RURAL ELECTRIFICATION AND POVERTY
AN INTERSTATE ANALYSIS

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I, **Pooja Tyagi** certify that the dissertation entitled **" Rural Electrification and Poverty: An Interstate Analysis"** for the degree of **MASTER OF PHILOSOPHY** is my bonafide work and may be placed before the examines for evaluation.

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Dedicated
to
Our Sara

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CHAPTER 1

INTRODUCTION

Power is an essential requirement for all facets of our life and has been recognized as a basic human need. It is the critical infrastructure on which the socio-economic development of the country depends. The growth of the economy and its global competitiveness hinges on the availability of reliable and quality power at competitive rates. The demand of power in India is enormous and is growing steadily.

Power is the basic building block for socio-economic development. Future economic growth crucially depends on long-term availability of energy in increasing quantities from sources that are accessible, affordable, socially acceptable and environment friendly. India is recognized as one of the great potential markets for the energy in the coming years with estimated demand growth rate of 63% annually. The total installed capacity in power sector in total is around 1,23,668 MW out of which State sector contributes about 70,572 or 57.1% , central Sector contributes 39,909 MW or 32.3% and private sector contributes 13,187 MW or 10.6% of total Installed Capacity .Out of the total energy demand of 521,872MU 480.242MU of demand is met creating a deficit of 8%.

The power sector has registered significant progress since the process of planned development of economy began in 1950. Hydropower and coal based thermal power have become main sources of generating electricity. Nuclear power development is at slower pace, and was introduced in the late sixties. The over all growth rate of the electricity sector has been higher than GDP growth rate. In the total installed capacity thermal power constitutes the majority of fuel composition around 82,065MW or 66.4% out of which 68,434MW(55.5 %) is contributed by coal, Gas constitutes 12,430 (10.0%) and Oil constitutes 1,201 (0.9%) Hydro Power is 32,135or (26.0%) , Nuclear Power is 3,310 or (2.7%) .The renewable fuel is around 6,158MW or (4.9%) of total installed capacity.

Efficient provision of electricity contributes to poverty reduction by fuelling economic growth and enabling the fulfillment of the basic human needs of health and education. Provision of electricity is thus crucial for improving living standards, supporting development job opportunities and fostering social activities. To meet the challenges of ever-increasing demand for electricity different models for reforming the power sector have been adopted across the developing countries.

Power sector reforms generally involve commercialization, setting up of independent regulators, restructuring and privatization of electricity sector. Ensuring that power sector interventions are designed so as to benefit the poor is vital both for social equity and sustainability of reform process. It is therefore appropriate to ask the extent to which these reforms have benefited the poor . There is often a concern that these reforms are a great setback to the poor The per capita consumption of Electricity for year (2004-05) is 606KWH/year .Out of the total no. of villages (census 1991) 593,732 villages Electrified as on 31st march 2004 is 474,982 with 80% electrification percentage .Out of the total Rural Households (census 2001) 138,271,559 the no. of rural households having access to electricity is around 60,180,685 that is 44%.

It has been observed that the focus of Indian reform legislation has been more on improving financial viability of ailing power sector than on improving the access to electricity. To effectively meet the electricity needs of the poor , legislative and policy support for mechanisms like the provision of lifeline rates and special functions like missionary electrification needs to be put in place

A number of projects have been applied to target the poor. Rural electrification can be a powerful instrument for putting poor people first. Electricity improves access to productive activities thus lessening their vulnerability to shocks. Rural Electrification in India increases the use of irrigation there by significantly reducing poverty incidence

The work of this study is an attempt at examining the state of Rural Electrification Agricultural output and Rural Poverty and the links between them during last two decades.. It also overviews the Power Sector Reform critically in respect to rural

electrification and issues related to it The study also analysis the Pre and Post reform scenario

The Rural electrification emerges as one of the aspects of power sector reform process and therefore it is important to assess the current status of rural electrification in power sector reforms.

While large-scale reforms have repeatedly been attempted in the past. India's achievement in the field of rural access to electricity leaves much to be desired. India is home to 35% of the global population without access to electricity, and only 44% of all rural Indian households are electrified. It may be mentioned here that although the number of electrified villages has increased rapidly, the number of households electrified has not matched in pace. The Ministry of Power's figures on rural electrification (RE) states that 87% of villages are electrified, while only 42-44% of rural households are electrified. According to the 2001 Census, 6.02 crore households use electricity as the primary source of lighting out of a total of 13.8 crore households in the country.

Currently, there is a vast difference between the urban and rural areas in regard of access to electricity. Electrification varies dramatically between the urban poor (33% without connection) and rural poor (77% without connection). This inequity impedes the development of poor rural population and underscores the fact that India's rural electrification programs have not reached the most marginalized and needy people.
In 1969, in a bid to intensify the rural electrification efforts, the Govt. of India, in collaboration with the USAID created the Rural Electrification Corporation (REC). This organization was built upon the Tennessee Valley Authority (TVA) experience in the United States, and is mandated to facilitate availability of electricity in rural and semi-urban areas. Although during its thirty-seven years of existence, the REC has financed numerous village electrification, pump set energization and Low Tension system improvement projects, its focus was more on the extensive (number of villages electrified) rather than intensive (% of households covered), leaving large gaps in rural electrification. With a change in the definition of an electrified village, the mid-term review of India's Tenth Five-Year Plan has acknowledged that the year-end figures as of 31st March 2004 of 84.3% village electrification would reduce to less

than 70%. As seen in Figure 2, the although electricity for the purpose of agriculture is highly subsidized, the poor farmers (marginal and small) as compared to rich farmers, frequently pay a high fraction of their gross farm income for irrigation.

Himachal Pradesh, Goa, Punjab, Haryana, Jammu & Kashmir, and Sikkim, that comprise 6% of country's total rural households, 75% of households are electrified. It also points out that in six states viz., Bihar, Jharkhand, Assam, Orissa, Uttar Pradesh, and West Bengal, comprising 43% of country's total rural households, around 80% of the households are yet to be provided with the electric connection

Only eight states, constituting 18% of the villages in India, have achieved 100% village electrification - Andhra Pradesh, Goa, Haryana, Maharashtra, Kerala, Punjab, Tamil Nadu and Nagaland. Eight states viz., UP, Bihar, West Bengal, Uttaranchal, Jharkhand, Orissa, Assam, and Meghalaya still do have the daunting task of electrifying a substantial number of villages.

Theoretically rural electrification constitutes an important factor in determining the agricultural output. It forms a crucial part of infrastructural base to agriculture sector .Rural electrification would therefore affect growth in agricultural income. On the other hand agriculture growth facilitates in reducing incidence of poverty therefore a linkage between them can be established

Rural Electrification as a planned programme was initiated in the country in 1950s. In the initial stage, the emphasis dues to electricity as a social amenity rates than an input for agriculture growth in rural areas. Out of 5,87,556 inhabited villages in the country as per 1991 census 5,08,863 villages (86.6%) have been declared electrified by March, 2002. The pumps sets energisation potential in the country is 16.59 million.

A village was said to be electrified prior to 2003-04 if atleast our electric connection existed in that village during 2003-04, the definition of village electrification was changed. Now, a village is considered to be electrified if atleast 10% of its households have access to electricity.

There are various other studies which clearly reveal the increase in agricultural production through rural electrification. These studies would be discussed in the literature Review

In rural areas a large number of population is engaged in agriculture , therefore the income from agriculture sector enhance rural incomes Thus it is intuitively understandable that an increase in the level of agricultural income should have an effect on the level of poverty In order to explore these linkages it is important to understand the state of poverty prevailing in rural India.

India has the world's second-largest population (after China) with approximately 1.2 billion people. Seventeen major languages and over 800 dialects are spoken there. The preamble of India's Constitution calls it a "a sovereign, socialist, secular, democratic republic". Poverty and inequality has been a crucial point of discussion ever since India moved on path of planning since 1950s . It was picked up as an objective only after the third plan .

In 1983, the percentage of rural population below poverty line was highest for Orissa (67.53%) followed by Bihar (64.37%) and West Bengal (63.05). Punjab had the lowest percentage of population below poverty line only 13.2%.

After one decade we observe that it was Bihar which had the highest percentage of rural population below poverty line i.e. (58.2%) followed by Orissa (49.72%) and Assam 45.01%. Even after a decade of economic reforms in India, rural Orissa (48.01%) continues to be one of the poorest regions of the country

As a result rural electrification may be a mechanism through which economic growth indirectly influences status of poor people. In rural economies farm and non-farm growth plays an important role in poverty reduction. Since rural India is dependent on agriculture , programmes that increase agricultural labour productivity by increasing irrigation, introducing electricity to villages are therefore important for rural poverty reduction.

1.1 OBJECTIVE AND SCOPE OF STUDY

In most of the developing countries, power supply to the urban sector receives more attention than the rural sector as most of the economic activities are concentrated in urban areas. Rural electrification becomes a preferred program for promoting equity and development in developing countries. Electricity is perceived as a modern source of energy, essential for development. The regions without electricity are for less developed than those with the access. Electricity plays an important role in the rural areas as it significantly contributes to increase productivity in agriculture by improving to the improvement in the facilities or provision of health and education. Electricity is used in energy-saving mills and contributes substantially in time saving end is also used in motors and pumps at large scale in rural areas. Electricity is key source for many income generating activities and therefore electricity access promotes economic development in rural areas.

Electricity access in rural areas would further lead to social development. It increases efficiency by reducing the time spent on collecting fuel. It leads to more productive uses by enhancing social life and facilities community based development. Access to electricity may reduce dependence on fuel wood, which may in turn asset forest degradation. This would further have positive effects on land degradation and water depletion. Besides, provision of electricity opens up the possibility of providing various social infrastructure like street lighting, better equipped hospitals and schooling facilities. Therefore, access to electricity leads to overall socio-economic development of rural areas.

The objective of this study would be to examine the reforms in the rural electricity sector that have had crucial influence on rural electricity access. The performance of the electricity sector in terms of rural electricity access and level of rural electricity consumption per capita may be attributed to many factors, which may be affected by the institutional reforms that have taken place in various states over the years. The focus of the study is to assess whether the institutional restructuring and reforms have an impact on access of electricity among the rural poor. which ultimately played a role I reducing poverty.

The study would be discussing the following issues:

1 The Power Sector Reforms

2. Impact of these reforms on Rural Electrification

3. Impact of Rural Electrification on Poverty using the following linkages:

   - Impact of Rural Electrification on Agriculture Income
   - Impact of agriculture income on Poverty

4 To assess the impact of rural electrification on poverty for both pre-reform and post reform phases

The study would be using sixteen major states for the time period of 1980 – 2000 to achieve the above objective

1.2 HYPOTHESES OF THE STUDY:

The study would be testing the following two hypotheses:

1. The level of rural electrification has a positive impact on agricultural output.
2. Agricultural output reduces the incidence of poverty.

The above mentioned hypotheses would be tested for sixteen major states of India for the time period 1980 to 2000

1.3 DATA SOURCE:

Secondary data are used to establish the hypotheses. These are

1. Statistical Abstract of India(1980 to 2001) published by CSO;
2. Census of India(1981,1991,2001);
3. Planning commission
4. Centre for Monitoring Indian Economy (CMIE)
5. Economic and Political Weekly (EPW)

1.4 ORGANISATION OF STUDY

The study would be organized in total of seven chapters where the first chapter is of introduction which would introduce the background of power sector and its reforms , impact of reforms on rural electrification .It would introduce the effect of rural electrification on agricultural growth and finally the effect of agricultural growth on poverty The second chapter would review the various literature so as to cover the objective of the study .and would contain the methodology used in the study to establish the hypotheses. The third chapter discusses the impact of Power sector reforms on rural electrification .The fourth chapter discusses the linkage of rural electrification, agriculture growth and poverty The fifth chapter would study the trends and the disparities of the indicators used in the study during last decades .The sixth chapter will try to establish linkages between poverty and rural electrification through per-capita state agricultural product.

Chapter 2

LITERATURE REVIEW

" In the normal processes of development , most of the gains go to the rich and less the poor. The question we confront is how the poorer can capture more of these potentials and gain more from these opportunities... ....

For putting poor people first, especially resource-poor farmers, field evidence points to electricity pricing and supply as powerful instruments.

Chambers et al 1989

The performance of the electricity sector in terms of electricity access to rural poor and level of agriculture electricity consumption per capita may be attributed to many factors, among which are institutional reforms in rural electrification that have taken place in various states over the years. The focus of the study is to assess whether the institutional restructuring and reforms have an impact on access of electricity among the rural poor and their effect on agricultural growth and rural poverty. Poverty in India has been quite an extensively discussed topic throughout the nation's 56 years history. As already mentioned the objective of our study is to understand how rural electrification can help to reduce poverty through increase in agricultural output across sixteen major states .In the present chapter we will make an attempt to review the existing literature on rural electrification, agricultural growth, poverty and their interlinkages. We will try to give a brief account of the existing literature on the following issues.

1. Power sector reforms
2 State of Rural Electrification During last two decades
3 Impact of Rural Electrification on agricultural growth
4 Poverty and its trend.
5 Impact of agricultural growth on poverty

Rural electrification emerges as one of the branches of reform process in power sector .In order to visualize the state of rural electrification and the perceived linkages related to it we would briefly review the literature of reform process .

Power Sector Reforms

Energy constitutes a significant part of infrastructural base for a country It is considered an engine of growth for developing nations like India .The Power sector in particular has undergone numerous reforms process

Upadhyay (2000) examines the Indian experience in context of power sector reforms and states that Electricity supply industry worldwide has been undergoing radical transformation in the 1990s. The restructuring has been driven by ideological considerations in some developed countries and by a fiscal crisis and power shortages. It has usually succeeded in increasing supply and stabilizing or reducing prices. Indian experiments with reform have found consumers willing to pay economic prices for power.

Godbole (2002) in his article states that Comprehensive power sector reforms, particularly in the transmission and distribution segments, have been discussed at least since 1993 when a Committee of the National Development Council comprising six chief ministers was set up. Conferences of chief ministers/power ministers were held in 1996, 1998, 2000 and 2001. However, in spite of the hardy ritual of conferences and resolutions without any seriousness of purpose – just to give the appearance of progress where there is in fact none – there is no light at the end of the tunnel. In fact the tunnel seems to get darker and longer each year.

In the same article (2002) he also concludes that starting with Andhra Pradesh, several state governments, including Maharashtra, have announced free power for farmers. In this rush towards competitive populism, the past experience of states that adopted the suicidal policy of giving free power for agriculture appears to have been lost sight of completely. Moreover, considering that subsidies for agricultural consumption largely benefit big farmers and other well-to-do people, the subsidization of these sections by common taxpayers militates against all canons of the welfare state. The common minimum program (CMP) of the ruling United Progressive Alliance (UPA) has declared that the Electricity Act, 2003 (hereinafter referred to as the act) will be

reviewed. There are conflicting signals on what such a review would imply. The central minister for power has declared that with the extension of time given for reorganization of the state electricity boards (SEBs), there will be no further review of the act.

Sankar (2003) discusses the experience of Electricity sector of Andhra Pradesh and states that from being the only state electricity board in the country in the eighties to steadily maintain a profitable profile over a period of a decade, the Andhra Pradesh State Electricity Board (APSEB) had by 2000 slid to the last position among SEBs in financial management. It has recorded the highest losses among all SEBs in the last three years. This paper attempts to examine how this horrendous deterioration happened and what factors contributed to it. To study this the history of the electricity sector in the state has been divided into three periods: Rise (1970-90), Fall (1990-96) and Reform (1996-2000).

State of Rural Electrification in last two decades

One of the main objectives of planning and reforms have been a balanced regional development by reducing inequality .Rural areas have been neglected in case of power sector reforms, though we observe a lot of progress have been made in terms of rural electrification by introducing various schemes to improve electricity access to poor people .The following literature will review the studies done on identifying the impact of reforms on rural electrification.

Sihag, Misra and Sharma (2004) in their report while examining the impact of power sector reform on rural poor state that Rural Electrification Operation established on 25th July, 1969 has definitely acted as a catalyst for rural electrification of the total of 0.509 million villages so far reported to be electrified, about 0.305 million villages have been electrified under REC – financed schemes. Some other schemes financed by REC were the KJ (Kutir Jyothi) Scheme, Dalit Basthi Scheme, Hamlet Electrification, Pump sets Energisation, System Improvements, Small Generation and Rural Electricity Corporation. The census of 2001 found that 56% of rural

households did not have access to electricity as compared to 12% of urban households.

According to Sihag, Misra, and Sharma (2004) the performance of the REC has, no doubt, contributed to the spread of rural electrification in the country, yet 78 240 villages are awaiting electrification. These are mainly in Bihar, West Bengal, Orissa, Uttar Pradesh, and Assam, the states that account for 40% of the country's population. The overall pace of rural electrification as well as energization of pump sets received a setback in the last reform decade The poor financial health of the SEBs, increasingly reluctant to move to rural areas because of high costs and low returns is largely responsible for this trend Gokak (2002). The Gokak study has mentioned the following adverse features plaguing the program of rural electrification the cost of transmission lines is very high—20 000 Rupees–30000 rupees per kilometer depending on the terrain, high T&D losses low and fluctuating voltage on account of the overloading of the grid system, Erratic power supply and poor maintenance The Gokak study also points that the financial problem posed by the program of rural electrification, which is subsidized, is enormous. The net subsidy after accounting for amounts received from state governments was 1034.6 million dollars in 1991 and increased to 4710.87 dollars million in 1999–2000. The Government of India has recognized the need for new initiatives in rural electrification in the wake of the problems outlined above. This has been reflected in Section 5, Part II of the (Electricity Act, 2001), which views distributed generation as a possible alternative to the current problem. It envisages stand-alone systems for generation and distribution of power and decentralized management of distribution through Panchayats, users associations, and co-operatives or franchisees. However, implementation of new concepts on rural electrification would require articulation of a clear policy in terms of Clause 5 of the Electricity Act (2001), at the national level

Impact of Rural Electrification on Agricultural growth

Rural electrification constitutes a significant input to infrastructure which is a prerequisite for agricultural development .The following literature would review the studies done on impact of rural electrification on agriculture.

Bhatia (2000) in his article states that rural infrastructure is said to strengthen the foundation of agriculture which is a pace setter of our economic growth. The World Development Report (1994) which focuses on infrastructure for development brought out a strong positive relationship between the level of GDP and infrastructure stock per capita. Good infrastructure helps in raising productivity and lowering the unit cost in the production activities of the economy. The pay-off from better infrastructure services go beyond reducing technical inefficiencies and financial losses [Gowda and Mamatha 1997].He further states that many people, especially the rural poor, and backward areas do not have access to even minimal infrastructure services. If the nation aspires to attain maturity in economic growth, it must give a big push to the up liftment of the network of physical infrastructure like energy, transport, etc. The importance of a strong infrastructure has been well-recognized by the government. The united front in its Common Approach to Major Policy Matters and Minimum Programme (1996) observed that "*Investment in infrastructure has to be stepped by from the present 3.5-4.0 per cent to atleast 6 per cent of GDP in the next* few years"

Bhatia's paper aims at examining the pattern of development of rural infrastructure in India over the years; regional variations in availability of rural infrastructure facilities; attempts and finally to build composite index of rural infrastructure state wise and; examine the relationship between infrastructure development and level of production and growth in agriculture The major items of infrastructure as identified in the planning process include irrigation, power, transport, communication, education, health, etc. Within these major heads, there are sub-items of rural infrastructure which have direct bearing on agricultural development. For example, it is not only the total power availability in the states, but equally important is its access to the villages and then to the agriculture As far as availability of power in rural areas is concerned, all villages have been electrified in Andhra Pradesh, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Maharashtra, Punjab and Tamil Nadu. However, the percentage of villages with power facilities as low as in the range of 71-76 per cent included the state of Bihar, Orissa, Uttar Pradesh and West Bengal. The proportion of power used for agriculture is highest in Haryana as 49.5 followed by Punjab and Andhra Pradesh with 44.27 and 40.25 per cent respectively. This proportion is as low as 2.34 in Assam, 2.76 in Himachal Pradesh, 4.05 in Kerala 4.83 in Orissa and 6.96 in West Bengal.

Bhatia (2000) finally concludes that overall index of infrastructure is highest in Punjab followed by Kerala, Tamil Nadu and Haryana, the index being 85.3, 70, 68.4 and 65.9 respectively against the all-India average of 52.1. The infrastructure index is lowest in Rajasthan as 38.3 and only slightly higher than this in the states of Bihar and Madhya Pradesh with index as 42. The overall infrastructure index is also relatively low in the states of Orissa, Uttar Pradesh, West Bengal and Assam. This index is moderately good in the states of Gujarat, Himachal Pradesh, Jammu and Kashmir, Karnataka and Maharashtra. The different states which have an overall low index of infrastructure, have varied deficiencies

Fan and Hazell (2000) examine whether the developing countries invest more in less favored areas in the empirical analysis of rural India .They state that overall index of infrastructure is highest in Punjab followed by Kerala, Tamil Nadu and Haryana, the index being 85.3, 70, 68.4 and 65.9 respectively against the all-India average of 52.1. The infrastructure index is lowest in Rajasthan as 38.3 and only slightly higher than this in the states of Bihar and Madhya Pradesh with index as 42. The overall infrastructure index is also relatively low in the states of Orissa, Uttar Pradesh, West Bengal and Assam. This index is moderately good in the states of Gujarat, Himachal Pradesh, Jammu and Kashmir, Karnataka and Maharashtra. The different states which have an overall low index of infrastructure, have varied deficiencies He concludes that roads have sizeable productivity impacts in all three types of areas, but a much larger impact on poverty alleviation in rain fed areas, particularly the low-potential rain fed lands. Rural electrification and education have their biggest productivity impacts in rain fed areas, and they also impact favorable on the poor in these areas. Their impacts in irrigated areas are very small. He further concludes that In order to promote economic growth and to redress poverty, policy-makers in developing countries will need to promote agricultural intensification for both high and low-potential regions. This dual strategy will be particularly challenging if government budgets for investment in agriculture and rural areas continue to remain tight, and striking the right investment balance between irrigated and rain fed regions, and between high- and low potential rain fed areas will be particularly important.

