	10087	11705	293.47	252.9

Source: Power Development In Andhra Pradesh (Statistics) 2003-04, Aptransco, And Pg.118 and Tariff orders for different years

## Annexure 11

## INDEX NUMBERS OF AVERAGE COST OF POWER AND AVERAGE REVENUE REALISATION

	Year	Average cost of Power Ps/kWh	Index	Average Revenue Ps/kWh	Index
	1	4	5	6	7
Pre Reform Period	<b>83-84</b>	<b>51.83</b>	<b>100</b>	<b>49.11</b>	<b>100</b>
	84-85	51.02	98.44	53.62	109.18
	85-86	56.15	108.33	52.56	107.03
	86-87	56.88	109.74	49.4	100.59
	87-88	60.67	117.06	60.07	122.32
	88-89	60.23	116.21	61.07	124.35
	89-90	70.18	135.4	69.21	140.93
	90-91	75.87	146.38	75.19	153.11
Reform Period	<b>91-92</b>	<b>87.27</b>	<b>168.38</b>	<b>86.25</b>	<b>175.63</b>
	92-93	96.53	186.24	98.14	199.84
	93-94	104.51	201.64	102.48	208.67
	94-95	135.7	261.82	92.88	189.13
	95-96	151.6	292.49	97.18	197.88
	96-97	203.16	391.97	155.98	317.61
	97-98	229.62	443.03	166.64	339.32
	98-99	283.26	546.52	165.87	337.75
	99-00	267.95	516.98	164.77	335.51
	Post Reform Period	<b>2k-01</b>	<b>307.97</b>	<b>594.19</b>	<b>218.96</b>
2k1-02		263.42	508.24	198.65	404.5
2k2-03		251.14	484.55	233.85	476.18
2k3-04		275.38	531.31	222.2	452.45
2k4-05		291.12	561.68	259.47	528.34
2k5-06		293.47	566.22	252.9	514.97

Source : Power Development In AndhraPradesh (Statistics),2003-04  
APTRANSCO Page No.118 and Tariff orders for different years

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