Honnihal (2004) in his analysis of the information on agricultural power consumption in some large states shows that the methodologies adopted by many electricity regulatory commissions (ERCs) for estimation of unmetered consumption are weak. These methods need to be improved, especially because of the lack of progress on metering of agricultural connections. The recently enacted Electricity Act 2003 is a watershed in the Indian power sector. The act envisages major structural changes by freeing up captive generation, allowing electricity trading and choice of supplier to large consumers. These changes, along with the requirement of tariff guidelines enumerated in the act, are likely to result in rapid removal of cross-subsidy. Hence, agricultural consumers, by far the largest recipients of cross-subsidy in the power sector, are likely to see a significant increase in power tariff in the coming years. In this context, the issue of estimating correct levels of unmetered agricultural consumption and the feasibility of metering these connections in the near future becomes important. The establishment of state electricity regulatory commissions (ERCs) in several states in the past few years has increased transparency in the sector, especially in terms of more information about agricultural consumption and tariff being easily available to the general public.

Gupta (2001) divides his paper into three sections. Section one deals with impact of rural electrification on agriculture productivity, cropping patterns, income of the farmers etc. in Rajasthan. Second section examines the benefits of rural electrification, financial implications and inadequacies of rural electrification and last section desecrates the international experience on rural electrification on 1967,

The National council of Applied Economic Research (NCAER)(1967)undertook in study on the impact of rural electrification in Punjab. It was stated that as a result of pump sets energisation, the average gross irrigated area increased by 7.63%, cultivating households received an additional income of Rs. 236.87 per acre. In its 60 page report, the NCAER testified that rural electrification in Punjab has bestowed substantial benefits on the farmers, industrialists and households.

Kothari and Dedi (1999) attempted to estimate the socio-economic benefits of rural electrification in Gujarat, Taking the benefits of electrification at 1972-73 prices they concluded that the net benefit cost ratio of rural electrification in Gujarat was high

even at a discount rate of 15%. Bhatia and Mehta observed in their study that if all the relevant components of the cost of using electric motors are included and instead of market cost, real economic cost of electricity is used then diesel engines produce better returns than electric pumpsets.

The programme Evaluation Organization (PEO) published its report on "Evaluation of Rural Electrification Programme" (1982) while Volume-I of the Report highlighted the organization growth and coverage of rural electrification Scheme in India, in Volume-II (published in 1983), an attempt was made to assess the impact of such programme. The PEO study revealed that electrification of wells brought about a major change in cropping pattern. While the area under pulses, oilseeds, fibers, fodder crops etc. declined, it increased quite significantly in respect of vegetables, plantations, sugarcane, fruits. About 80% of sample cultivators had experienced an increase in the farm employment.

While examining the trends of share of electricity consumption of Agriculture sector in total electricity consumption, Gupta (2001) concludes that with the increase in number of electrified villages and pumpset energisation over the last five decades of planning process, the consumption of electricity in agriculture sector is growing at a much faster rate.

According to Meghani (1994) infrastructure development plays a significant role in raising levels of rural economic growth particularly by raising labour productivity. Meghani (1994) further asserts that rural electrification may be another mechanism through which economic growths indirectly influences poverty.

Fan, Hazell and Thorat (1999) engage in a detailed study of India, examining the levels between rural poverty and government spending on variety of areas. They provide a system of equations that examines poverty as a function of total factor productivity, wages, and terms of trade, rainfall, non-agricultural employment, landless ness and population. Each of these explanatory variables is in term a dependent variable in another part of their model. Their analysis determines that government investment would have the most positive effects in the poor. They find that road construction, agricultural Research and Development (R&D) and education

programs have the largest impacts Literacy reduces poverty through its impact on greater non-form employment, increased wages and total factor productivity.

Ali and Pernia (2003) cite endure from China and Bangladesh on how electricity empowers the poor to take advantage of more productive opportunities that exist in the rural economy. Electricity is used as an impact to a variety of new agricultural technologies and also encourages the erection of non farm opportunities.

Fan, Hazell and Thorat (1999) find that government Expenditure on power has a small and insignificant effect on rural poverty and productivity growth. They suggest them non-farm employment and improved irrigation provide over 90% of the explanatory power of electricity. There is a disparity between parts of India with regards to electrification. In Andhra Pradesh and Gujarat for example over 95% of the villages had electricity by 1995. In Bihar on the other hand, almost a thread of villages still did not by the same year. Finally the use of new agricultural technologies reduces rural poverty though their impact on labour productivity, Fan, Hazell and Thorat (1999) conclude that agricultural R&D reduces rural poverty principally through its effects on productivity.

Poverty and its trends

Poverty and inequality has been a crucial point of discussion ever since India moved on path of planning since 1950s. It was picked up as an objective only after the third plan. The following literature would review the trends of poverty with special emphasis on rural poverty and the disparities associated with it across states.

Sundaram and Tendulkar (2003) examine the poverty situation in 15 major states across four distinct dimensions of headcount ratio, size of the poor population, depth and severity for the rural, the urban and the total population. The poverty situation, they find, worsened over the six-year period 1993-94 to 1999-2000 in Assam, Madhya Pradesh and Orissa. In the remaining 12 states there was a distinct improvement in terms of the most visible indicator, namely, the absolute size of the poor population. Overall, despite diversity across poverty indicators and across states, the overwhelming impression is one of greater improvement in the poverty situation

in the 1990s than in the previous 10½-year period. At the all-India level, all the measures of poverty, including the size of the poor population and the distribution sensitive measures such as poverty gap index (PGI) and squared poverty gap (FGT*) exhibit a clear and sharp decline in both the rural and the urban areas and, therefore, also at the level of the country as a whole . At the all India level, the overall performance in all dimensions of poverty has been much better between 1994 and 2000 than that in the preceding ten-and-a-half years.

Sundaram and Tendulkar (2003) further analyses the changes in rural poverty and conclude that in terms of the headcount ratio, poverty has shown a distinct decline in all but two of the 15 states, with the population weighted average for the 15 states taken together declining by a little over 9 percentage points at an average rate of 1.5 percentage points per year. The two states forming an exception to this general and widespread decline in rural poverty are: Assam and Madhya Pradesh. Even in these two states, the increase over the entire six-year period was marginal – of the order of less than one percentage point. To place the broad and widespread decline in rural poverty during the 1990s in perspective, it needs to be noted that the preceding ten-and-a-half years too had witnessed a significant and broad based decline in poverty in terms of headcount ratio, PGI[1] and FGT[2] – with only Assam and Haryana recording a rise in these indicators. In terms of the size of the poor population, however, six of the 15 states (Assam, Bihar, Haryana, Karnataka, Maharashtra and Orissa) and, the aggregate for fifteen states taken as a group, recorded an increase in the size of the rural poor population between 1983 and 1994. Among the states that recorded a decline in rural poverty in terms of headcount ratio during the 1980s, Madhya Pradesh (which also recorded a decline in poverty in terms of the number of poor, PGI and FGT during the 1980s) is the only state which records a rise in head count ratio and in the number of rural poor during the 1990s. As noted in the previous section, rural Madhya Pradesh does record a fall in PGI and FGI during the 1990s as well They finally conclude that the poverty situation across four distinct dimensions of headcount ratio, size of the poor population, depth and severity across 15 major states, for the rural, the urban and the total (rural plus urban) population separately. Assam,

[1] PGI poverty gap index

[2] FGI squared poverty gap

Madhya Pradesh and Orissa are the three states where the poverty situation worsened over the six-year period 1993-94 to 1999-2000. In the remaining 12 states, there was a distinct improvement in terms of the most visible indicator, namely, the absolute size of the poor population. Overall, despite diversity across poverty indicators and across states, the overwhelming impression is one of greater improvement in the poverty situation in the 1990s than in the previous ten-and-a-half year period.

Desai (2002) reinterpreted study by Narain (1986)on trends in rural poverty in India There was no trend in the incidence of rural poverty between 1956/57 and 1970/71. Ahluwalia(1978) in his paper reveal the extent of inter-state differences in the pace of economic growth in the past decade. Rising regional inequality as measured by an increase in the Gini-coefficient from 1986-87 to 1997-98, has important implications from poverty

The percentage of the rural population in poverty declined continuously from 54.1 in 1956/57 to 38.9 in 1960/61, rose to 56.6 in 1966/67, and then fell to 47.5 in 1970/71. If the missing observations for 1962/63 and 1969/70 are ignored, the changes in each sub period were in only one direction. During the entire fifteen-year period, the percentage of the rural population in poverty moved between an upper bound of 57 percent and a lower bound of 39 percent. A decline of 15 percentage points in the incidence of rural poverty during 1956/57-1960/61 was associated with neither a decline in the price variable nor an improvement in agricultural performance. Thus, time as a proxy for the other factors, notably land reforms, becomes relevant in explaining the reductions in the incidence of rural poverty.

Srinivasan (1998) mentions that the removal of nationwide poverty has consistently been one of the chief objectives of Indian policy. The country's modern history contains myriad examples of discussion on this topic as far back as 1901 Mahatma Gandhi and Jawaharlal Nehru, the first Prime Minister of India, wrote extensively on this matter pre-independence.2 Since its inception, India has instituted a variety of anti-poverty programs, including the National Rural Employment Program and the Rural Landless Employment Guarantee Program.

Datt and Ravallion (1998), in their comparative analyses of poverty in Indian states. did not find any major changes in the signs or in the statistical significance of the coefficients of their explanatory variables as higher order measures were used, suggesting that the headcount index is sufficient for most analyses.

According to Meghani (1994) National Sample Survey Organization (NSSO), part of the Indian Ministry of Statistics & Programme Implementation, collects the data that is used to determine who falls below the poverty line. It has carried out the National Sample Survey (NSS) since 1950. Until 1977, the NSS was conducted yearly. Since then, so-called "thin rounds" have been run annually between the "thick rounds" that are held every five years. The quinquennial rounds have a sample size of roughly 150,000 households over India. The thin rounds have a much smaller size, usually on the order of 40,000 households. The NSS collects a variety of data, including statistics on household expenditures. It is important to stress that the NSS gathers information on households, not individuals. Official expenditure data is also available by looking at the National Account Statistics (NAS). The decision to use one set of data versus the other depends on the type of research being conducted and on personal preference.

Dealton and Dreze (2002) give special attention to the Indian poverty debate over the past several years. Their research attempts to correct several flairs in the measurement of poverty in India.

Datt and Ravallion, (2003) proposed on economic model of poverty incidence incorporating 20 household surveys for India's 15 major states spamming 1960-1994. The model builds on past research suggesting that the key determinants of rate of poverty reduction at state level are agricultural yields, growth of non-form sector, development spending and inflation. The overall incidence of poverty is projected to have fallen from 39% to 34% over this period, suggesting that the rate of poverty reduction in 1990s is slightly more than 1980s and lower than one would have expected given the growth in 1990s of India's 15 largest states, UP and Bihar accounted for the largest share of national poverty in 1993-94 (18% and 17% respectively). The diverse experience of India's states in reducing poverty at a given rate of growth also holds some dues to what else needs to be done to assure more pro-poor growth in the future.

Meghani (1994) in his paper examines rural poverty in fifteen Indian States using poverty estimates derived from seven National Sample Survey NSS rounds conducted between 1983 and 1994. The paper distinguishes between farm and non-farm growth, focusing on factors that drive the former. He concluded that sustained increases in agricultural productivity are critical to reducing rural poverty. Inline combined with strong human development, in the form of increased literacy, its pro-poor effect in strengthened. The absence of a significant poverty reduction during the last decade may be reflected by a showdown in primary sector, especially within India's poorest states.

Impact of Agricultural growth on Poverty

The technologies that improve agricultural productivity would finally improve the income from agriculture sector, since people in rural areas are mostly engaged in agriculture sector; agricultural growth would mean directly reduction in rural poverty. The following literature would review the studies done on impact of agricultural growth on poverty.

According to Kundu (2002) in order to understand the impact of agricultural growth on poverty, it is important to know the trends of inequality. Trends of inequality within the states are fluctuating from time to time. Gini index and Theil's measure of inequality calculated for 15 major states in India for the year 1972-73, 1973-74, 1977-78 and 1983. After the economic reforms these fluctuations become more intensive. The rural inequality started declining while the urban inequality started rising during nineties (Angus Deaton and Jean Dreze, 2002). The incidence of poverty is higher in rural areas than the urban areas. The rural urban inequality in income and consumption expenditure exists in India since Independence and even before. During the nineties this disparity has been sharpened after the new economic policy was adopted.

Radhakrishna (2001) in his article states that Interdependencies in the food and labour markets are important for the development process. A strategy combining promotion of agricultural growth, productive non-farm employment and high levels of social

development would be needed for labour-intensive growth in rural areas. There should also be substantial investment in human resource development for enhancing people's inherent earning capacity. The aim thus would be the generation of self-reliant employment In the pre-green revolution period, from 1950-51 to 1965-66, the main policy thrust was on agrarian reforms as well as modernizing agriculture through large-scale investment in irrigation and power and creation of other infrastructure such as credit institutions, regulated markets, roads and extension as also research institutions. Immediately after independence, India abolished intermediary landlordism (zamindari system), giving occupancy rights to 20 million statutory tenants, and facilitating modernization of agriculture

Balakrishnan (2000) provides an overview of the principal developments in the agricultural sector since 1991, i e, since the economic reforms, and of their likely consequence for the standard of living. The paper has been conceived more with a view to raising essential questions than providing complete solutions. An examination of the principal developments in agriculture since 1991 raises issues that have a bearing on the Indian standard of living and welfare. Some have argued that the economic reforms since 1991 have not targeted the agricultural sector directly, and hence not much may be expected of it under the new policy regime

Datt and Ravallian (2002) show that growth in non-form sector is 1990s has generally not been any hugged in the states where it would have had the most impact on poverty nationally, there is virtually zero correlation between growth rates and growth elasticities of poverty.

Ahluwalia (1978) in his paper reveal the extent of inter-state differences in the pace of economic growth in the past decade. Rising regional inequality as measured by an increase in the Gini-coefficient from 1986-87 to 1997-98, has important implications from poverty reduction. Because of State specific characteristics, the divergent patterns of economic growth witnessed in 1990s do not necessarily imply that economic reforms at national level were based. His paper attempts to document the performance of the major states in the post-reform period 1991-92 to 1998-99 and compare it with performance in provision decade. This paper funds that provision of certain infrastructure, and to some extent also literacy, are associated with variations

in growth. In 1965, India embarked on a remarkable program of innovative agricultural experiments called the "Green Revaluation" for about twenty years. Punjab, a state famous for its high level of success in sustaining a strong agriculture sector had almost 90% of its cropped area filled with high-yielding varieties by the early 1990s.

Fan, Hazell and Thorat (1999) prove that irrigation is another area where government initiative can sustain growth in agriculture sector. They find that support of new irrigation initiatives, in addition to raising agricultural productivity also encourages private investment into those regions.

Meghani (1994) in his Regional analysis of the states conclude that many states have bad consistently high rates of poverty. India's independence with no clear signs of a convergence anytime soon. In last two decades, states such as Kerala, Orissa, Tamil Nadu and West Bengal have made progress in reducing their initial levels of poverty. Six out of the eight poorest states in 1983 – Assam, Bihar, Madhya Pradesh, Maharashtra, Orissa and Rajasthan are still among the eight poorest.

Ahluwalia's (1978) three major findings based on all-India evidence serve as a backdrop to Dharm Narain's results: First, there was no discernible trend between the mid-1950s and the early 1970s in the incidence of poverty in rural India, measured as the percentage of the rural population in poverty . Second, improved agricultural performance, measured as an increase in the net domestic product in agriculture per head of rural population at 1960/61 prices (NDPARP), was definitely associated with reduced incidence of rural poverty. Third, there was no underlying time trend in the incidence of rural poverty, even after allowing for changes associated with agricultural performance.

Srinivasan (2000) associated that almost two-third of India's labor focus depends on agriculture on rural economy, an important asset in access to land, either by owning or operating it. Accordingly, many of the poor in rural India tend to be landless wage laborers.

Seminal work by Ahluwalia (1978) notices a strong inverse relationship between rural poverty and agricultural performance per head at the all India level. He does not find a consistent, clear relationship at the state-level, providing several explanations. First of all, state economies are more "open". In a bad agricultural year n a given state, one might see a temporary migration to urban areas or to rural economies in other parts of the country. Also at the time of the study, the availability of state domestic product time series data was limited. Nevertheless, Ahluwalia (1978) finds a significant inverse relationship between rural poverty and agricultural growth for half the states in his study, which collectively represent almost 75% of India's rural poverty. He maintains that other unidentifiable factors, independent of agriculture work at the state level to increase rural poverty. Rapid agricultural growth mitigates those elements.

The two economists at the World Bank, Ravallion and Datt, have researched the question of why economic growth in some India States have been more pro-poor then others, especially the non-farm variety. Their work can be found in Datt and Ravallion (1996, 1998 and 2002), Datt, Kozel and Ravallion (2001) and Ravallion and Datt (1996, 2002). In most of their studies, the another examine twenty rounds of the NSS from 1960 onwards for fifteen major states in India. Their research focuses on tend sets of variables to understand the interregional differences in poverty. They look at the state-level sectional composition of economic growth and the impact of certain demographic and social initial conditions. Ravallion and Datt (2002) conclude that non-forum economic growth also helps the poor. They find that real non-agricultural output per person had negative poverty elasticity's that varied between states.

Cecelsike (2002) in her paper relates rural electrification and rural development and poverty and states that rural electrification benefits the non poor more than the poor. The study further states that like many other new technologies, it can increase iniquities in rural areas. The study tackles two major issues, first the relationship between specific energy strategies and poverty reduction and the impact of privatization and market reform on poor. Many studies have concluded that rural electrification benefits higher income populations more than lower income ones (Jechoutek 1992, Foley 1992, Munasinghe 1987 Barnes 1988, Cecelsbi 1990) Jechoutek (1992) stated that only those with sufficient resources for initial investment

in the connection and energy-using equipment will be in a position to benefit from electricity.

Sinha (2000) run the basic model linking the economic growth and poverty where measure of poverty (using the HCI, PGI, and SPGI)[3] in state was regressed as per capita GDP levels in primary, secondary and tertiary sectors respectively and time which is the trend term that equals the number of years since 1983. Secondary and tertiary sectors had very strong correlation over 0.90 indicating that their effects on rural poverty may be similar. Therefore, in the study the secondary and tertiary sectors were summered into new variable as non-forum income. The result of regression is consistent with most of the empirical studies cited by the paper.

Datt and Ravallion (1994) even though large portion of the rural poor do not own or have access to land, there seems to be evidence that agricultural growth trickles down to them the coefficient of per capita agricultural output are negative and statistically significant for all measures of poverty.

The study of by Sinha (2000) concludes that the electrification variable in the model is statistically significant. A 20% increase in no. of villages electrified will approximately raise agricultural output by 0.095% and lower the head count by 0.084%. The reasons for small coefficient are that most states already provided villages with access to electricity over last twenty years and thus quite a large increase in access to electricity in required to see any economically significant change in productivity or reduction in poverty. Every state except Bihar was able to provide more than three fourth of its villages with electricity by 1994. Even the poor states such as Orissa and Uttar Pradesh have achieved a convergence. Both states had an electrification rate below 50% in 1983 but were able to push it to nearly 75% a decade later. Another explanation is that electricity drives rural productivity provisionally through increased irrigation. Since model already includes the latter the additional explanatory power of electrification is small.

[3] HCI head count index

Bhattarad and Narayanomoorlty (2001) in their paper state that the overall growth and technical change in the agricultural sector has large implications on expanding the economic base and poverty attention in a region. Past empirical studies have shown that ultimately growth in productivity of all factors in agriculture is vital for alternating rural poverty in developing countries (Fan 1999, Mellor 2001 and 2000, Desai 2002) Mellor (2001) paints out that agricultural growth has a proposed impact on poverty reduction in developing countries including reduction and inequity overtime. The actual impact of agricultural growth on poverty in fact varies by nature, regions and time period selected for the studies.

Most of the previous studies have unequivocally demonstrated that agricultural productivity growth has a positioned impact on reducing poverty in Asia, but the existing literature on rural poverty has feasted to examine the incremental impact of each of the factor inputs on agricultural productivity growth as well as marginal impact on poverty alleviation. However, no straight forward relationship has been shown between irrigation and poverty alleviation and impact of irrigation on poverty alleviation depends on several other intermediate factors. An attempt is made to analyse the incremental impact of irrigation and other factor inputs on growth of total factor productivity and its implications on poverty alleviation in India over the last two and a half decades. In addition this study also examines the structure and relative importance of factors that affect variations in poverty and rural consumption levels across India. This is done by using airmail time series data from 1970 to 1994 per 14 major states of India accounting for more than 90% of agrarian economy of India.

Rao, Gupta and Sharma (2000) in their paper suggest that to explained poverty, not only growth of agricultural output but the factors that determine the pattern of that growth should be analyzed. The study first tries to separate out the influence of institutional, infrastructural and technological factors that seem to underlie agricultural performance and then to capture the effect of different variables by cross-sectional analysis of NSS regions. The study concludes that literacy turns out to be positive and significant when a calorie intake definition of poverty rated is based, but it is negative and non-significant when the poverty rated is based on per capita expenditure corrected with prices. They further conclude that relations between various infrastructural variables and poverty levels are complex. Canal irrigation

facilities tend to reduce poverty levels, and rural electrification appears to be a useful means of dealing with poverty problems. The effects of roads and fertilizers use are not conclusive and need further investigation. This analysis implies that higher prices lead to higher poverty by depressing purchasing power and altering the patterns of consumption. Also, the regions with high growth rates in agriculture and high agricultural output per person have a low poverty ratio. Productivity per hectare, on the other hand, generally is positively related to rural poverty.

According to Fan, Hazell and Thorat (1999) in the state that poverty in rural India has declined substantially in recent decades. The percentage of the rural population living below the poverty line fluctuated between 50 and 65% prior to mid 1960s but then declined steadily to about one-third of rural population by early 1990s. This steady decline in poverty was strongly associated with agricultural growth particularly Green Revolution which in turn was a response to massive public investments in agriculture and rural infrastructure. The primary purpose of this research is to investigate the causes of decline in rural poverty in India and particularly to determine the specific role that government investments have played. The research aims to quantify the different types of government expenditures in contributing to poverty alleviation. The conceptual framework proposed for this analysis is a simultaneous structural equations system in which many economic variables are endogenous and third direct and indirect infectious are explicitly considered in the model. The results show that government spending on productivity – enhancing investments (especially agricultural research and extension), rural infrastructure (roads and education) and rural development targeted directly to the rural poor, all contribute to reductions in rural poverty, and also contributed to growth in agricultural productivity. But their effects on poverty and productivity differ greatly.

The study by Fan, Harzell and Thorat (1999) has important policy implications. In order to reduce rural poverty, the Indian government should give priority to increasing its spending on rural roads and agricultural research and extension additional government spending on irrigation has substantial productivity effects, but no substantial impact on poverty reduction. The impact of governmental spending on power is smaller than other productivity-enhancing investments and its poverty effect is also small.

After giving a brief account of the existing literature our present study is another attempt in exploring the inter-linkages between rural electrification, agricultural output and poverty. We adopt the following methodology

Methodology

Rural electrification may be a mechanism through which economic growth indirectly influences status of poor people. In rural economies form and non-form growth plays an important role in poverty reduction. Since rural India is dependent on agriculture, programs that increase agricultural labour productivity by increasing irrigation, introducing electricity to villages are therefore important for rural poverty reduction.

Electricity is used as an input to variety of new agricultural technologies and also encourages the creation of non-form opportunities. The use of new agricultural technologies reduces rural poverty through their impact on labour productivity. As a result the aim of this study would to be to examine the impact of increase in agricultural income on reduction in incidence of poverty where consequent the role of rural electrification on agricultural growth on productivity of agriculture sector would be examined.

The objective of this study would be to examine the state of rural electricity sector that have had crucial influence on electricity access. The performance of the rural electricity sector in terms of electricity access and level of electricity consumption per capita may be attributed to many factors, among which are institutional reforms that have taken place in various states over the years. The focus of the study is to assess whether the institutional restructuring and reforms have an impact on access of electricity among the poor which in turn has an effect in reducing rural poverty through increase in agricultural productivity The aim of the study is to assess distinctively the impact of these reforms on the electricity access of the poor

In order to establish the linkage of rural electrification , agricultural output and Poverty sixteen major states have been considered for the time period 1980-2000 .

Indicators used for the variables :

1 Rural electrification : Two indicators of rural electrification have been used
   a) Agricultural Electricity Consumption (million Kwh)
   b) Villages Electrified (%)
2 Poverty : The proportion of population above poverty line has been taken as a measure of poverty
3 Agricultural output : Per Capita Net State Domestic Product from Agriculture sector is taken as an indicator for Agricultural output
4 Irrigation: Gross irrigated area as percentage of Gross cropped area is taken as an indicator for irrigation

There are two indicators for rural electrification in the study .A composite index has been calculated for rural electrification using the two indicators namely percentage of village electrified and Agricultural electricity consumption .The composite index has been calculated using Principal Component Analysis, this paper tries to objectively determine the impact of overall rural electrification on poverty therefore the two indicators have been clubbed together . It might be recalled that the PCA method enables one to determine a vector known as the first principal component/factor, linearly dependent on the constituent variables, having the maximum sum of squared correlations with the variables. The eigen vector corresponds to the maximum eigen value of the correlation matrix gives the required factor loadings (weights). The composite index for a particular geographical unit may be obtained by linearly combining the standardized variable values, the weights being the corresponding elements of the eigen vector.

Suppose we have a (N×M) data matrix where N indicates the number of geographical units (say countries) and M, the number of variables. In order to obtain a composite index of the entire variable through PCA, the following steps are to be performed.

Step1

Transform the causal variables into their standardized form

$X_M = \{x_M - M(x_M)\}/SD(x_M)$

where, M (x_M) is the arithmetic mean and SD (x_M) is the standard deviation of observations on x_M. X_M is the matrix of standardized indicator values.

Step2

Obtain the correlation matrix (R) as

$R = X'_M * X_M/N$

where, X'_M is the transpose of the X_M matrix while NN is the number of observations.

Step3

Solve the determinantal equation

$| R- \lambda I | = 0$ for all λ.

R is an (M×M) matrix. This leads to a M^{th} degree polynomial equation in λ and hence M roots. These roots are called the characteristic roots or eigen values of R. Arrangeλ in descending order of magnitude as

$\lambda_1 > \lambda_2 > \lambda_3 > \ldots > \lambda_M$

Step4

Corresponding to each value of λ we solve the matrix equation,

$(R-\lambda I) = 0$

for the (M×1) eigen vector β, subject to the condition $\beta' * \beta = 1$.

Let us write the characteristic vectors as$\beta_1, \beta_2, \ldots \beta_M$.

Step5

The first principal component is obtained by multiplying the elements of the column vector β_1 with the standardized data matrix. Thus,

$P_1 = \beta_{11}X_1 + \ldots + \beta_{1M}X_M$, using the elements of the characteristic vector β_1 corresponding to the largest root λ_1 of R.

In order to analyze the trends in the variables used in the study the trend growth rates have been calculated for three different time periods , 1980-2000 , 1980-90 and 1990-2000 , further segregating pre-reform period 1980-1990 and 1990-2000 as post reform period The analysis of trend of various indicators has been done in the third chapter .The coefficient of Variation is calculated for poverty in order to assess the level of

disparity across states since coefficient of variation is a relative measure calculated as ratio of standard deviation and mean. This indicates whether the level of disparity across states has increased in a given time period.

Rank correlation has been calculated for rural electrification and poverty which further gives the idea how the correlation has changed in post and pre reform periods .

To assess the impact of rural electrification on poverty the following models have been used.

Model 1

This model identifies the impact of rural electrification on agricultural income by regressing per capita net state domestic product on rural electrification and gross area irrigated

In the first model we test the following causal relationship.

$$\mathbf{PCNSDPAgr} = \alpha + \beta_1 \mathbf{(CompIndRE)} + \beta_2 \mathbf{(GIA)}$$

Where,

1 **PCNSDPAgr** = Per Capita Net State Domestic Product from Agriculture

2 **CompIndRE** = Composite Index of Rural Electrification that consists of two indicators:
   a) Percentage of Village Electrified, (%)and
   b) Agricultural Electricity Consumption(million Kwh)

3 **GIA** = Gross Irrigated Area as Percentage of Gross Cropped Area(%)

α. Is the constant term which gives the level of income from agriculture sector when rural electrification and percentage of gross area irrigated are negligible .

β_1 :. Is the coefficient of composite index of rural electrification

β_2. . Is the coefficient of gross Irrigated Area as Percentage of Gross Cropped Area(%)

This regression would be run separately for all sixteen major states for the time period 1980-2000.This would give us the time series analysis for each state for the time period 1980-2000

Model 2

This model identifies the impact of agricultural income on the level of poverty by regressing proportion of population above poverty line on income from agriculture sector and rural literacy rate .In this model we take percentage of population above poverty line as indicator of level of poverty

In the second model we test the following causal relationship.

$$\mathbf{PAbPL} = \alpha + \beta_1 \mathbf{(log\ PCNSDPAgr)} + \beta_2 \mathbf{(RLit)}$$

Where,

PAbPL = Percentage Population above Poverty Line

PCNSDPAgr = Per Capita NSDP from Agriculture

RLit = Rural Literacy Rate

α. Is the constant term which gives the level of income from agriculture sector when per capita net state domestic product from agriculture sector and rural literacy are negligible .

β_1 :. Is the coefficient of Per capita net state domestic product from agriculture sector

β_2. . Is the coefficient of rural literacy rate (%)

This regression would be run for four different time periods 1983, 1987 , 1993 and 1999 across sixteen major states .This would give us a cross sectional analysis for each of four time periods .The pre and post reform scenario can be assessed taking the analysis in time period 1983 and 1987 as pre reform scenario and 1993 and 1999 as the post reform scenario .

Chapter 3

Power Sector Reforms and Rural Electrification

3.1 POWER SECTOR

India has come a long way in power sector since independence. For instance, in 1947, India was generating only 1362 MW of power (private sector contributing 63% and public sector generating 37% of the total). India now generates 126008 MW as on June 2006. Generation in the country has also increased from 5 billion units in 1950 to about 515 billion units today. The growth in the transmission lines has been from 2708 km in 1950 to more than 200,000 km today. The most prominent source of power is thermal which constitutes around 66% of the total power generation in the country. Hydro-electricity is next claiming for a little over 26%. Rest of the power is generated by nuclear and renewable energy sources. As per the Indian Constitution, the power sector is a concurrent subject and is the joint responsibility of the State and Central Governments. The power sector in India is dominated by the government. At present, the contribution of the state sector is highest (55.8%) in the total power generation, followed by the central sector (32.1%) and the private sector (12.1%).

State sector generates an overwhelming share of hydra power (77.8%) and contributes to half of the thermal power generated in the country. The entire nuclear power generation is done by the central sector as it is the exclusive domain of the central government. Private sector on the other hand generates most of its power through diesel and renewable enegy resources where the intervention of the central and state governments is minimal. In this regard, it would be interesting to analyze the position of different regions with respect to the power generation in India.

3.1.1 REGIONAL DISTRIBUTION OF POWER GENERATION

The northern, western and southern regions generate around 85% of the power while the hydro and coal resource-rich eastern region contributes only to around 13% of the total power generated in the country. Similarly, the contribution of hydro-rich north-

eastern region is abysmal by any standard at 2%. While the concentration of the industry and the rich agricultural land can partly explain such a heavy concentration of power generation in the aforementioned three regions, extremely low capacity of the power transfer from the eastern and north-eastern region to the central grid is one of the major factors explaining such a low contribution of these resource-rich areas to the power generation in the country. As a consequence, despite the availability of the resources to generate power in abundance, the country is reeling under considerable power deficit.

3.1.2 SHORT FALL IN POWER SUPPLY

Under normal situation there has always been a shortfall in the power availability. This deficiency has evidently adversely affected the development of the country as modern agriculture, industry and service sectors are heavily dependent upon the power supply. In this regard, it may be mentioned that according to World Bank estimates, attainment of a rate of growth of GDP around 7% per annum, is possible only with 10% growth in the power supply..

During the 2004-2005 fiscal year the power shortage across India was 11.7%, with the southern region logging the least shortage (3.1%) and the western region (Gujarat, Madhya Pradesh, Maharashtra) the most (22.4%). The perennial power shortages can be attributed to the slippages in the Targets. For instance, against targeted capacity addition plan of 30, 538 MW in VIII Five-Year Plan, actual capacity addition was only 16423 MW (54%). Similarly, in IX Plan, against the target of 40,245 MW, only about 20,420 MW (51%) is likely to fructify. Thus, there have been major slippages in both Plans. The substantial peak and power shortages have led to the private investment in costly captive plants, small generating sets, inverters and voltage stabilizers of various types ranging from 300 Mega Watts (industry) to 250 Watts (households) to address issues of supply and its quality. Such an investment in small doses proves to be very expensive implying unnecessary wastage of resources. The same money could be more gainfully invested through corporate investments in power generation, transmission and distribution with assured returns on investments.

In this regard, it may be pertinent to mention that the problem of power shortage persists even though the average annual per capita electricity consumption in India at 400 kWh, is far behind other developing countries such as China (900 kWh), Malaysia (2500 Kwh), Thailand (1,500 kWh) Brazil (1,783) and Egypt (787), and the developing countries such as UK (5,843), Australia (6,606) and USA (8,747). However, the fact that the per capita electricity consumption in India increased from 15.55 Kwh in 1947 to 178 Kwh in 1985-86 to 400 Kwh in 2002, is quite encouraging. It may be appropriate to mention here that the elasticity ratio (elasticity of electricity consumption with respect to GDP) was 3.06 in the first Plan and peaked at 5.11 during third plan and declined to 1.65 in the Eighties. While consumption went up by 3.14% for every 1% growth in GDP in the first five-year plan period (1951- 56), it went up by only 0.97% in the eighth plan period (1992- 97). The growth in electricity consumption over the past decade has been slower than the GDP's growth. This could be due to high growth of the services sector or it could reflect improving efficiency of electricity use. Moreover, captive generation has also increased. However, as growth in the manufacturing sector picks up, the demand for power is also expected to increase at a faster rate. Demand will also increase along with electrification. In order to support a rate of growth of GDP of around 7% per annum, the rate of growth of power supply needs to be over 10% annually.

Ever increasing demand for power from 4.16 quadrillion Btu (quads) in 1980 to 12.8 quads in 2001 due to rise in population, per capita incomes, urbanization, industrial expansion and mechanization of agriculture can also be accounted for this shortfall in the availability of the power. In fact, about 65–70 percent of industrial energy consumption is accounted for by seven energy-intensive sectors -fertiliser, cement, pulp and paper, textiles, iron and steel, aluminium, and refineries.

3.2 Major Issues in Power Sector

3.2.1 Inadequate Inter-Regional Transmission Links:

Poor linking of power surplus eastern region with the most power deficient western and northern regions. The total installed capacity in the Eastern Region is of the order

of 15,000 MW whereas the peak load is around 6500-7500 MW and off-peak load is 4000-4500 MW. However total transfer of only 1100 MW is possible currently.

3.2.2 Inadequate Investment in New Capacities and T&D Networks due to Mounting Debts of SEBs and Huge Additional Investment Requirement:

In 2002, the cumulative amount dues of SEBs to power generating companies, coal suppliers and railways to these agencies exceeded Rs.41,000 crore, seriously impacting the borrowing capacities of the SEBs. The fact that 60% of Indian manufacturing entities need to have captive power generating units actually says it all. The equivalent number in China is 16%; in Brazil 17%; and in Pakistan 42%. It may be mentioned here that the share of the electricity sector in the five-year Plans has been in the range of 15%-20%. However, investment has gone into generation rather than transmission and distribution. In terms of actual investments 72% has gone toward generation, 18% toward transmission and only 10% toward distribution.(task Force Report 2004). This highlights that matching investment in the arena of power distribution did not take place, leaving it ill-equipped to meet the needs of the efficient business. Recently, Government of India has consequently launched the APDRP (Accelerated Power Development and Reform Program), to ensure matching investments in T&D

3.2.3 Large Gestation Period for Building Fresh Capacity and Slippages in the Targets:

The gestation period for building up the new power generation project are quite high and have to be installed well in advance by correctly projecting rise in the demand for energy in future. Also there have been large slippages in the targets set for addition to the generation capacity. This can be seen from the fact that in the Sixth Plan period, capacity addition was only 72.3 per cent of the target. This percentage came down steeply to 53.77 per cent in the Eighth Plan and is expected to come down further to

just about 52 per cent of the original target (40,245 MW) in the Ninth Plan. Only in the Seventh Plan was the achievement reasonable (96.2 per cent).

3.2.4 LARGE TECHNICAL T&D LOSSES

Large technical T&D losses are due to ageing sub-transmission & distribution network and Lack of Renovation and Modernization. Up-rating the performance/ life extension through renovation and modernization are cost effective methods of capacity creation (Rs. 1 crore per MW for Thermal and Rs. 60-70 lakhs per MW for Hydro as compared to Rs. 4 to 5 crores per MW for new green-field power projects). As a result of poor maintenance and other problems, the plant load factor has also been on the lower side.

Inadequate maintenance as is reflected by the fact that over 25% distribution Transformers fail every year in SEBs compared to less than 1% abroad, . resulting in: unplanned outages, frequent breakdowns and low output.

Large non-technical T&D losses due to pilferage and large scale theft. 40% against the world average of 6-7%. Even in countries such as China, Malaysia, and Thailand, they are less than 10%. Although reported total energy losses in T&D are 28% on an all India average basis, a closer examination reveals that actual losses including theft and wrong classification could be in the range of 40-45 per cent.

3.2.5 INCREASING COST-REVENUE GAP IN THE INDIAN POWER SECTOR

Out of total energy generated, only 55% is billed and only 41% is realised. The gap between average revenue realisation and average cost of supply has been constantly increasing. During the year 2000-2001, the average cost of supply was 304 paise per unit and average revenue per unit was 212 paise per unit i.e. there was a gap of 92 paise for every unit of power supplied. All this has caused erosion in the volume of internal resources generation by the SEBs. It may be further mentioned that though the industrial and commercial sectors pay very high tariff, they cannot rely on the grid for power supply. When not suffering from hours of blackouts or brownouts, the

supplied power is of very poor quality, with voltage and frequency deviating well beyond the norms of 6% and 3% deviation, respectively. Information about percentage energy sales and revenue

Sectors like Industry, commercial establishments and others are paying far more than the proportion in which they are consuming the power, while some other sectors such as agriculture and domestic are paying much less than the former sectors However, the contention that losses can largely be attributed to the agricultural sector, needs to be examined deeply so as to find out the correct picture. Since only a small part of the energy sold is metered (about 40 per cent), over the years part of the T and D losses are being hidden in the name of agricultural consumption which is mostly unmetered. Several recent studies in various states show that actual agricultural consumption is much lower than what was estimated earlier. As a result, it is seen that the actual T and D losses are as high as 55 per cent in Delhi (where agricultural land is extremely limited) , 51 per cent in Orissa, 47 per cent in Haryana, 45 per cent in Andhra Pradesh, 43 per cent in Rajasthan and 39 per cent in Maharashtra. It is necessary to note in this context that most of the losses take place in the sub-transmission and distribution segment (66 KV and below) which is the most value-added stage in the entire power sector. This is therefore the most crucial area calling for urgent reforms.

3.2.6 POWER SUBSIDIES/FREE POWER/FLAT RATE PRICING

to the priority sector leading to misallocation of resources. One major fallout of this approach is the phenomenal growth in electricity consumption by agricultural sector. In the 1980s agriculture consumed 18 percent of India's electricity; by 1998 it consumed 28% percent (CMIE, 1996). Even after accounting for the additional pump sets installed during this period, extremely low electricity prices are one of the main reasons for the increase in the sector's energy intensity. Worth mentioning is the fact that 28% of total power consumption in India is by irrigation pumpsets (IPS) which are power inefficient by 30-50%. The consumption is somewhat higher in the states like Andhra Pradesh, Gujarat, Madhya Pradesh, Uttar Pradesh, Karnataka, and Haryana, where agricultural electricity use is between 35-45%. However, sale of this electricity amounts to no more than 5-10% of the state electricity boards' revenues.

3.2.7 INEFFICIENT USE OF ENERGY ON ACCOUNT OF:

a. Prevalence of relatively obsolete technology products,
b. Agricultural pump-sets are energy inefficient by 30-50%. And nearly 500 thousand IPS continue to add each year.
c. Poor customer awareness, and
d. Inappropriate enforcement of the energy conservation regulations such as Energy Conservation Act of October 2001.

3.6.8 EXAGGERATED POWER DEMAND ESTIMATES

It may also be pointed out that the demand estimates made by the SEBs or the all-India power surveys have proved to be way off the mark. Thus, though the generation capacity addition in the Ninth Plan was just 52 per cent of the target, as in March 2001, there was a peak deficit of only 13 per cent and energy deficit of only 7.8 per cent at the all-India level as against a peak deficit of 18 per cent and energy deficit of 11.5 per cent during 1996-97. This is partly due to a marked improvement in the plant load factor (PLF) of thermal plants as well as inter-regional transfer of power through the national grid. The increasing contribution of service sector to GDP and the sharp decline in the elasticity of electricity consumption referred to earlier are other factors which need to be reckoned with. The price at which electricity will be made available is also important in assessing the demand. For example, the large demand, by way of theft of power or unmetered supply at highly subsidised tariff, will not remain at the same level if power supply is to be metered and charged at a reasonable cost-based tariff. The significant contribution which demand side management (DSM) can make to containing the demand also needs to be taken note of in making projections of demand for electricity. It hardly need be emphasised that reasonable accuracy of demand projections is particularly important due to the highly capital intensive nature of this industry.

3.2.9 OTHER SINGNIFICANT ISSUES ARE:

- Lack of competitive pressure and profit centric approach.

- Highest cost of power paid by the industrial and residential consumers in the world. The average generation cost of central utilities, National Thermal Power Corporation (NTPC) and National Hydroelectric Power Corporation (NHPC), is just Rs 1.60 per unit and Rs 1.40 per unit, respectively.

- Poor HRD Infrastructure for training, motivating, compensating, retaining, and revitalizing staff.

- Political interference, commercially unsound and unsustainable System.

3.3 AN OVERVIEW OF REFORMS IN POWER SECTOR

3.3.1 THE INDIAN ELECTRICITY SECTOR

Power is a concurrent responsibility of the central and state governments. A State Electricity Board (SEB) owns each state's power system and is responsible for the generation, transmission, distribution, and pricing of power. The SEB is not an independent entity but is a part of the state government's ministry of power.

The central government is an important players, partly due to its powers over finance sought by SEBs (usually from central financial institutions and international lenders). Over time, it has also become the owner of the largest generating utility. It has also, as we shall see below, been the driver of reforms.

3.3.2 THE CENTRAL GOVERNMENT ORGANIZATIONS INVOLVED IN ELECTRICITY SUPPLY INCLUDE:

The Central Electricity Authority (CEA), which provides technical and economic evaluation of projects that need funding from centrally controlled financial institutions, such as the Power Finance Corporation and the pubic-sector banks. The CEA also evaluates project for location, size, environmental clearances, availability of fuel, and suitability with the national output plans.

The Power Finance Corporation (PFC), which syndicates loans for the SEBs.

The National Thermal Power Corporation (NTPC), a thermal generator which has become, over time, the single largest generator of power in India. The NTPC was established to build power stations at coal mine-mouths for onward transmission to the rest of the country. It owns about 20 percent of national generating capacity.

The National Hydroelectric Power Corporation and the Nuclear Power Corporation (NPC) are smaller entities organized along the lines of the NTPC. The NPC owns all nuclear power in India.

3.3.3 POLICIES AND PERFORMANCE PRIOR TO REFORM

India began to reform its electricity sector in 1991. Prior to that date, policy objectives included: (1) meeting the requirements of commercially viable clients, such as commercial and industrial users, metropolitan households, etc. (2) serving underprivileged users through subsidized connectivity programs and prices; and (3) generating a surplus for supporting other social programs.

The third goal was a non-starter due to the absence of surplus in most states. Both cross-subsidies and subsidies from the state budget were used to meet the second goal by extending the distribution network to unserved areas, particularly to rural areas, where 70 percent of India's population lives. This policy had some success: as of

The above policies have led to power sector losses becoming the largest drain on state resources, a problem that continues after several waves of reform. In 2001-02, the power sector's losses were Rs. 284 bn (US$5.9 bn) or -38.2% capital employed.

Table 3.2: *Tariff and costs in 1993-4*

Uses	Tariff Rs./Kwh	Tariff $/Kwh	% of average cost recovery	% of consumption	% of cost recovery in 1997-98
Agriculture	0.20	0.006	14.2	28.4	12
Domestic	0.85	0.027	60.3	16.5	54
Commercial/Industrial	1.80	0.057	127.6	42.0	122
Other	1.24	0.039	87.9	13.1	
Average Tariff	1.13	0.036	80.1		
Average Cost	1.41	0.045			
Projected average Cost at 10% T&D losses.	1.10	0.035			

Source: Economic Survey 1997 - 98

3.3.4 THE 1991 REFORMS

The initial driver for reforms in India was the shortage of funds with SEBs. The central government, as the financier of the stages, began reform, in close consultation with the states.

The first policy statement of October, 1991, titled the Government of India Resolution – Policy on Private Participation in the Power Sector, did the following:

- It allowed the private sector to "set up thermal projects, hydroelectric projects, and wind/solar energy projects of any size. Generators were invited to submit unsolicited proposals to SEBs for the purpose.

- It allowed the private sector to "supply and distribute energy in a specified area,... (even without ownership of) a generating station".

- Foreign ownership upto 100% was allowed.

- The contract between the generator and the SEB would be a long-term power purchase agreement (PPA) offering a guaranteed return on equity of 16 percent. Foreign investors would receive exchange rate protection up to the benchmark return and for the servicing costs of foreign debt.

In practice, distribution was not privatized. The language of the regulations governing IPPs was intrusive and confused investors enough to prevent the conclusion of most deals. Most importantly, the document did not address the financial health of SEBs, a perquisite for the viability of PPAs and the privatization of distribution. Second, related to the financial health of the SEBs, the reforms failed to render the SEBs independent from political influences through either privatization, reorganization within public ownership, or through independent regulation.

3.3.5 POST REFORMS: THE 1997 GUIDELINES

By 1996, the failure of the 1991 reforms was apparent. The Ministry of Power organized a discussion between the centre and the states in October and December 1996, from which emerged the "Common Minimum National Action Plant for Power" (CMNAP).

The CMNAP recommended:

1 That the SEBs be corporatized, initially within the existing framework for public ownership followed by gradual privatization.

2 That the SEBs focus on improving efficiency in both generation and distribution via reorganization, efficient metering and energy audits.

3 The creation of independent state electricity regulatory commissions (SERCs), answerable only to the state high court.

4 That tariffs be set – "with immediate effect" – to earn a return on capital employed of at least 3 percent.

5 Cross-subsidization be continued provided that no user pay less than 50 percent of its average costs. A three-year phase-in was allowed for farmers only, who would immediately pay at least Rs. 0.50/kWh.

6 Simplification of procedures, including that adjustments for changes in fuel charges be "automatically incorporated" in the tariff structure as a pass-through cost. This concept was incorporated in the June 1997 guidelines for private sector participation in generation.

The CMNAP formed the basis for the June 1997 guidelines on generation it eh power sector. It had the following components:

7 Generation companies would be compensated through a long-term PPA based on power made available (but not offtake), instead of return on equity.

8 The SEBs would invite competitive bids rather than allow a generator to make unsolicited proposals for supply.

9 Bids would be compared on tariffs offered.

Since much of the earlier disputes between generators and the SEBs had centered on the definition of assets, costs and off-take, the new policy was expected to resolve the contentious issues. The 1996/7 reforms were, however, flawed in not progressing with distribution sector reform. Even if the earlier, intrusive conditions for generation could have been resolved, private investors in generation would still have been deterred by having to deal with state-owned financially weak SEBs.

3.3.6 THE 1998 LEGISLATION AND CHIEF MINISTERS' AGREEMENT AND LATER DEVELOPMENTS

In April 1998, the central government passed legislation to establish the Central Electricity Regulatory Commissions (CERC) and to enable the states to set up SERCs (Electricity Commissions Act,1998) . Under the Electricity Amendment Act, SERC consists if a single regulator with the status of a high court judge or higher, whom the state government will appoint for a minimum tenure of five years, with no right of interim oversight by the government. The regulator then recommends names for a regulatory commission that is answerable to the regulator, but whose names must be approved by the State Government.

Further, the Electricity Amendment Act of 1998 separated transmission from distribution and created the national Power Grid Corporation to own and operate interstate transmission lines.

The sector continued to stagnate through 1998. Concerned by slow progress, the Ministry of Power organized a second centre-states conclave in December, 1998 to set time-bound plans, at which it was agreed that:

1 All states would set up SERCs by March 1999.

2 All states would corporatize the SEBs quickly and unbundled (de-integrate) the SEBs into separate activities of generation, transmission, and distribution.

3 Transmission was to be opened to the private sector.

4 Distribution reforms were urgent, contrary to the 1997 preference for a "gradual program of private sector participation in the distribution of electricity.

Following the meetings, a number of states set up SERCs and corporatized and unbundled their SEBs. But failure is apparent, as only 6000 megawatts (MW) of

private project had been implemented by 2002 and another 2000 MW was under construction. Loss-making SEBs, driven by continued high subsidies to agriculture and high T&D losses, continued to be the main obstacle.

SERCs have, therefore, dealt mainly with SEBs or state-owned, corporatized utilities rather than with privatized distribution companies. The SERCs' focus has been on directing SEBs to reduce theft and T&D losses and to raise revenue. The latter depends on raising average prices charged as well as receiving adequate subsidies from the state. Although average prices have risen in most states, they are well below cost and T&D losses continue to be large, as noted earlier.

In the only state where there has been experience with regulation of privatized distribution companies, Orissa, the private firms have complained that the regulator has been captured by politicians supporting lower prices for small and rural users.

The government has also proposed a write-off of the debt of SEBs in order to increase their saleability to the private sector. This improves their financial health but does not solve the problem of how to charge more for electricity and risks opening up new incentives for inefficiency. A new Electricity Bill was tabled in Parliament in 2001 but has yet to be passed. It calls for, among other things, mandatory metering of all users, a move strongly opposed by the agricultural lobby; this had delayed its passage into 2003, at least.

In summary, reform has progressed in generation and regulation since 1991, but has failed in distribution. The result is the system's failure. There is a growing realization that an economically efficient solution must focus on distribution and that distribution reform must include a pathway and an end-solution that are both economically and politically feasible.

This, however, raises the risk that optimal solutions may not be found. For example, suppose that the large, privately-owned firm with a state-wide franchise is an economically efficient form of organizing distribution. But, suppose that private investors will not be interested until regulators' independence from politicians is demonstrable. This may force the state to own and operate the system for a while

under regulatory supervision, until the regulators' independence is demonstrated. If, however, state-ownership is accompanied by the risk of higher political interference than private ownership, then private investors may never observe enough regulatory independence to justify their investment.

3.3.7 THE ELECTRICITY ACT, 2003

The Hon'ble Prime Minister and Chief Ministers have set before the nation the goal of electrifying all our villages by 2007 and all our households by 2012. Access is yet to be provided to about 80,000 villages. Uninterrupted and reliable supply of electricity for 24 hours a day needs to become a reality for the whole country including rural areas. Enough generating capacity need to be created to outgrow the situation of energy and peaking shortages and make the country free of power cuts with some spare generating capacity so that the system is also reliable

It is in this context that the Electricity Act, 2003 seeks to bring about a qualitative transformation of the electricity sector through a new paradigm. The Act seeks to create liberal framework of development for the power sector by distancing Government from regulation. It replaces the three existing legislations, namely, Indian Electricity Act, 1910, the Electricity (Supply) Act, 1948 and the Electricity Regulatory Commissions Act, 1998.

The objectives of the Act are "to consolidate the laws relating to generation, transmission, distribution, trading and use of electricity and generally for taking measures conducive to development of electricity industry, promoting competition therein, protecting interest of consumers and supply of electricity to all areas, rationalization of electricity tariff, ensuring transparent policies regarding subsidies, promotion of efficient and environmentally benign policies, constitution of Central Electricity Authority, Regulatory Commissions and establishment of Appellate Tribunal and for matters connected therewith or incidental thereto."

The Current Status of Indian Power Sector Reform can be briefly discussed as follows

i) Twenty two states namely, Orissa, Haryana, Andhra Pradesh, Uttar Pradesh, Karnataka, West Bengal, Tamil Nadu, Punjab, Delhi, Gujarat, Madhya Pradesh, Maharashtra, Rajasthan, Himachal Pradesh, Assam, Chhatisgarh, Uttaranchal, Goa, Bihar, Jharkhand, Kerala and Tripura have either constituted or notified the constitution of SERC.

ii) Eighteen SERCs viz. Orissa, Andhra Pradesh, Uttar Pradesh, Maharashtra, Gujarat, Haryana, Karnataka, Rajasthan, Delhi, Madhya Pradesh, Himachal Pradesh, West Bengal, Punjab, Tamil Nadu, Assam, Uttaranchal, Jharkhand and Kerala have issued tariff orders.

iii) Orissa, Haryana, Andhra Pradesh, Uttar Pradesh, Karnataka, Rajasthan, Madhya Pradesh, Delhi and Gujarat have enacted their State Electricity Reforms Acts, which provide, inter alia, for unbundling/ corporatisation of SEBs, setting up of SERCs, etc.

iv) The SEBs of Orissa, Haryana, Andhra Pradesh, Karnataka, Uttar Pradesh, Uttaranchal Rajasthan, Delhi and Madhya Pradesh have been unbundled/corporatised.

v) Distribution has been privatized in Orissa and Delhi.

The following table gives a brief review of the status of reforms in various states

Table 3.3: Status of Reforms in States

Sl. No.	State	Status
1.	Andhra Pradesh	· SERC constituted, functional. · Tariff orders issued. · Reform Law enacted. · SEB unbundled. · Distribution privatization strategy being finalized. · MOU signed with Government of India. · Anti-theft law passed.
2.	Arunachal	· MOU signed with Government of India.

	Pradesh	
3.	Assam	· SERC constituted, functional. · Tariff Order issued. · MOU signed with Government of India.
4.	Bihar	· MOU signed with Government of India. · SERC constituted. · Anti-theft law passed.
5.	Chhattisgarh	· MOU signed with Government of India. · SERC constituted.
6.	Delhi	· SERC constituted, functional. · Tariff order issued. · Reform Law enacted. DVB unbundled. · Distribution privatized.
7.	Gujarat	· SERC constituted, functional, tariff order issued. · Reform law enacted. · Anti-theft law enacted · MOU signed with Government of India.
8.	Goa	· MOU signed with Government of India. · SERC constituted.
9.	Haryana	· SERC constituted, functional. · Tariff Orders issued. · Reform Law enacted, SEB unbundled. · MOU signed with Government of India.
10.	Himachal Pradesh	· SERC constituted functional. · Tariff order issued. · MOU signed with Government of India.
11.	Jammu & Kashmir	· Reform Bill passed by State Assembly. · MOU signed with Government of India.
12.	Jharkhand	· MOU signed with Government of India. · SERC notified. · Tariff Order issued.
13.	Karnataka	· SERC constituted, functional. · Tariff Order issued. · Reform Law enacted, SEB unbundled. · MOU signed with Government of India. · Anti-theft law passed.
14.	Kerala	· SERC constituted. · MOU signed with Government of India. · Anti-theft law passed. · Tariff Order issued.
15.	Madhya Pradesh	· SERC constituted, functional. · Tariff order issued. · Reform Law enacted. · MOU signed with Government of India. · SEB Unbundled. · Anti-theft law passed.

16.	Maharashtra	· SERC constituted, functional. · Tariff order issued. · MOU signed with Government of India. · Anti-theft law passed.
17.	Orissa	· SERC functional. · Tariff orders issued. · Reform Law enacted. · SEB unbundled. · Distribution Privatized. · MOU signed with Government of India.
18.	Punjab	· SERC constituted, functional. · Tariff Order issued. · MOU signed with Government of India.
19.	Rajasthan	· SERC constituted, functional. · Tariff order issued. · Reform Law enacted. · SEB unbundled. · MOU signed with Government of India.
20.	Tamil Nadu	· SERC constituted, functional. · Tariff Order issued. · MOU signed with Government of India.
21.	Uttar Pradesh	· SERC constituted, functional. · Tariff order issued. · Reform Law enacted. · SEB unbundled. · MOU signed with Government of India. · Anti-theft law passed.
22.	Uttaranchal	· MOU signed with Government of India. · · SERC constituted. · SEB unbundled. · Tariff order issued
23.	West Bengal	· SERC constituted. · Tariff order issued · MOU signed with Government of India. · Anti-theft law passed.
24.	Nagaland Meghalaya Mizoram Manipur Tripura Sikkim	· North Eastern States have shown willingness to constitute Joint Electricity Regulatory Commission (JERC). · Mizoram and Manipur are in the process of constituting JERC. · Tripura has notified the constitution of SERC. · Nagaland, Meghalaya, Mizoram, Tripura and Sikkim have signed MOU with Government of India.

Source: Ministry of Power, Monitoring Cell , Nirman Bhavan , Government of India, New Delhi

However, in spite of substantial measures taken to improve the power situation in India, the implementation seems to be slow. One important aspect of the policy prescriptions has been rural electrification. We now turn to the power scenario in the rural areas of India and analyse the sector specific policy prescriptions as given by the Electricity Act 2003.

From the review of reforms it is observed that the focus of Indian reform legislation has been more on improving financial viability of ailing power sector than on improving the access to electricity. To effectively meet the electricity needs of the poor , legislative and policy support for mechanisms like the provision of lifeline rates and special functions like missionary electrification needs to be put in place

A number of projects have applied to target the poor Rural electrification can be a powerful instrument for putting poor people first. Electricity improves access to productive activities thus lessening their vulnerability to shocks. Rural Electrification in India increases the use of irrigation there by significantly reducing poverty incidence

The section below would discuss the status of rural electrification during the refor process of Power Sector .

3.4 RURAL ELECTRIFICATION

While large-scale reforms have repeatedly been attempted in the past, India's achievement in the field of rural access to electricity leaves much to be desired. India is home to 35% of the global population without access to electricity and only 44% of all rural Indian households are electrified. It may be mentioned here that although the number of electrified villages has increased rapidly, the number of households electrified has not matched in pace. The Ministry of Power's figures on rural electrification (RE) states that 87% of villages are electrified, while only 42-44% of rural households are electrified. According to the 2001 Census, 6.02 crore households use electricity as the primary source of lighting out of a total of 13.8 crore households in the country.

Currently, there is a vast difference between the urban and rural areas in regard of access to electricity. Electrification varies dramatically between the urban poor (33% without connection) and rural poor (77% without connection). This inequity impedes the development of poor rural population and underscores the fact that India's rural electrification programs have not reached the most marginalized and needy people.

In 1969, in a bid to intensify the rural electrification efforts, the Govt. of India, in collaboration with the USAID created the Rural Electrification Corporation (REC). This organization was built upon the Tennessee Valley Authority (TVA) experience in the United States, and is mandated to facilitate availability of electricity in rural and semi-urban areas. Although during its thirty-seven years of existence, the REC has financed numerous village electrification, pump set energization and Low Tension system improvement projects, its focus was more on the extensive (number of villages electrified) rather than intensive (% of households covered), leaving large gaps in rural electrification. With a change in the definition of an electrified village, the mid-term review of India's Tenth Five-Year Plan has acknowledged that the year-end figures as of 31st March 2004 of 84.3% village electrification would reduce to less than 70%. Although electricity for the purpose of agriculture is highly subsidized, the poor farmers (marginal and small) as compared to rich farmers, frequently pay a high fraction of their gross farm income for irrigation.

With the goal of electrifying all our villages by 2007 and all our households by 2012.. access is yet to be provided to about 80,000 villages. Uninterrupted and reliable supply of electricity for 24 hours a day needs to become a reality for the whole country including rural areas. . the Electricity Act, 2003 seeks to bring about a qualitative transformation of the electricity sector through a new paradigm. Inorder to visualize the current status of rural electrification let us look at the implications of the Electricity Act 2003 on rural electrification

The table 3.4 below shows the position of different status with respect to electrification of households as in December, 2005.

Table 3.4: Electrification of rural households, 2005

Sl. No.	State	Total rural households	% Rural households un-electrified
1	Lakshwadeep	5,351	0.3
2	Daman & Diu	22,091	2.5
3	Chandigarh	21,302	2.6
4	Himachal Pradesh	1,097,520	5.5
5	Goa	140,755	7.6
6	Punjab	2,775,462	10.5
7	Delhi	1 69,528	14.5
8	Dadra & NH	32,783	17.4
9	Pondicherry	72,199	19.0
10	Haryana	2,4 54,463	21.5
11	Sikkim	91,723	25.0
12	Jammu & Kashmir	1,1 61,357	25.2
13	Karnataka	6,675,173	27.8
14	Gujarat	5,885,961	27.9
15	Tamil Nadu	8,274,790	28.8
16	Andaman & Nicobar	49,653	31.9
17	Kerala	4,942,550	34.5
18	Maharashtra	10,993,623	34.5
19	Madhya Pradesh	8,124,795	37.7
20	Andhra Pradesh	12,676,218	40.3
21	Nagaland	265,334	43.1
22	Manipur	296,354	47.5
23	Uttaranchal	1,196,157	49.7
24	Chattisgarh	3,3 59,078	53.9
25	Arunachal Pradesh	164,501	55.5
26	Mizoram	79,362	55.9
27	Rajasthan	7,156,703	56.0

28	Tripura	539,680	68.2
29	Meghalaya	329,678	69.7
30	West Bengal	11,161,870	79.7
31	Uttar Pradesh	20,590,074	80.2
32	Orissa	6,782,879	80.6
33	Assam	4,220,173	83.5
34	Jharkhand	3,802,412	90.0
35	Bihar	12,660,007	94.9
	Total / Average	138,271,559	56.5

Source: Ministry of Power, Monitoring Cell , Nirman Bhavan , Government of India, New Delhi

In six states viz., Himachal Pradesh, Goa, Punjab, Haryana, Jammu & Kashmir, and Sikkim, that comprise 6% of country's total rural households, 75% of households stand electrified. It also points out that in six states viz., Bihar, Jharkhand, Assam, Orissa, Uttar Pradesh, and West Bengal, comprising 43% of country's total rural households, around 80% of the households are yet to be provided with the electric connection. Table below discerns information about the number of electrified and electrified villages in different states.

Table 3.5: State wise unelectrified villages, as on 12.12.2005

Sl. No	States/UT	Total No. of Inhabited Villages as per 2001 census	Total No. of Villages Electrified	No. of un-electrified villages	Un-electrified villages as a percentage of total inhabited villages
1	Andhra Pradesh	26613	26565	48	0.18
2	Arunachal Pradesh	3863	2335	1528	39.55
3	Assam	25124	19081	6043	24.05
4	Bihar	39015	19251	19764	50.66
5	Jharkhand	29354	7641	21713	73.97
6	Goa	347	347	Nil	0.00

7	Gujarat	18066	17940	126	0.70
8	Haryana	6764	6759	5	0.07
9	Himachal Pradesh	17495	16891	604	3.45
10	J&K	6417	6301	116	1.81
11	Karnataka	27481	26771	710	2.58
12	Kerala	1364	1384	Nil	0.00
13	Madhya Pradesh	52117	50474	1643	3.15
14	Chhatisgarh	19744	18532	1212	6.14
15	Maharashtra	41095	40351	744	1.81
16	Manipur	2315	2043	272	11.75
17	Meghalaya	5782	3016	2766	47.84
18	Mizoram	707	691	16	2.26
19	Nagaland	1278	1216	62	4.85
20	Orissa	47529	37663	9866	20.76
21	Punjab	12278	12228	Nil	Nil
22	Rajasthan	39753	37276	2477	6.23
23	Sikkim	450	405	45	10.00
24	Tamil Nadu	15400	15400	Nil	Nil
25	Tripura	858	818	40	4.66
26	Uttar Pradesh	97942	57042	40900	41.76
27	Uttaranchal	15761	13131	2630	16.69
28	West Bengal	37945	31705	6240	16.44
	Total (States)	592857	473287	119570	20.17
	Total (UTs)	875	875	Nil	0.00
	Total (All India)	593732	4745162	119570*	20.14

Source: Ministry of Power, Monitoring Cell , Nirman Bhavan , Government of India, New Delhi

As is revealed by Table 3.5, only eight states, constituting 18% of the villages in India, have achieved 100% village electrification - Andhra Pradesh, Goa, Haryana, Maharashtra, Kerala, Punjab, Tamil Nadu and Nagaland. Further a comparison of Table 3.4 and 3.5 points to the mismatch between the % of unelectrified households and the villages which can be attributed to the fallacy lying in the definition of an

electrified village. Eight states viz., UP, Bihar, West Bengal, Uttaranchal, Jharkhand, Orissa, Assam, and Meghalaya still do have the daunting task of electrifying a substantial number of villages.

Inorder to visualize the current status of rural electrification let us look at the implications of the Electricity Act 2003 on rural electrification

3.4.1 IMPLICATIONS OF THE ELECTRICITY ACT 2003 AND THE LATEST DEVELOPMENTS IN RURAL ELECTRIFICATION

The Electricity Act 2003 (EA03) for the first time mentions rural electrification in a law. Section 6 of the act mandates the hitherto implied Universal Service Obligation by stating that the government shall endeavor to supply electricity to all areas including villages and hamlets. Section 5 further mandates the formulation of national policy on rural electrification (RE) focusing especially on management of local distribution networks through local institutions. Subsequently, the Government of India has released a draft paper on National Rural Electrification Policy (REP). Giving a further boost to RE, the EA03 in Section 4 also frees stand-alone generation and distribution networks from licensing requirements. The new definition of an electrified village reflecting the commitments under EA03 are:

- Basic infrastructure such as distribution transformers and distribution lines are provided in the inhabited locality as well as in all Dalit bastis/hamlets. (For electrification through Non-Conventional Energy Sources a distribution transformer may not be necessary).
- Electricity is provided to public places like schools, panchayat offices, health centers, dispensaries and community centers.
- The number of households electrified should be at least 10% of the total number of households in the village.

The broad goals of RE as set out in the draft REP, referred to as **AARQA** goals, are as follows:

- Accessibility – electricity to all households by 2012
- Availability – adequate supply to meet demand by 2012

- **Reliability**- ensure 24 hour supply by 2012
- **Quality**- 100% quality supply by 2012
- **Affordability**- pricing based on consumer ability to pay

The first report of the Standing Committee on Energy, Fourteenth Lok Sabha 2004-05, also identified rural electrification as an essential infrastructure input for improving production-oriented activities and speeding up the pace of development of the rural economy. In its submission to the committee for the year 2004-05, the Ministry of Power outlined a new strategy involving creation of a Rural Electricity Distribution Backbone (REDB), Village Electricity Infrastructure (VEI). This also included distribution transformers in each village where grid access was feasible, and a decentralized distributed generation (DDG) and supply for villages where grid connectivity or NCES (non conventional sources of energy) might not be possible or cost effective.

The main sources of funding for current rural electrification programs are:the Rural Electrification Corporation , Plan allocation to the States ,Funding support from Government as loan and grant , Institutional financing bodies like commercial banks and International financing agencies like OECF etc

Some of the ongoing rural electrification programmes are briefly described below:

a. Pradhan Mantri Gramodaya Yojna (PMGY)

The PMGY launched in 2000-2001 provided additional financial assistance for minimum services by the central government to all states on a 90% loan and 10% grant basis. These included rural health, education, drinking water and rural electrification. The PMGY, with an outlay of about Rs. 1600 crores during the 10th Plan period, was being coordinated and monitored by the Rural Development Division of the Planning Commission. More importantly, under PMGY states had the flexibility to decide on the inter-reallocation of funds amongst the 6 basic services. Thus states could enhance allocations to expedite the pace of rural electrification. The scheme has been discontinued44 from 2005 onwards.

b. Kutir Jyoti Program (KJP)

KJP was initiated in 1988-89 to provide single point light connection (60w) to all Below Poverty Line (BPL) households in the country. KJP provides 100% grant for one time cost of internal wiring and service connection charges and builds in a proviso for 100% metering for release of grants. Nearly 5.1 million households have been covered under the scheme to date. The scheme was merged into the 'Accelerated Electrification of One Lakh Villages and One Crore Households' in May 2004 and now into the RGGVY.

c. Minimum Needs Program (MNP)

The MNP, which exclusively targeted states with less than 65% rural electrification (by the old definition), provides 100% loans for last mile connectivity. The program resources are drawn from the Central Plan Assistance. Rs. 775 crore was released during 2001-03 for rural electrification under the MNP. The scheme was discontinued in 2004-05 on account of difficulties in implementation.

d. Accelerated Rural Electrification Program (AREP)

The AREP, operational since 2002, provides an interest subsidy of 4% to states for RE programs.

The AREP covers electrification of un-electrified villages and household electrification and has an approved outlay of Rs. 560 crore under the 10th Plan. The interest subsidy is available to state

governments and electricity utilities on loans availed from approved financial institutions like the

REC, PFC (Power Finance Corporation) and from NABARD under the Rural Infrastructure Development Fund (RIDF).

e. Rural Electricity Supply Technology Mission (REST)

The REST was initiated on 11th September 2002. The mission's objective is the electrification of all villages and households progressively by year 2012 through local renewable energy sources and decentralized technologies, along with the conventional grid connection.

REST proposes an integrated approach for rural electrification and aims:

- To identify and adopt technological solutions

• To review the current legal and institutional framework and make changes when necessary

• To promote, fund, finance and facilitate alternative approaches in rural electrification, and

• To coordinate with various ministries, apex institutions and research organizations to facilitate meeting national objectives

Accelerated Electrification of One Lakh Villages and One Crore Households, MNP and Kutir Jyoti have now been merged with the RGGVY, discussed in detail ahead.

The Chief Ministers conference held on 3rd March 2001 recognized the need to adopt an integrated approach towards rural electrification and agreed to merge a number of RE programs into one umbrella program - the Rajiv Gandhi Grameen Vidyutikaran Yojna (RGGVY).

f. Rajiv Gandhi Grameen Vidyutikaran Yojna

The RGGVY is the latest national RE scheme launched by the Ministry of Power to execute the vision for rural electrification as enunciated in the NCMP and recommended by the Chief Ministers conference in 2001. The plan was initiated in April of 2005 with the following objectives:

• 100% electrification of all villages and habitations in the country

• Electricity access to all households

• Free of cost electricity connection to BPL (Below Poverty Line) households For achieving the said objectives, the RGGVY envisions creating a:

• Rural Electricity Distribution Backbone (REDB) with at least one 33/11 KV (or 66/11 KV) substation in each block

• Village Electrification Infrastructure (VEI) with at least one distribution transformer in each village/habitation

• Decentralized Distributed Generation (DDG) systems where the grid is not cost effective or feasible

The RGGVY positions rural electricity as a necessary component for broad based economic and human development, looking beyond the prevalent RE framework of increasing agricultural production through irrigation. The program, in addition to meeting the household electricity needs, looks at 24 hour supply of quality grid power

to rural areas for spreading industrial activity, provision of modern healthcare facilities, and the use of IT.(Information Technology)

3.4.2 INADEQUACIES OF RURAL ELECTRIFICATION

In spite of large amount of subsidies provided by the Government for Rural electrification, the Rural Electrification has helped only the rich and medium farmers. The small and marginal farmers have not been benefited from the programme. One has, however, to interpret statistics relating to village electrification with caution.

A village is considered to be electrified once the distribution network is extended to the village and the first connection in the village taken. No data of electricity used in that village for different purposes such as the village industries, households, street lighting or for any other purpose are furnished in the Statistics. However, even in the 13 states where 100 percent village electrification has taken place, substantial work remains to be done to ensure equal access among all sections of population
There are about 44 percent rural households that are yet to be electrified. It reflects that a significant number of households that are yet to be electrified. It reflect that a significant number of households have not been benefited from rural electrification programme due to high costs of connection and internal wirings. This has been partly responsible for slow load growth in the rural areas.

There is in our country long tradition to improve data base but no attempt has so far been made to improve the statistical base by collecting data on the number of households electrified in each village, the number of industries using power in rural areas and the kilometer age of street lighting in rural areas.

A large number of pump-sets in rural areas are of sub-standard quality and operate at sub-optimal efficiency. There is need of achieving higher efficiency in this area which will help conserving energy to a very large extent.

Rural electrification schemes were hitherto confined roughly to community block development areas, resulting in large number of small schemes, increasing paper work

concerning sanctions, disbursements collection of dues monitoring physical progress and closure.

Looking to the pace of private sector participation in electricity generation, transmission and distribution, the response of the private sector wards rural supply may not be encouraging. To encourage independent power producers in rural electrification process, grant subsidy is required to be provided to private sector producers by the government to supply subsidized power to different categories of rural consumers. If the independent power producers would not get a reasonable rate of return on power supply to rural areas, they would be reluctant to participate in this scheme.

The above chapter discusses the series of reform process that have taken place in the power sector and thc impact of these reforms on rural electrifications in various states in past decade.The chapter concludes that rural electrification as a crucial aspect of reform process of Power Sector was incorporated very late and the initial phase of power sector reforms ignored rural electrification.

Chapter 4

Rural Electrification, Agricultural Growth And Poverty

4.1 Rural Electrification and Agricultural Growth

Rural Electrification as a planned programme was initiated in the country in 1950s. In the initial stage, the emphasis dues to electricity as a social amenity rates than an input for agriculture growth in rural areas. Out of 5,87,556 inhabited villages in the country as per 1991 census 5,08,863 villages (86.6%) have been declared electrified by March, 2002. The pumps sets energisation potential in the country is 16.59 million.

A village was said to be electrified prior to 2003-04 if atleast our electric connection existed in that village during 2003-04, the definition of village electrification was changed. Now, a village is considered to be electrified if atleast 10% of its households have access to electricity. Besides, it is also required that electricity is provided to public places such as schools, Panchayats office, health centers, Dispensaries and community center. Further more, distribution transformers and distribution lines are provided in the inhabited locality. Using the new definition, only 4,75,155 villages out of 587556 villages as per 1991 census have been electrified so far which accounts for 80.8% of total villages. There are still 1,12,401 villages where electrification has not been done. In order to achieve the national goal of electrification of villages during the Tenth Five Year Pan. Village electrification has now been included under Pradhan Mantri Gramodaya Yogna as basic minimum services. Under the scheme, a.. allocation of Rs.418.59 crore has been made to the states for carrying out Rural Electrification works.

The increase in number of electrified villages and pumpsets energisation over last five decades of planning, process, the consumption of electricity in agriculture sector is growing at a much faster rate. The share of agriculture sector in total electricity consumption was only 3.16% in 1950-51. It steadily increased to 9.23% in 1970-71.

In eighties and nineties, the share of agriculture sector in total electricity consumption further stepped up. In the late half of the nineties, it was between 31 to 32%. It is interesting to note that although the share of agriculture sector in one-third of the total electricity consumption in the country that the share of revenue from agriculture sector in the total revenue from electricity sales is not in consonance with the sale but it is at a very low level due to increasing subsidies provided to the agriculture sector by the Govt.

The historical tariff structure of different status of India for different categories of consumers e.g. domestic, commercial agriculture and industry reveals that there has been a provision of cross-subsidization in favour of agriculture. The new electricity act has a provision of removal of cross-subsidization and reduction of subsidy. Due to inclusion of this new provision in the current act, tariff rates for agriculture are bound to increase phenomenally in the process of brining then equivalent to the cost of electricity supply.

There are large no. of inputs which determine the growth of agriculture output ,like road density, fertilizer consumption , use of pesticides , use of high yielding varieties of seeds .Rural electrification is one of the crucial variable in determining the agriculture output .

There are two kinds of advantages from Rural Electrification Direct and Indirect. The direct benefits include increased agricultural production through pumpsets energisation. Increased opportunities for employment through rural industrilisation and improvement in the quality of life are some of the indirect benefits. **In 1965,** Programme Evaluation Organization of the Planning Commission, Govt. of India undertook a pioneering study on the impact of rural electrification. The study pointed out that as a result of the installation of electric pumpsets on the existing irrigation works, the proportion of irrigated to gross cropped area increased by 66% of both rabi and khariff crops and new crops were grower by farmers. Similarly the PEO study reported that the yield rates of various crops except Bajra, showed as put after energisation of walls. For Paddy, wheat and sugarcane the yield rates should be increased of 48.7%, 38.7% and 22.3% respectively. The study also revealed that electrification of wells brought about a major change in cropping patter.

There are various other studies which clearly reveal the increase in agricultural production through rural electrification. These studies have been discussed in the literature Review

In rural areas a large number of population is engaged in agriculture , therefore the income from agriculture sector affects the incidence of poverty .An increase in the level of agricultural income reduces the level of poverty Now we will discuss the trend of poverty and inequality in rural India

4.2 TRENDS OF POVERTY

India has the world's second-largest population (after China) with approximately 1.2 billion people. Seventeen major languages and over 800 dialects are spoken there. The preamble of India's Constitution calls it a "a sovereign, socialist, secular, democratic republic". Poverty and inequality has been a crucial point of discussion ever since India moved on path of planning since 1950s. It was picked up as an objective only after the third plan. The following literature would review the trends of poverty with special emphasis on rural poverty and the disparities associated with it across states.

In 1983, the percentage of population below poverty line was highest for Orissa (67.53%) followed by Bihar (64.37%) and West Bengal (63.05). Punjab had the lowest percentage of population below poverty line only 13.2%.

After one decade we observe that it was Bihar which had the highest percentage of population below poverty line i.e. (58.2%) followed by Orissa (49.72%) and Assam 45.01%. Even after a decade of economic reforms in India, rural Orissa (48.01%) continues to be one of the poorest regions of the country.

Poverty is a sum total of all deprivation in India governmental deprivations of poverty is based on the sole criterion of minimum food requirement for survival. Thus the poverty line is decided by the income sufficient to by food equivalent of 2400 calories in rural and 2100 calories in urban areas. The data base for poverty estimates is provided by the quinquenial surveys of NSS, NSS also collects the consumer

expenditure data by decile group on an annual basis. Those who do not earn income sufficient for this minimum calories intake are below poverty line.

A variety of descriptive indices are used to measure poverty, but the most common are the headcount index (HCI), poverty gap index (PGI), and squared poverty gap index SPGI). The headcount index, also called the headcount ratio (HCR), is the most widely used index. If a household spends below a pre-defined level, then it is considered to be poor. The index measures the portion of families below the poverty line. The HCI is useful since it allows one to calculate the marginal impact of additional spending, output, etc. on the number of people lifted out of poverty. The HCI is specified by,

$$HCI = HC/n$$

where n is the total population and HC is the number of households that satisfy the condition $yi < p$, where I define p to be the poverty line and yi to be the expenditure level of an individual or household i (both measured in the same currency).

The Planning Commission estimates poverty from consumption distribution reported by the National Sample Survey (NSS). These results obtained from the consumer expenditure data of the 55th Round are compared with the previous estimates in Table 4.1.

Table 4.1 : Poverty as assessed by the Planning Commission

Year	Percentage Below Poverty Line	Annual decline in percentage points during this period	
1973 -4	56.4		
1987 - 8	39.1	1974 - 87	1.3
1993 - 4	36.2	1987 - 94	0.4
1999 -2000	26.1	1994 - 2000	1.7

Source : Government of India (2000)

According to Table 4.1 the strongest decline in poverty took place during the period 1994–2000, by
1.7% annually, as opposed to only 0.4% during 1987–93.
However, the large sample survey of 1999–2000 (55th Round) on which these figures are based.

The Reforms have reversed the two decades long declining trend of poverty. The rural poverty went up from the pre-reform low of 33.7% to 41.7% in 1991 and slightly declined to 40.2% in 1993-94. The urban poverty also showed the same trend shooting up from the pre-Reform low of 36% to 37.8% and then coming down to 36.2%.

4.2.1 POVERTY AND INEQUALITY IN RURAL INDIA

In order to understand the impact of agricultural growth on poverty, it is important to know the trends of inequality. The trends of inequality within states are fluctuating from time to time. Gini index and Theil's measure of inequality calculated for 15 major states in India for the year 1972-73, 1973-74, 1977-78, and 1983 show that inequality was rising upto the year 1978 and then it decreased in the year 1983. After the economic reforms, these fluctuations became more intensive. The rural inequality started declining while the urban inequality started rising during nineties (Angus Deaton and Jean Dreze, 2002).

The incidence of poverty is higher in rural areas than the urban areas. It would be important to discuss the rural-urban disparity during nineties. The rural-urban inequality in income and consumption expenditure exists in India since independence and even before that. During nineties this disparity has been sharpened after the new economic policy was adopted.

Table4.2 Number and Proportion of Population in Poverty in India

Years	Number in million			Percentage below poverty line		
	1970	1983	1988	1970	1983	1988
Rural	236.8	252.1	252.2	53.	44.9	41.7
Urban	50.5	64.7	70.1	45.5	36.4	33.6
Total	287.3	311.7	322.3	52.4	42.5	39.6

Souce : World Bank , India : Poverty , Employment and Social Sciences (1989)

The above table indicates the status of poverty in India between 1970 and 1988

Infrastructure development through public investment in irrigation , rural electrification , roads and so on is expected to distribute the gains from agricultural growth widely by providing opportunities to less developed regions and to small and marginal farmers.

4.3 Linking Agricultural Growth and Poverty

Rural electrification may be a mechanism through which economic growth indirectly influences status of poor people. In rural economies form and non-form growth plays an important role in poverty reduction. Since rural India is dependent on agriculture, programs that increase agricultural labour productivity by increasing irrigation, introducing electricity to villages are therefore important for rural poverty reduction.

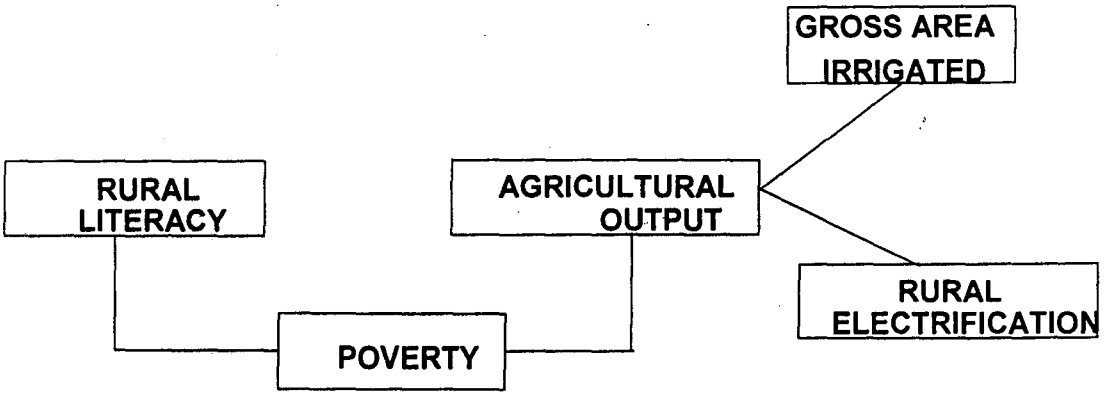
Electricity is used as an input to variety of new agricultural technologies and also encourages the creation of non-form opportunities. The use of new agricultural technologies reduces rural poverty through their impact on labour productivity

An increase in per capita state domestic product in primary sector can be perceived as improvement in conditions of agricultural production or agricultural modernization involves intensification of cultivation methods which increase productivity of land. These methods include use of fertilizers improved seeds varieties, irrigation facilities, use of electricity, insecticides etc. An increase in productivity would finally mean a reduction in poverty.

The chart below cleary depicts a clear linkage between rural electricity, agriculture output and poverty

CHART-I

Inter Linkage Between Rural electrification Agriculture output and poverty



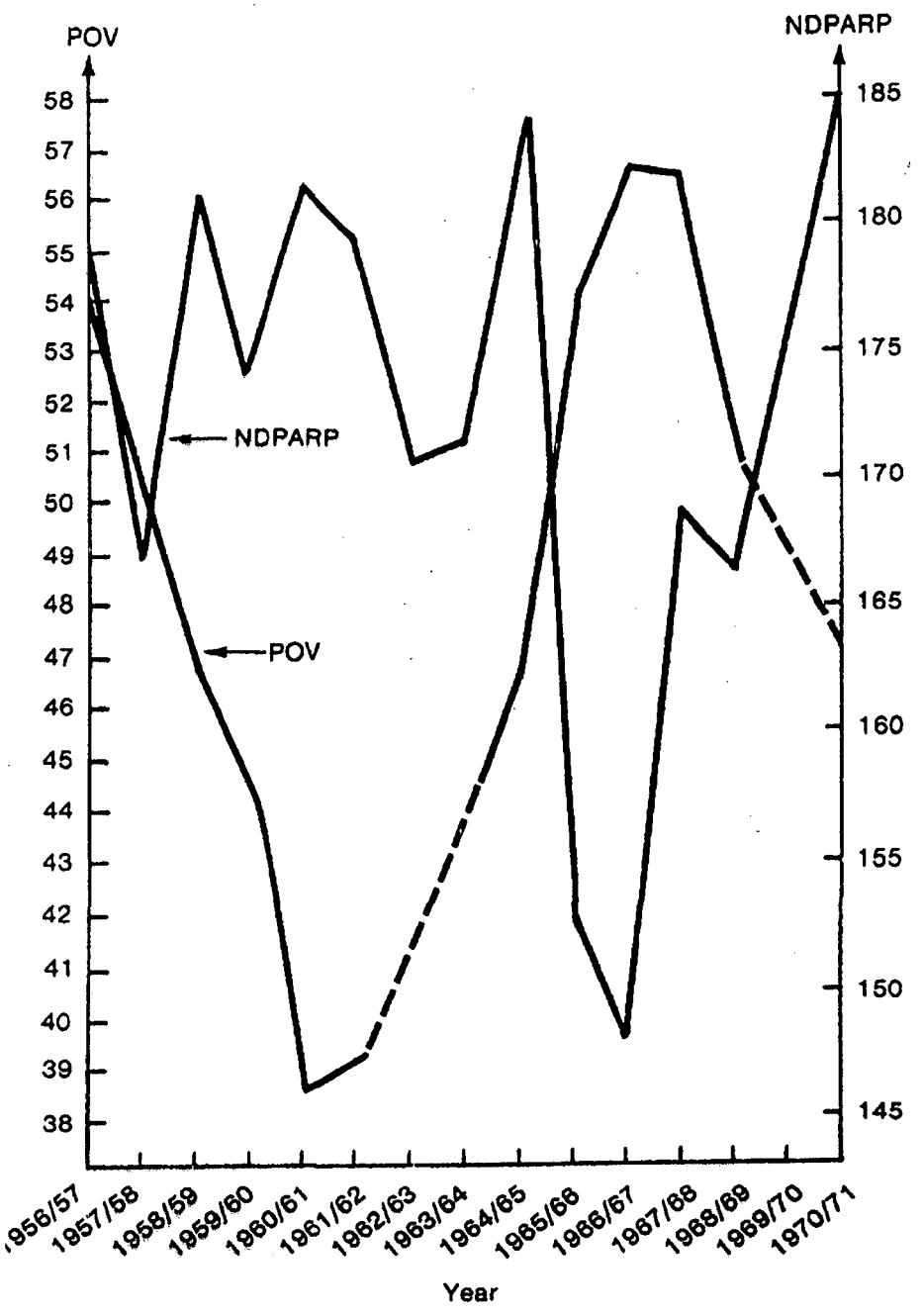
As we can see from the Chart above that gross Area Irrigated and Rural electrification together determine the agricultural output which further combined with rural literacy determine level of poverty

The following study gives an empirical evidence of the linkage of rural electrification , agricultural growth and poverty .

The study by Dharam Narain (1986) on rural population and net domestic product in agriculture per head of rural population identifies the relationship between percentage of rural population and net domestic product in agriculture per head of rural population from 1956/57 to 1970/71

Chart – 4.2

Percentage of rural population in poverty (POV) and net domestic product in agriculture per head of rural population (NDPARP) at 1960/61 prices, 1956/57-1970/71



There was no trend in the incidence of rural poverty between 1956/57 and 1970/71, as Ahluwalia observed. But there were no yearly fluctuations either. The figures show that the percentage of the rural population in poverty declined continuously from 54.1 in 1956/57 to 38.9 in 1960/61, rose to 56.6 in 1966/67, and then fell to 47.5 in 1970/71. If the missing observations for 1962/63 and 19 69/70 are ignored, the changes in each subperiod were in only one direction. During the entire fifteen-year period, the percentage of the rural population in poverty moved between an upper bound of 57 percent and a lower bound of 39 percent. A decline of 15 percentage points in the incidence of rural poverty during 1956/57-1960/61 was associated with neither a decline in the price variable nor an improvement in agricultural performance.

Ahluwalia's (1978b) three major findings based on all-India evidence serve as a backdrop to Dharm Narain's results: First, there was no discernible trend between the mid-1950s and the early 1970s in the incidence of poverty in rural India, measured as the percentage of the Second, improved agricultural performance, measured as an increase in the net domestic product in agriculture per head of rural population at 1960/61 prices (NDPARP), was definitely associated with reduced incidence of rural poverty Third, there was no underlying time trend in the incidence of rural poverty, even after allowing for changes associated with agricultural performance.

The above chapter connects rural electrification to poverty through agricultural growth .and thus establishes the linkage between rural electrification, agricultural growth and poverty.

Chapter 5

Rural Electrification, Agricultural Output & Poverty A Study of Trends and Disparities

5.1 Introduction

The removal of nationwide rural poverty has consistently been one of the chief objectives of Indian Policy. Since independence India has instituted a variety of anti-poverty programmes. First Five Year Plan, containing some kind of poverty eradication programme was launched in 1951. During the mid to late 1990s, India saw tremendous growth, particularly in industrial and resources sector. India's success in lowering poverty during 1970s accrued largely due to growth driven increases in agricultural productivity. This work focuses on rural poverty where Almost 70% of India's population lives in (World Bank 2002),

Rural electrification is part of the Power Sector Reform process. It may be considered as a mechanism through which economic growth indirectly influence the status of poor people. Since rural India is dependent on agriculture, programs that increase agricultural labor productivity by increasing irrigation, introducing electricity to villages, are therefore important for rural poverty reduction. Electricity is used as an input to variety of new agricultural technologies.

The objective is to study the state and effect of rural electrification on reducing poverty for all states between 1980 to 2000. Since rural electrification is a crucial component of agricultural output, this work tests the hypothesis that rural electrification increases agricultural output which in turn reduces poverty.

The percentage of population below poverty line would be used as an indicator of poverty. Rural Electrification constitutes an important determinant for increasing income from the agricultural sector. The two indicators for rural electrification are Agricultural Electricity consumption in (million kwh) and percentage of villages electrified. The other determinants of agricultural output is irrigation. Gross Irrigated Area as Percentage of Gross Cropped Area is taken as the indicator of irrigation. In

this chapter we would be reviewing the interstate variations in these indicators. The trend behavior of these indicators for the 16 major states, for the period 1980 to 1999-00 shall be analyzed by dividing the entire period into two sub-periods (1980 to 1990 and 1990 to 1999-00). In effect, the sub-periods also represent the pre and post reform era and allows us to do some useful comparisons.

Next, we discuss the inter-state as well as decadal variation in these indicators and try to analyze their performance in light of the onset of economic reforms.

5.2 RURAL POVERTY:

Percentage of rural population below poverty line has been used as an indicator. The table No5. 1 shows how the proportion of people below poverty line has changed at three points of time 1983, 1993-94 and 1999-00. The coefficient of variation (CV) of rural poverty has been calculated for six time periods. The coefficient of variation is a relative measure of inequality and it gives the level of disparity in rural poverty across states. The value of CV indicates that there has been a continuous increase in the level of disparity in reducing rural poverty, for the period 1980s to 1999-00.

Table 5.1: proportion of people below poverty line in different states during last three decades

States	1983	1993-94	1999-00
Andhra Pradesh	26.53	15.92	11.05
Assam	42.6	45.01	40.04
Bihar	64.37	58.21	44.3
Gujarat	29.8	22.18	13.17
Haryana	20.56	28.02	8.27
Himachal Pradesh	17	30.34	7.94
Karnataka	36.33	29.88	17.38
Kerala	39.03	25.76	9.38
Madhya Pradesh	48.9	40.64	37.06
Maharashtra	45.23	37.93	23.72
Orissa	67.53	49.72	48.01
Punjab	13.2	11.95	6.35
Rajasthan	33.5	26.46	13.74
Tamil Nadu	53.99	32.48	20.55
Uttar Pradesh	46.45	42.28	31.22
West Bengal	63.05	40.8	31.85

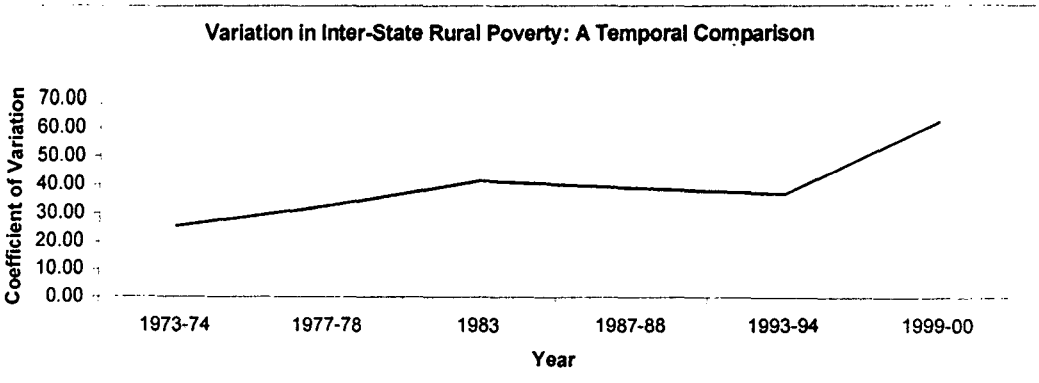
Source: Planning Commission.

In 1983, the percentage of population below poverty line was highest for Orissa (67.53%) followed by Bihar (64.37%) and West Bengal (63.05). Punjab had the lowest percentage of population below poverty line only 13.2%.

After one decade we observe that it was Bihar which had the highest percentage of population below poverty line i.e. (58.2%) followed by Orissa (49.72%) and Assam 45.01%. Even after a decade of economic reforms in India, rural Orissa (48.01%) continues to be one of the poorest regions of the country.

The coefficient of variation of percentage of population below poverty line across states for a given time period describes the level of disparity in terms of poverty across states. We observe that it was minimum for 1973-74 that is 25.46% and highest after the reforms in 1999-00 i.e. (61.97%). There has been a consistent rise in the coefficient of variation of poverty for five decades from 1973-74 to 1999-00 and the level of disparity in terms of poverty across states has considerably increased after the reforms. This is evident from the following graph.

Graph 5.1 A Temporal Comparison of Variation in Inter-State Rural Poverty



Source: Author's Calculation

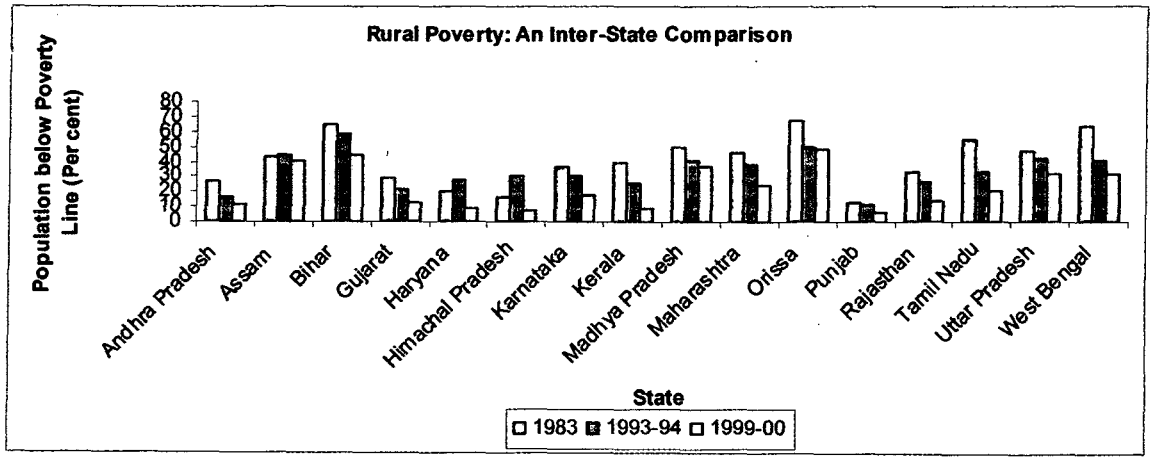
Table 5.2 CV of proportion of people below poverty line in different states during last three decades

Years	Coefficient of Variation
1973-74	25.46
1977-78	32.43
1983	41.30
1987-88	38.80
1993-94	36.63
1999-00	61.97

Source: author's calculation

While comparing the rural poverty across states in the Chart-5.1, Orissa had the highest percentage of population below poverty line. The level of rural poverty declined considerably in the pre-reform period in almost all states except Assam, Haryana and Himachal Pradesh. This decline in rural poverty was highest for West Bengal and Orissa. In the post-reform period we observe that there is consistent decline in rural poverty across states and the decline is maximum for Himachal Pradesh and minimum in Orissa.

Chart: 5.2 An Inter-State Comparison of Rural Poverty



Source: Author's calculation

5.3 RURAL ELECTRIFICATION

In order to measure rural electrification we consider agricultural electricity consumption and percentage of villages electrified as the relevant indicators.

5.3.1 AGRICULTURAL ELECTRICITY CONSUMPTION :

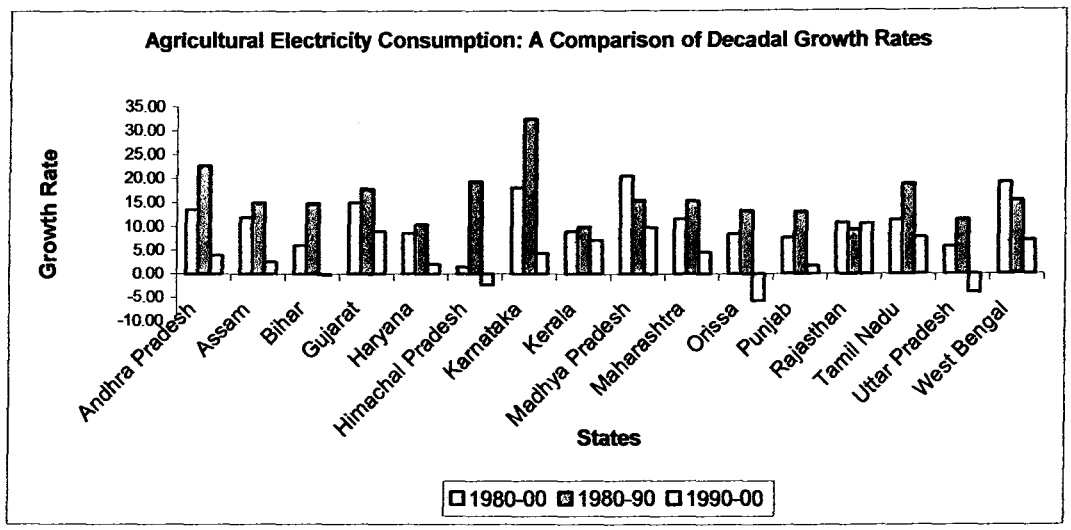
Looking at the trend growth rate of this indicator in the following table, growth rate for agricultural electricity consumption was highest for Madhya Pradesh (20.42) followed by West Bengal (19.01%) and Karnataka (18.07) for the period 1980 to 2000. If we look at the segregated figure of trend growth rate in pre-reform period 1980-90, it is evident from chart 3.2 that it was highest in Karnataka (32.45). We observe a considerable decline in decadal growth rate of Agricultural Electricity Consumption after the reforms in period 1990-2000 across states. This decline was maximum in the case of Karnataka. Though Rajasthan showed a rise in the growth rate of agriculture electricity consumption after the reforms, the growth rate become negative for states like Himachal Pradesh, Orissa and Uttar Pradesh. Bihar on other hand experienced almost negligible growth rate of Agriculture Electricity Consumption in post-reform period. Himachal Pradesh had a unique experience in terms of growth rate of Agriculture Electricity Consumption as it should an extreme variation in the pre-reform and post-reform period and when we look at the growth rate during 1980 to 2000 it was quite minimal.

Table 5.3 Trend Growth Rate of Agricultural Electricity Consumption in different states during last three decades

Trend Growth Rate			
States	1980-00	1980-90	1990-00
Andhra Pradesh	13.57	22.75	3.96
Assam	11.87	14.96	2.46
Bihar	5.98	14.72	-0.23
Gujarat	14.90	17.85	8.95
Haryana	8.51	10.39	2.08
Himachal Pradesh	1.47	19.36	-2.34
Karnataka	18.07	32.45	4.28
Kerala	8.84	9.80	7.00
Madhya Pradesh	20.42	15.41	9.67
Maharashtra	11.51	15.23	4.50
Orissa	8.33	13.21	-5.70
Punjab	7.50	12.97	1.67
Rajasthan	10.63	9.23	10.47
Tamil Nadu	11.21	18.74	7.62
Uttar Pradesh	5.77	11.32	-3.99
West Bengal	19.01	15.27	6.99

Source: Author's calculation

Chart 5.3 A comparison of Decadal Growth Rate of Agricultural Electricity Consumption



Source: *Author's Calculation.*

The following table shows the differences in ranks of sixteen Indian states in terms of agriculture electricity consumption in two decades

Table 5.4 Decadal difference in ranks of sixteen Indian States for agriculture electricity consumption

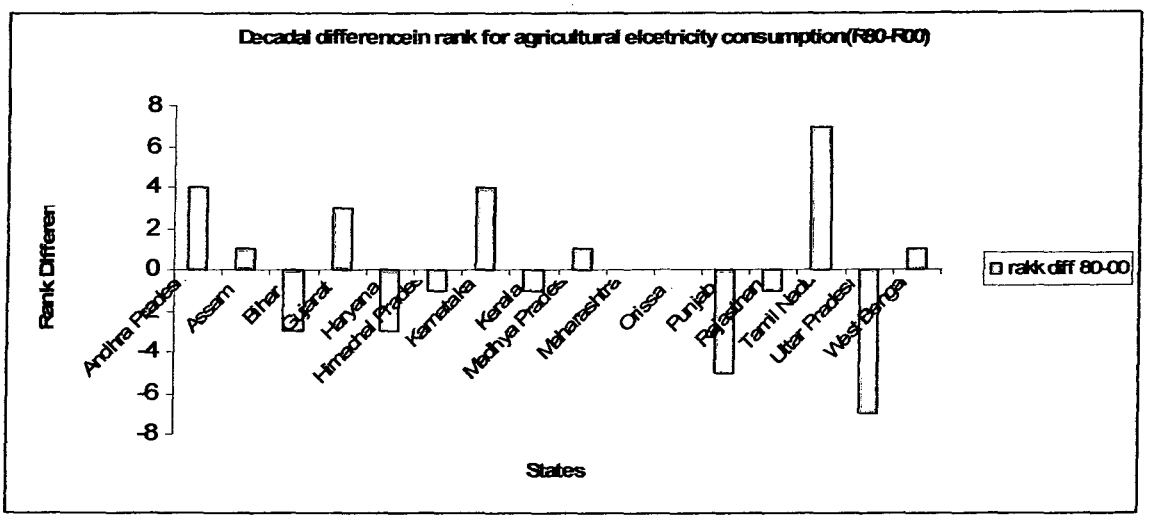
States	1980	1990	2000-01	Rank 80	Rank 90	Rank 00	Rank DIFF (80-000
AP	977.13	6459.68	11747.96	6	3	2	4
Assam	4	26	40.68	16	16	15	1
Bihar	434.63	1462.97	1548.63	8	11	11	-3
Gujarat	1333.99	5679.84	15489.28	4	4	1	3
Haryana	953.77	2711.78	4535.3	7	8	10	-3
HP	5.77	26.16	19.2	15	15	16	-1
Karnataka	392.97	4420.65	7435.22	9	6	5	4
Kerala	79.8	207.62	350.21	12	13	13	-1
Mp	344.87	2524.13	4897.74	10	9	9	1
Maharashtra	1724.37	6604.45	9876.22	3	2	3	0
Orissa	58.73	182.56	196	14	14	14	0
Punjab	1849.75	5095.6	5534.35	2	5	7	-5
Rajasthan	1009.11	2366.82	7046.3	5	10	6	-1
Tamil Nadu	236.66	4057.97	9311.65	11	7	4	7
Uttar Pradesh	2791.67	7759.4	5259.71	1	1	8	-7
West Bengal	72.37	454.01	998.97	13	12	12	1

Source Authors Calculation.

We observe that Bihar , Haryana , Himachal Pradesh , Punjab Rajasthan , Uttar Pradesh have deteriorated in ranking in terms of Agriculture electricity consumption

from 1980 – 2000 .While Tamil Nadu has improved in ranking considerably .Orissa has remained same in ranking in this time period showing no change in level of agriculture electricity consumption .West Bengal has deteriorated in ranking the most.

The following chart gives a clear picture of the change in ranks for agriculture electricity consumption across states between the period 1980 – 2000.



Source: Author's calculation

5.3.2 VILLAGE ELECTRIFICATION:

Village Electrification is another important indicator of Rural Electrification. Rural Electrification is part of the Power Sector Reform process. By studying the growth rates of percentage of village electrified one can assess the impact of Power Sector Reform on village electrification.

Chart 5.4 clearly indicates that the trend growth rate of percentage village of Electrified over the time period 1980 to 2000 was maximum in Madhya Pradesh, almost negligible for Haryana and negative for Punjab. During the pre-reform period that is 1980 to 90, the growth rate of percentage of villages electrified was relatively very high for states like Bihar, Madhya Pradesh, Uttar Pradesh and West Bengal and the figures were quite comparable. While Assam, Haryana, Punjab, Rajasthan and Tamil Nadu showed a very minimal growth rates of percentage of villages electrified. On the other hand the post reform period of 1990-2000, saw negative growth rate of percentage of villages Electrified in Assam, Tamil Nadu, Punjab and Karnataka. One

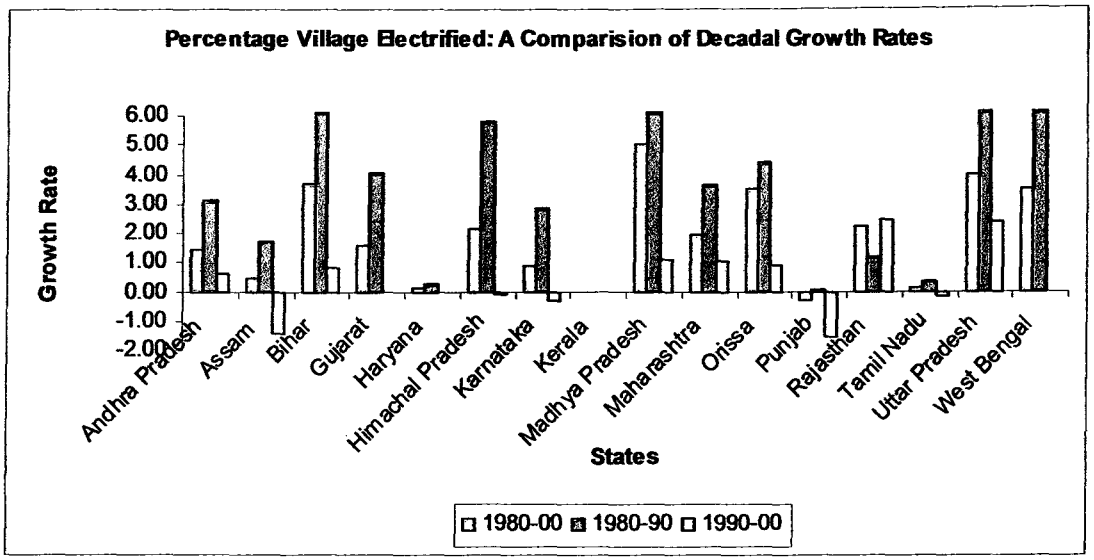
common feature across states in the post-reform period is that there has been a considerable decline in the growth rates of percentage of village electrified. Rajasthan however witnessed the maximum growth rate on the post-reform period between 1990-2000 followed by Uttar Pradesh. The trend growth rates of percentage of villages electrified was negligible in Gujarat, Haryana, Himachal Pradesh and Kerala.

Table 5.5 Trend Growth Rates of Percentage of Villages Electrified

Trend Growth Rate			
	1980-00	1980-90	1990-00
Andhra Pradesh	1.44	3.16	0.63
Assam	0.43	1.70	-1.44
Bihar	3.71	7.70	0.83
Gujarat	1.55	4.04	-0.05
Haryana	0.08	0.27	0.00
Himachal Pradesh	2.15	5.78	-0.09
Karnataka	0.88	2.81	-0.29
Kerala	-0.01	0.00	-0.06
Madhya Pradesh	5.01	9.38	1.09
Maharashtra	1.91	3.64	1.00
Orissa	3.45	4.39	0.85
Punjab	-0.35	0.06	-1.56
Rajasthan	2.23	1.15	2.45
Tamil Nadu	0.13	0.32	-0.18
Uttar Pradesh	3.98	6.65	2.32
West Bengal	3.49	7.17	0.00

Source: Statistical Abstract of India (CSO)

Chart 5.5: A Comparision of Decadal Growth Rate of Percentage of Villages Electrified



Source: Author's Calculation.

Table 5.6 Decadal difference in ranks of sixteen Indian States for percentage of villages electrified

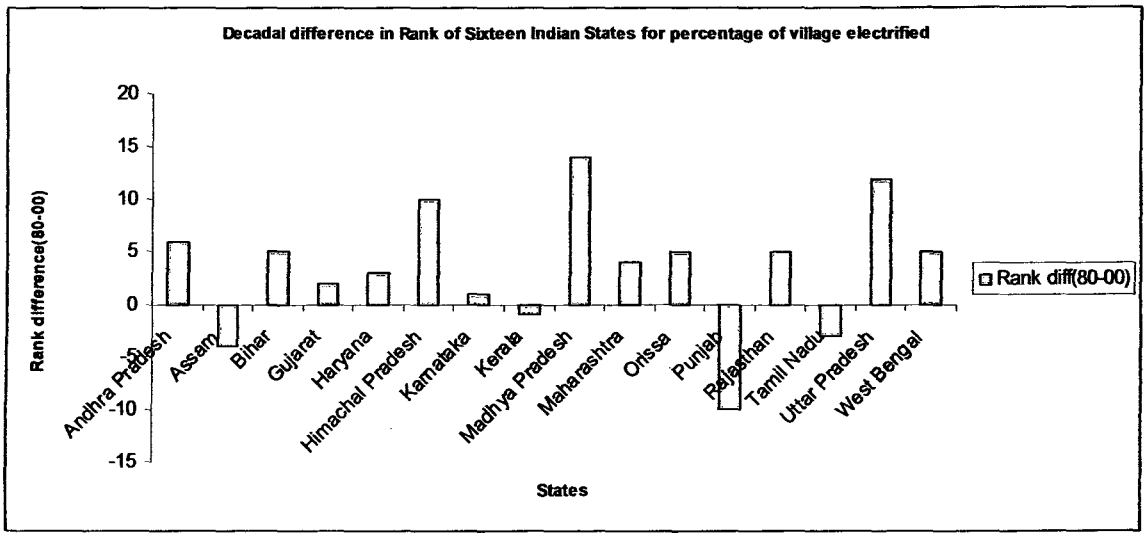
States	VE 80	VE 90	VE 00	Rank 80	Rank 90	Rank 00	Rank diff(80-00)
AP	68.87	95.53	100	7	4	1	6
Assam	71.54	84.31	77.09	6	7	10	-4
Bihar	30.28	66.14	70.99	16	12	11	5
Gujarat	63.49	96.75	91.66	10	3	8	2
Haryana	94.23	100	100	4	1	1	3
HP	58.74	100	100	11	1	1	10
Karnataka	75.1	100	97.19	5	1	4	1
Kerala	100	100	98.88	1	1	2	-1
MP	34.06	84.15	100	15	6	1	14
Maharashtra	63.66	92.16	97.1	9	5	5	4
Orissa	43.14	65.92	92.3	12	11	7	5
Punjab	99.5	100	98.74	2	1	12	-10
Rajasthan	65.23	75.73	100	8	8	3	5
Tamil Nadu	95.76	99.71	96.08	3	2	6	-3
Uttar Pradesh	36.98	69.76	100	13	10	1	12
West Bengal	36.03	76.24	79.33	14	9	9	5

Source: Authors Calculation

Assam , Kerala , Punjab and Tamil Nadu witnessed a negative difference in ranks showing fall in their ranking in terms of percentage of villages electrified ..While

Madhya Pradesh experienced the highest rank difference indicating its improvement in rank in terms of percentage of villages electrified followed by Uttar Pradesh and Himachal Pradesh

Chart 5.6: Decadal Difference in Ranks For Percentage of Villages Electrified



Source: Author's Calculation

5.4 PER CAPITA NSDP FROM AGRICULTURE

The income from agriculture sector is an important variable which connects rural electrification and poverty. In order to measure income from agriculture sector per capita NSDP from Agriculture has been taken at 1980-81 constant prices for the period between 1980 to 2000. The trend growth rate has been calculated for per capita NSDP from Agriculture for three time periods years 1980 to 2000, 1980-90 and 1990-99.

It is observed that the growth rate of per capital NSDP from agriculture was highest in West Bengal for the period 1980-2000 followed by Punjab. The Chart 5.7 clearly shows that there has been a negative growth rate for Bihar, Gujarat and Orissa. Comparing the pre-reform period of 1980-90, Punjab and West Bengal showed highest growth rate whereas Gujarat and Orissa showed negative growth rates of per capita NSDP from agriculture.

Looking at the impact of reform (i.e., for the period 1990 to 1999-00) on growth rate of per capita NSDP from agriculture we observe that income from agricultural sector has considerably increased for Gujarat and West Bengal. While growth rates are negative in Bihar, Orissa, Haryana and Assam. The growth rates of income from agricultural sector slowed down in post-reform period for Assam, Himachal Pradesh, Madhya Pradesh, Maharashtra, Punjab.

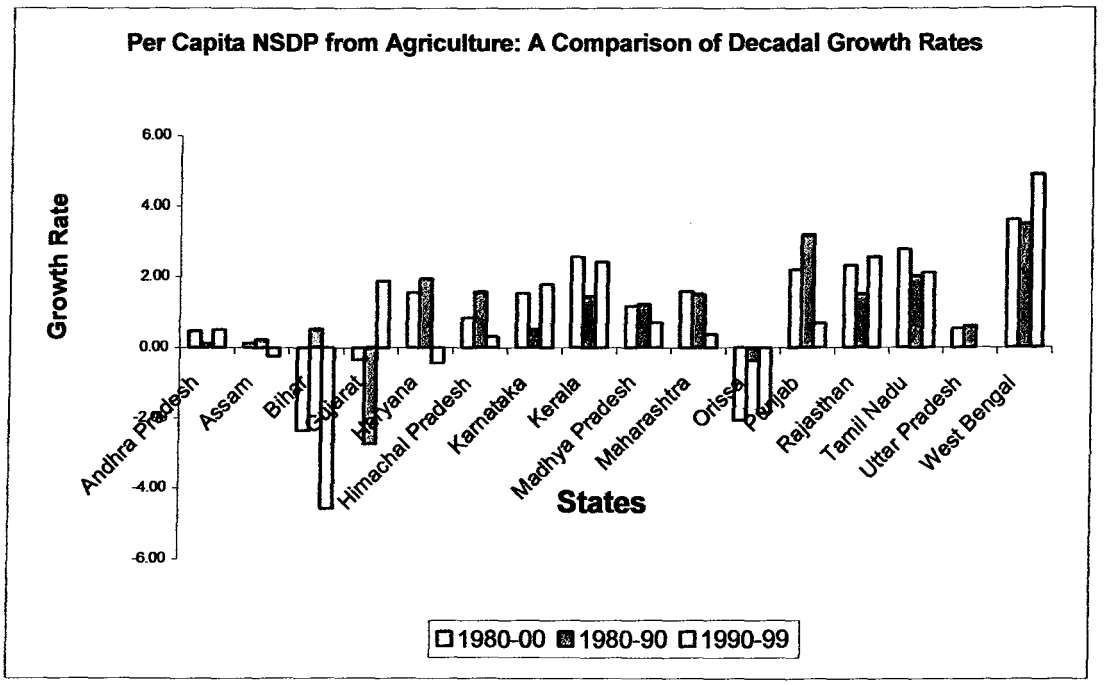
From the above analysis it can be concluded that in most of the states agricultural income has shown a considerable decline after the reform

Table 5.7: Trend Growth Rate of Per-Capita NSDP from Agriculture

	Trend Growth Rate		
	1980-00	1980-90	1990-99
Andhra Pradesh	0.47	0.11	0.51
Assam	0.12	0.22	-0.24
Bihar	-2.36	0.52	-4.58
Gujarat	-0.34	-2.74	1.89
Haryana	1.56	1.94	-0.43
Himachal Pradesh	0.84	1.58	0.31
Karnataka	1.53	0.51	1.79
Kerala	2.55	1.44	2.41
Madhya Pradesh	1.16	1.23	0.70
Maharashtra	1.58	1.51	0.37
Orissa	-2.05	-0.37	-1.84
Punjab	2.19	3.20	0.68
Rajasthan	2.31	1.50	2.56
Tamil Nadu	2.78	2.01	2.11
Uttar Pradesh	0.53	0.60	0.00
West Bengal	3.61	3.48	4.88

Source: National Accounts Statistics (CSO)

Chart 5.7: A Comparison of Decadal Growth Rate s of Per Capits NSDP from Agriculture



Source: Author's Calculation

5.5 GROSS IRRIGATED AREA AS PERCENTAGE OF GROSS CROPPED AREA:

Irrigation is another variable which determines the income from agricultural sector. Gross irrigated are as percentage of gross cropped area can be taken as one of the indicators of irrigation. The trend growth rate of Gross irrigated areas as percentage of Gross Cropped area across states has been calculated for three time periods like 1980-2000, 1980-90 (the pre-reform period and 1990-2000 (the post-reform period).

Madhya Pradesh shows the highest trend growth rate for the period 1980 to 2000. The growth rates were almost negligible for West Bengal. It was negative for Kerala. If we look at the pre-reform period between 1980 to 1990 the growth rates of Percentage of Gross Cropped Area were highest for Madhya Pradesh and Orissa. The growth rates in the pre-reform period were negative in Tamil Nadu and quite less in Himachal Pradesh, Punjab and Assam.

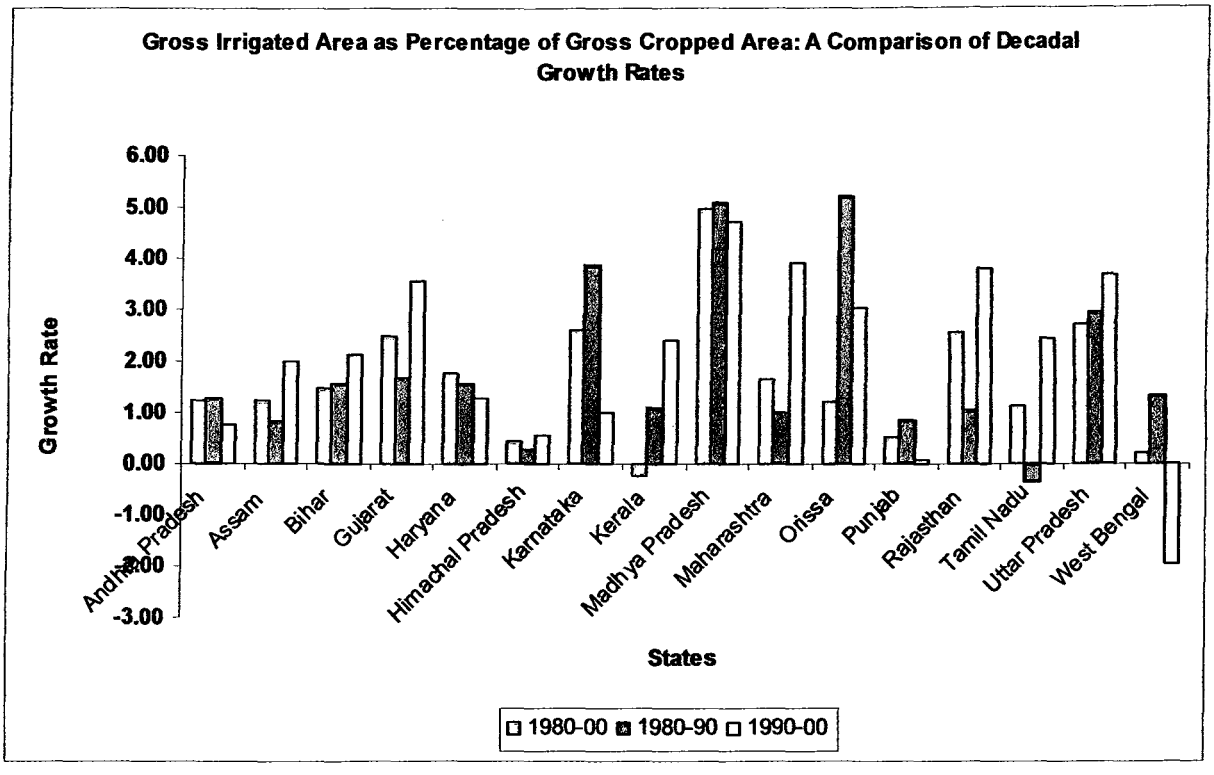
In the post-reform period between 1990-2000, Madhya Pradesh experienced the highest trend growth of gross irrigated area as percentage of Gross Cropped Area. Followed by Maharashtra, Gujarat, Rajasthan, Uttar Pradesh. However, the experience of West Bengal was unique in the sense that the trend growth rate turned out to the negative in the post-reform period 1999-2000 though it was positive in the pre-reform period.

Table 5.8: Trend Growth Rate of Gross Irrigated Area as Percentage of Gross Cropped Area

Trend Growth Rate			
	1980-00	1980-90	1990-00
Andhra Pradesh	1.24	1.29	0.77
Assam	1.23	0.83	1.98
Bihar	1.46	1.57	2.13
Gujarat	2.47	1.70	3.56
Haryana	1.76	1.57	1.29
Himachal Pradesh	0.44	0.28	0.54
Karnataka	2.60	3.89	1.01
Kerala	-0.24	1.09	2.40
Madhya Pradesh	4.96	5.10	4.73
Maharashtra	1.63	1.01	3.93
Orissa	1.18	5.18	3.05
Punjab	0.52	0.84	0.08
Rajasthan	2.54	1.02	3.80
Tamil Nadu	1.11	-0.38	2.42
Uttar Pradesh	2.72	2.97	3.67
West Bengal	0.20	1.32	-1.96

Source: Statistical Abstract of India

Chart 5.8 : A comparison of Decadal Growth Rate of Gross Irrigated Area as Percentage of Gross Cropped Area



Source: Author's Calculation

Both village electrification and agricultural electricity consumption which have been taken as indicators of rural electrification have shown a considerable decline in the post reform period It is Rajasthan which has shown a remarkable performance in terms of rural electrification in the post reform phase in case of both indicators Punjab ,Assam and Himachal Pradesh have witnessed the worst impact of reforms on rural electrification

During the pre-reform period that is 1980 to 90, the growth rate of percentage of villages electrified was relatively very high for states like Bihar, Madhya Pradesh, Uttar Pradesh and West Bengal

It can be concluded that in most of the states agricultural income has shown a considerable decline after the reform The growth rate of per capita NSDP from agriculture we observe that income from agricultural sector has considerably increased for Gujarat and West Bengal.

In terms of irrigation West Bengal was most adversely affected showing a negative trend growth rate ., while Madhya Pradesh experienced the highest trend growth rate

In 1983, the percentage of population below poverty line was highest for Orissa (67.53%) followed by Bihar (64.37%) and West Bengal (63.05). Punjab had the lowest percentage of population below poverty line only 13.2%. After a decade of economic reforms in India, rural Orissa (48.01%) continues to be one of the poorest regions of the country.

This decline in rural poverty was highest for West Bengal and Orissa. In the post-reform period we observe that there is consistent decline in rural poverty across states and the decline is maximum for Himachal Pradesh and minimum in Orissa. Orissa continues to be a poor state and its trend rate of growth of rural electrification was also very low The per capita income from agriculture sector was also quite low in post reform period in Orissa Therefore the result is consistent to the hypothesis of the study .

In the above chapter we tried to examine the growth rates of various variables which will be used to establish our next hypothesis that rural electrification reduces incidence of poverty by increasing the agricultural income In the post reform period while the growth of income in agricultural sector was highest but rural electrification was quite minimal.

Chapter 6

An Exploration of Linkages

An improved infrastructure is a prerequisite for the growth of any sector . Rural electrification is a crucial component of infrastructure which considerably affects the agricultural output . An increase in agricultural output in turn reduces poverty . The two hypothesis of the study are

1. The level of rural electrification has a positive impact on agricultural output.
2. Agricultural output reduces the incidence of poverty.

These two hypothesis establish a link between Rural electrification , Agricultural output and Poverty .In order to establish the linkage between these variables , the appropriate indicators have been chosen

6.1 RURAL ELECTRIFICATION

Village electrification and Agricultural electricity consumption have been used as two indicators to measure rural electrification

1 Village electrification : It is the percentage of villages electrified

2 Agricultural electricity consumption : It is the quantity of electricity consumed in agriculture sector of each state in (million Kwh)

A composite index of rural electrification has been constructed using the two indicators . The composite index further serves as an independent variable for the Model 1

6.2 IRRIGATION

Irrigation constitutes another significant input to agricultural output Gross irrigated area as percentage of gross cropped area is taken as an indicator of irrigation . This further serves as an independent variable for the Model 1 .

6.3 POVERTY :

The proportion of population above poverty line is taken as one of the indicators of level of poverty . A state which has higher proportion of population above poverty line has lower level of poverty

6.4 LITERACY

The proportion rural population which is literate is considered as an indicator of literacy . Literacy reduces poverty by raising the proportion of population above poverty line .

In order to assess the performance of states in terms of rural electrification for the time period 1980 -2000 we can rank the states in terms of their composite index of rural electrification for the years 1983 and 1999 This would give a n idea for pre-reform and post reform phase .The rank difference would indicate the performance of the state in terms of rural electrification A negative rank would mean that the state has performed better in terms of rural electrification and vice-versa .the following table indicates the ranks of various states in terms of their composite index of rural electrification

Table 6.1: Rank Difference of Principal Composite of Index for Rural Electrification

Rank of PCA on Rur Elec			
States	1983	1999	Rank diff
Andhra Pradesh	6	14	8
Assam	11	2	-9
Bihar	14	1	-13
Gujarat	7	15	8
Haryana	3	9	6
Himachal Pradesh	12	5	-7
Karnataka	9	11	2
Kerala	8	7	-1
Madhya Pradesh	13	13	0
Maharashtra	4	16	12
Orissa	15	3	-12
Punjab	1	10	9
Rajasthan	10	6	-4

Source Author's Calculation

We observe that Punjab was the first in terms of rural electrification in 1983 but it became 10^{th} in 1999 showing the poor performance in the post – reform period .On the other Orissa which was fifteenth in 1983 improved considerably in terms of rural electrification in 1999 . The other state which considerably performed better and improved in terms of rural electrification is Bihar as the rank was fourteen in 1983 and it became one in the post reform period . From the table it is clear that for the states like Assam, Bihar , Himachal Pradesh , Orissa and Kerala there has been a considerable rise in rural electrification in the post reform period .

While Maharashtra , Gujarat , Punjab and Andhra Pradesh have performed poorly in terms of rural electrification Maharashtra and Gujarat are among the highest income states in the post reform period but we observe that these states have poorly performed in terms of rural electrification

Inorder to link rural electrification , Agriculture output and poverty the following two models have been used

Model 1

In the first model we test the following causal relationship.

$$\mathbf{PCNSDPAgr} = \alpha + \beta_1 \mathbf{(CompIndRE)} + \beta_2 \mathbf{(GIA)}$$

Where,

PCNSDPAgr = Per Capita Net State Domestic Product from Agriculture

CompIndRE = Composite Index of Rural Electrification that consists of two indicators:

a) Percentage of Village Electrified, and
b) Agricultural Electricity Consumption

GIA = Gross Irrigated Area as Percentage of Gross Cropped Area

α. Is the constant term which gives the level of income from agriculture sector when rural electrification and percentage of gross area irrigated are negligible .

β_1 : Is the coefficient of composite index of rural electrification

β_2. . Is the coefficient of gross Irrigated Area as Percentage of Gross Cropped Area(%)

In the first model for each sixteen major states , time series regression has been run for time period 1980-2000 to calculate the value of coefficients β_1. and β_2. along with the values of R square where R square is coefficient of determinarion

Table 6.2: Results for Model One

States	Constant	β_1	β_2	R^2
Andhra Pradesh	389.312	- 0.180	0.382	0.049
Assam	571.168	0.240	0.019	0.062
Bihar	23.656	- 0.748	0.345	0.201
Gujarat	-64.450	- 0.719	0.564	0.185
Haryana	372.665	0.060	0.755	0.635
H .P	28.249	0.334	0.284	0.272
Karnataka	472.067	0.144	0.648	0.612
Kerala	731.132	- 0.889 *	- 0.217 *	0.937
Madhya Pradesh	836.319	1.422 *	- 0.752 *	0.643
Maharashtra	789.418	0.560 *	- 0.145	0.288
Orissa	550.890	- 0.528 *	0.065	0.302
Punjab	598.973	0.766 *	0.211	0.937
Rajasthan	557.020	0.456	0.218	0.424
Tamil Nadu	220.705	0.878 *	0.130	0.819
Uttar Pradesh	702.819	0.949 *	- 0.194	0.597
West Bengal	871.180	1.073 *	- 0.168	0.890

* indicates that the results are significant at 1 % level.

Source Author's Calculations

R squared is the proportion of variation in the dependent variable explained by the regression model. The values of R squared range from 0 to 1

β_1 . describes the impact of rural electrification on income from agriculture sector We observe β_1 . is positive for all sixteen major states indicating a positive relationship between rural electrification and agricultural income . The positive β_1 . values are quite significant for West Bengal , Uttar Pradesh , Tamil Nadu and Punjab .indicating a strong positive impact of rural electrification on poverty .At the same time we observe that the negative values are also quite significant .

On the other hand β_2. is the coefficient of gross irrigated area as percentage of gross cropped area . It describes the impact of irrigation on agriculture income . β_2 . is also

positive for most of the states showing that irrigation positively affects poverty . β_2. . is observed as negative for Uttar Pradesh and West Bengal indicating a negative relationship between irrigation and agriculture income The positive values of . β_2 . are significant for Karnataka , Haryana and Gujarat showing the positive impact of irrigation on agricultural income . For the states showing the negative relationship of irrigation and agricultural income the values of β_2 . are quite insignificant leaving the case of Madhya Pradesh .where it shows a strong negative relationship between irrigation and agricultural income .

R square values which show the extent to which dependent values are explained by independent values are quite high for almost all states indicating the goodness of fit of the model .As a result the two independent variables used in the model , the composite index of rural electrification and Gross irrigated area as percentage of gross cropped area affect the agricultural income .

The level of agricultural income for the states West Bengal , Uttar Pradesh, Rajasthan, Punjab , Maharashtra , Madhya Pradesh and Kerala is quite high when there is no rural electrification and irrigation

The second model describes the impact of agricultural income on poverty.

Model 2

In the second model we test the following causal relationship.

$$\mathbf{PAbPL = \alpha + \beta_1 (\log PCNSDPAgr) + \beta_2 (RLit)}$$

Where,

PAbPL =Percentage Population above Poverty Line

PCNSDPAgr = Per Capita NSDP from Agriculture

RLit = Rural Literacy Rate

α. Is the constant term which gives the level of income from agriculture sector when per capita net state domestic product from agriculture sector and rural literacy are negligible .

β_1 :. Is the coefficient of Per capita net state domestic product from agriculture sector

β_2. . Is the coefficient of rural literacy rate (%)

In the second model Model we regress percentage of population above poverty line on per capita net state domestic product for agriculture sector and rural literacy .The model uses four time periods 1983 , 1987 , 1993 and 1999 . The regression is run for four different time periods using cross sectional data for sixteen major states .the values of coefficients β_1 . and β_2 , are calculated along with the values of R square .

Table 6.3: Results for Model Two

Year	Constant	β_1	β_2	R^2
1983	-136.13	0.742 *	0.368	0.511
1987	-125.12	0.687 *	0.301	0.500
1993	-87.80	0.663 *	0.296	0.508
1999	-114.60	0.654 *	0.512 *	0.507

* indicates that the results are significant at 1 % level .

Source : Author's Calculations.

β_1 . is the coefficient of agricultural income which describes the impact of agricultural income on poverty . A positive β_1 . indicates that agricultural income increases percentage of people above poverty line or reduces the level of poverty. We observe β_1 . is positive for four different time periods and the values are also significant showing a strong positive impact of agricultural income on percentage of people above poverty line which implies increase in agricultural income reduces poverty .1983 and 1987 can be taken as period in the pre reform scenario and 1993 and 1999 as period in post reform .

We further observe that β_1 . was more significant in pre reform period than in post reform .This positive impact of agricultural income on raising the percentage of population above poverty line was stronger in 1983 and since then it showed a considerable decline .

β_2 is the coefficient of rural literacy which describes the impact of rural literacy on poverty .A positive β_2 indicates that rural literacy increases percentage of people above poverty line or reduces the level of poverty .We observe β_2 . is positive for four different time periods and the value is significant only in 1999 indicating that rural literacy strongly affected poverty or increased percentage of people above poverty line , while in rest of the years the impact of rural literacy was insignificant .

R square values are reasonably high in all four time periods .This indicates the goodness of fit of our model . The two independent variables agricultural income and rural literacy are able to explain a considerable variation in percentage of population above poverty line .The values of R square are almost same in all four time periods .

The development of irrigation and rural electrification seems to be associated with a lower poverty ratio Irrigation, particularly canal irrigation, should result in the reduction of the rural poverty ratio, this is to be expected in view of the rise in employment and wage rates associated with such development. Also, the benefits from canal irrigation can be expected to be distributed widely among different classes of farmers. The negative sign of the variable representing the percentage of villages electrified, though not significant, reinforces the above inference in regard to the impact of irrigation on the rural poverty ratio. One cannot overlook the high inter-correlation between irrigation variables and rural electrification. But there is a possibility that rural electrification may not get translated to irrigation or percentage of gross area irrigated .It may be possible that it is the households which increase in electricity consumption under percentage of villages electrified which is one of the two indicators of rural electrification

The second model gives a reasonably strong positive relation between agriculture income and percentage of people above poverty line indicating that at all four points of time growth in agricultural output reduces poverty The agricultural income in turn is positively and significantly related to composite index of rural electrification , thus conforming to our hypotheses that rural electrification increases agricultural income and an increase in agricultural income further reduces poverty

Five of the sixteen states Andhra Pradesh, Bihar, Gujarat, Kerala and Orissa witness a negative relation between agriculture income and composite index of rural electrification but the values of the coefficient are not significant indicating a weak relationship .The value of coefficient for composite index is high for Gujarat, Kerala and Orissa showing that rural electrification has not turned into increase in agricultural income this is probably because the cropping patterns used in these states may not involve use of electricity or the electricity may be consumed by households out of the total percentage of villages electrified .

In the above chapter we tried to link rural electrification , agriculture output and poverty using the two models and concluded that most of the states conform to our hypotheses that rural electrification significantly increases agricultural income and an increase in agricultural income further reduces poverty.

Limitations of the Study

The present study has tried to link rural electrification, agricultural growth and poverty. This is a comprehensive study which analysis this linkage across states. There are both theoretical and data limitations associated with the study

Rural Electrification and Irrigation are taken as two variables which affect Agricultural Income. But the Agriculture Income is further affected by some of the more crucial variables like Road Density per thousand square kilometer, average rainfall in a state, percentage of cropped area sown with high yielding varieties, fertilizer consumption, pesticides consumption etc.

The Data related to Poverty was a big constraint in establishing the hypothesis as the study could analyse data on poverty for only five points of time. As a result the time series Regression could not be run in the second Model. Jammu and Kashmir is left out of analysis due to lingering questions about data validity from that state due to prevailing political unrest.

Due to unavailability of reliable data the study could not be extended for an intra – state level comparison. A district level income from agricultural sector can be formulated and an intra-state or a regional analysis could be carried out to test the hypothesis that rural electrification reduces poverty for a three decade time period. The time span taken to test the hypothesis could also be extended to include three decades of time period. i.e. from 1970 to 2005.

The level of poverty gets affected by number of other variables like income from non-agricultural output. Though the estimated results of the study are quite satisfying but the model could have incorporated the non-agricultural income which affects the level of poverty.

The same hypothesis could be tested with other measures of poverty like Head-Count Ratio (HCR), Poverty Gap Index (PGI), Monthly per Capita Consumer Expenditure (MPCE).

CONCLUSION

Power is an essential requirement for all facets of our life and has been recognized as a basic human need. It is the critical infrastructure on which the socio-economic development of the country depends. The growth of the economy and its global competitiveness hinges on the availability of reliable and quality power at competitive rates. The demand of power in India is enormous and is growing steadily. . Future economic growth crucially depends on long-term availability of energy in increasing quantities from sources that are accessible, affordable, socially acceptable and environment friendly. The power sector has registered significant progress since the process of planned development of economy began in 1950.

It has been observed that the focus of Indian reform legislation has been more on improving financial viability of ailing power sector than on improving the access to electricity. To effectively meet the electricity needs of the poor , legislative and policy support for mechanisms like the provision of lifeline rates and special functions like missionary electrification needs to be put in place

Rural electrification is part of the Power Sector Reform process. It may be considered as a mechanism through which economic growth indirectly influence the status of poor people. Since rural India is dependent on agriculture, programs that increase agricultural labor productivity by increasing irrigation, introducing electricity to villages, are therefore important for rural poverty reduction. Electricity is used as an input to variety of new agricultural technologies.

The objective of the study was to examine the effect of rural electrification on reducing poverty for all states between the time period 1980 to 2000. Since rural electrification is a crucial component of agricultural output, this work tested the hypothesis that rural electrification increases agricultural output which in turn reduces poverty.

The second chapter reviewed the literature of power sector reforms , its impact on rural electrification , impact of rural electrification on agricultural income and finally

the impact of agricultural income on poverty It also discussed the methodology used in this paper to establish the hypotheses.

The third chapter overviewed the reform process and identifies the aspects of rural electrification It discussed some of the crucial implications of reforms on rural electrification and the inadequacies related to rural electrification It also concluded that the initial phases of power sector reforms did not have any element of rural electrification and rural electrification was given priority in the later power sector reforms and electricity acts

The fourth chapter discussed the linkage between rural electrification , agriculture growth and poverty and while doing so incorporated some of the important arguments of studies which help in establishing the linkage .

In the fifth chapter we tried to examine the growth rates of various variables used to establish the hypothesis that rural electrification reduces incidence of poverty by increasing the agricultural income In the post reform period while the growth of income in agricultural sector was highest but rural electrification was quite minimal

The chapter also concluded that both village electrification and agricultural electricity consumption which have been taken as indicators of rural electrification have shown a considerable decline in the post reform period It is Rajasthan which has shown a remarkable performance in terms of rural electrification in the post reform phase in case of both indicators Punjab , Assam and Himachal Pradesh have witnessed the worst impact of reforms on rural electrification

During the pre-reform period that is 1980 to 90, the growth rate of percentage of villages electrified was relatively very high for states like Bihar, Madhya Pradesh, Uttar Pradesh and West Bengal It can be concluded that in most of the states agricultural income has shown a considerable decline after the reform The growth rate of per capita NSDP from agriculture we observe that income from agricultural sector has considerably increased for Gujarat and West Bengal.

This decline in rural poverty was highest for West Bengal and Orissa. In the post-reform period we observe that there is consistent decline in rural poverty across states and the decline is maximum for Himachal Pradesh and minimum in Orissa. Orissa continues to be a poor state and its trend rate of growth of rural electrification was also very low The per capita income from agriculture sector was also quite low in post reform period in Orissa

In the sixth chapter we tried to link rural electrification , agriculture output and poverty using the two models and concluded that most of the states conform to our hypotheses that rural electrification significantly increases agricultural income and an increase in agricultural income further reduces poverty

There exists a reasonably strong positive relation between agriculture income and percentage of people above poverty line indicating that at all four points of time growth in agricultural output reduces poverty The agricultural income in turn is positively and significantly related to composite index of rural electrification , thus conforming to our hypotheses that rural electrification increases agricultural income and an increase in agricultural income further reduces poverty

Five of the sixteen states Andhra Pradesh , Bihar , Gujarat , Kerala and Orissa witness a negative relation between agriculture income and composite index of rural electrification but the values of the coefficient are not significant indicating a weak relationship .The value of coefficient for composite index for rural electrification is high for Gujarat , Kerala and Orissa showing that rural electrification has not turned into increase in agricultural income , this is probably because the cropping patterns used in these states may not involve use of electricity or the electricity may be consumed by households out of the total percentage of village electrified .

BIBLI0GRAPHY

"Dabhol Power Project. 2004. Resolving the Imbroglio", Economic and Political weekly, June 5, pp 2329-34.

Ahluwailia, Montek. 1978. "Rural Povery and Agricultural Performance in India." *Journal of Development Studies.* 14(3): 298-323.

Ahluwalia, M.S. 1978. "Rural poverty and agricultural performance in India". *Journal of Development Studies* 14 (3): 298-323.

Bardhan, K.P. 1973. "On the incidence of poverty in rural India in the sixties". *Economic and Political Weekly* 4,5 and 6 (February).

Bhagwati, J. 1988. "Poverty and public policy". *World Development* 16 (5): 539-555.

Bhagwati, Jagdish 2001, "Growth, Poverty, and Reforms." *Economic and Political Weekly.* 10 March. 843-86.

Bhatia M.S 1995. "Rural Infrastructure and Growth of Agriculture EPW, March, 27.

Binswanger H, M. Rosengweig and S Khrandker 1993. 'How Infrastructure and Financial Institution' Affect Agricultural output and Investment in India', Journal of Development and Economies, 41 99, 337-66.

Blakrishnan Pulapre. 2000. "Agriculture and Economic Reforms "Growth and welfare". Economic and Political weekly, March 18,

Cecelski Elizabeth 2000. "Enabling Equitable Access to Rural Electrification Current thinking and Major Activities in Energy, Poverty and Gender" Asia Alternative Energy Unit, The world Bank, Washington, DC 26-27 January

Center for Monitory Indian Economies, CMIE, Indian Harvest Data Sect.

Datt, Gaurav 1999. "Has Poverty in India Declined since the Economic Reforms?" Economic and Political Weekly 84 (December 11-17).

Datt, Gaurav and Martin Ravallion 1998. 'Why have some Indian States Done Bether than others at Reducing Rural Poverty?' Economics, 65: 17-38.

Datt, Gaurav and Martin Ravallion. 2002. "Is India's Economic Growth Leaving the Poor Behind?" mimeo, World Bank.

Datt, Gaurav Valerie Kozal, Martin Ravallion, 2003. "A model-Based Assessment of India's Progress in Reducing Poverty in the 1990's, Economic and Political Weekly, January 25,

Datt, Gaurav, Valerie Kozel, and Martin Ravallion. 2001. "A Model-Based Assessment of India's Progress in Reducing Poverty During the 1990s." mimeo, World Bank.

Deaton A. Euze J. 2002. "Poverty and Inequality in India: A reexamination", Economic and Political Weekly, September 7.

Deaton, Angus and Jean Dreze. 2002. "Poverty and Inequality in India: A Reexamination." *Economic and Political Weekly.* 7 Sep. 3729-48.

Dev, S.M. 1988. "Poverty of agricultural labour households in India: A state level analysis". *Indian Journal of Agricultural Economics* 43 (1): 15-25.

Dreze J and P. Srinivasan, 1996. "Poverty in India: Regional Estimates, 1987-88" Delhi School of Economics and Indira Gandhi Institute of Development Research, Memo

Electricity Act. 2003. Ministry of Energy Govt. of India.

Ghose, A.K. 1989. "Rural poverty and relative prices in India". *Journal of Economics 13:307-331.*

Godbole Madhav. 2002. "Electricity Regulatory Commissions". The Jury is Still Out". Economic and Political Weekly June 8-14.

Gupta V. P and Earla C.S. 1995. "Rural Development and Electrification". Printwell Publishers Jaipur.

Honnihal Siddharth 2004. "Estimating Power consumption in Agriculture". Economic and political weekly, February 21,

Human Development India, 2005

Jose, A.V. 1974. "Trends in real wage rates of agricultural labourers". *Economic and Political Weekly* 9 (March 30): A 25-A30.

Kakwani, N., and K. Subbarao. 1990. "Poverty and its alleviation in India". *Economic and Political Weekly* 13 (March 31): A2-A 16.

Kothari V.N. and Dadi NM 1977. "Economic benefits of Rural Electrification in Gujarat" (Mimeo).

Lal, D. 1976. "Agricultural growth, real wages and the rural poor in India". *Economic and Political Weekly* (June 26): A47-A61.

Lal, Deepak, Rakesh Mohan, and I. Natarajan, 2001. "Economic Reforms and Poverty Alleviation: A Tale of Two Surveys." *Economic and Political Weekly.* 24 March, 1017-28.

Ministry of Power, Govt. of India 2001 "Blue Print for Power Sector Development in India"-Vision 2012, 'Power for all" August.

Ninan, K.N. 1994. "Poverty and income distribution in India". *Economic and Political Weekly* 29 (June 18): 1544-1549.

Planning Commission 2001. "Poverty Estimates for 1999-2000".

Planning Commission, GOI, 2002. Annual Report (2001-02) on the working of State Electricity Boards, and Electricity Departments, Power and Energy Division.

Planning Commission. 2002. Annul Report (2001-02) on the working of the state Electricity Boards and Electricity Departments, May.

Programme Evaluation Organization Planning Commission, Govt. of India, Evaluation of Rural Electrification Programme, Vol I 1982, and Vol II 1983.

Ranganathan V. and T.V. Ramanayya. 1998. "Long-term impact of Rural Electrification: A Study of UP and MP". Economic and Political Weekly 33 (50): December 12, pp 3181-3185.

Rao Hanumantha C.H and Hans Linneamann. P-199 Economic Reforms and Poverty Alleviation in India.

Ravallion, Martin and Gaurav Datt. 2002. "Why has economic growth been more pro-poor in some states of India than others?" *Journals of Development Economics.* 68 (2): 381-400.

Sankal TL 2003. "Power Sector: Rise, Fall and Reform", Economics and Political Weekly, March 22-29.

Shenggen Fan, Peter Hazell, and Sukhadeo Thorat. 1999. "Linkages between Government Spending, Growth, and poverty in Rural India." *International Food Policy Research Institute Research Report.* Research Report 110.

Shergill, H.S. 1989. "Agarian structure as a factor in rural poverty: Some cross-section evidence". *Economic and Political Weekly* (March 25): A9-A12.

Sheuggen Fan, Peter Hazell, 2000. "Should Developing Countries Invest more in less-favoured Areas?" An Empirical Analysis of Rural India, Economic and Political weekly, April 22.

Sihag, A.R. Neha Misra, Vivek Sharma. 2003. Teri Report No. 2002 RT 48, "Impact of power Sector Reform on Poor: A case Study of South and South East-Asia".

Sing; Nirvikae, Lavesh Bhandari, Aoyu Chen and Aarti Khare 2003. "Regional Inequality in India: A Fresh Look", Economic and Political Weekly, March 15.

Sundaram K Suresh D. Tendulkar. 2003. Economic and Political Weekly. "Poverty in India in the 1990's An Analysis of changes in 15 Major states.

UNDP 1999. Diversity and Disparaties in Human Development; Key Challenges for India, United Nations, New Delhi.

Van de Walle, D. 1985. "Population growth and poverty: Another look at the Indian time series data". *Journal of Development Studies* 21 (3): 429-439.

Vyas, V.S., and P. Bhargav. 1995. "Public interventions for poverty alleviation: An overview". *Economic and Political Weekly* (October 14-21): 2559-2572.

World Bank, 2002. Energy Strategies for rural India: Evidence from six static, joint UNDP/ World Bank Energy Sector Management Assistance Programme (ESMAP).

World Development Report 2004. "Making Services Work for poor People". World Bank.

APPENDIX 1

Raw data for percentage of rural electrification(1980-81 to 1988-89)

						Rural Literacy			
Year	**1980-81**	**1981-82**	**1982-83**	**1983-84**	**1984-85**	**1985-86**	**1986-87**	**1987-88**	**1988-89**
Andhra Pradesh	24.03	24.21	24.67	25.03	25.38	25.87	26.22	27	27.48
Assam	41.46	44.16	44.24	44.48	44.45	44.48	44.51	44.96	45
Bihar	20.14	20.24	20.74	21.34	21.57	22.17	22.56	23.09	23.47
Gujarat	35.2	36.15	36.91	37.71	38.5	39.25	40.09	41.11	42.03
Haryana	28.47	28.91	28.76	28.91	28.91	29.27	29.52	29.86	30.19
Himachal Pradesh	38.69	39.42	40.41	41.65	42.63	43.85	44.95	46.25	47.56
Karnataka	28.67	29.32	29.72	30.32	30.71	31.53	31.88	32.38	32.92
Kerala	65.72	66.97	68.03	68.92	69.66	70.59	71.56	72.48	73.48
Madhya Pradesh	20.47	20.99	21.56	22.3	22.92	23.64	24.22	25.06	25.69
Maharashtra	41.96	43.61	43.29	43.06	42.84	42.68	42.3	42.22	41.85
Orissa	30.44	31.01	31.47	31.67	32.33	32.77	32.86	33.36	33.9
Punjab	34.78	34.93	35.75	36.31	37.29	38.2	39.07	40.06	41.02
Rajasthan	17.44	17.93	18.5	18.92	19.54	20.07	20.71	21.44	22.06
Tamil Nadu	38.02	38.49	39.21	39.74	40.26	40.99	41.63	42.4	43.14
Uttar Pradesh	18.55	18.28	19.5	20.2	20.95	21.71	22.62	23.45	24.49
West Bengal	30.7	31.3	32.03	32.99	33.97	34.84	35.86	37.01	37.9
All India	28.74	28.61	29.27	29.82	30.32	30.92	31.45	32.14	32.74

Raw data for percentage of rural electrification (1989-90 to 1995-96)

Year	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96
Andhra Pradesh	28.05	28.82	28.07	30.14	30.91	32.44	33.26
Assam	45.5	45.79	45.73	46.27	46.87	48.15	49.13
Bihar	24.02	24.64	24.87	25.55	26.03	27.2	27.77
Gujarat	42.93	43.92	44.78	45.76	46.85	49.11	50.07
Haryana	30.64	31.17	32.55	32.54	32.92	34.72	35.6
Himachal Pradesh	48.68	50.04	51.26	52.66	54.25	57.31	58.76
Karnataka	33.47	34.04	34.69	35.38	35.98	37.22	37.84
Kerala	74.45	75.44	76.44	77.45	78.6	80.61	81.73
Madhya Pradesh	26.5	27.36	28.3	29.08	29.88	31.86	33.41
Maharashtra	42.35	41.34	41.2	40.63	40.43	42.58	40.52
Orissa	34.55	35.05	35.46	36.04	36.61	37.83	38.51
Punjab	41.74	42.89	43.97	44.96	45.92	48.27	49.32
Rajasthan	22.65	23.42	24.19	24.92	25.71	27.35	28.4
Tamil Nadu	44.03	44.5	45.54	46.49	47.15	48.81	49.8
Uttar Pradesh	25.56	26.71	27.43	29.38	30.88	34.52	36.55
West Bengal	39.26	40.63	42.07	43.61	45.59	49.96	52.5
All India	33.53	34.21	34.58	35.67	36.63	38.84	39.81

APPENDIX 2

Raw data for percentage of village electrifird (1980 -1990)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Andhra Pradesh	68.87	74.24	79.42	83.08	86.71	89.07	90.93	92.24	94.39	95.54	95.53
Assam	71.54	72.51	73.64	75.25	76.53	77.54	78.98	80.58	82.03	82.93	84.31
Bihar	30.28	34.77	39.02	44.8	49.77	50.44	53.28	57.18	60.14	63.35	66.14
Gujarat	63.49	72.66	76.98	79.42	83.76	89.52	93.08	94.21	96.11	96.45	96.75
Haryana	94.23	100	100	100	100	100	100	100	100	100	100
Himachal Pradesh	58.74	63.19	70.1	75.53	81	86.47	91.8	96.87	100	100	100
Kamataka	75.1	80.58	85.57	89.81	92.98	96.76	99.65	100	100	100	100
Kerala	100	100	100	100	100	100	100	100	100	100	100
Madhya Pradesh	34.06	38.7	44.28	49.89	55.35	60.4	64.59	69.54	75	80.66	84.15
Maharashtra	63.66	70.3	72.46	75.7	78.96	80.82	81.5	88.59	90.28	92.02	92.16
Orissa	43.14	45.81	45.98	48.04	50.41	51.77	54.13	57.61	60.97	63.79	65.92
Punjab	99.5	99.5	99.52	99.59	99.75	99.85	99.94	100	100	100	100
Rajasthan	65.23	64.82	64.93	65.36	64.8	65.72	66.3	66.67	67.48	70.45	75.73
Tamil Nadu	95.76	97.11	97.37	97.97	98.15	98.19	98.31	98.41	98.53	99.68	99.71
Uttar Pradesh	36.98	40.98	43.37	47.25	50.89	55.07	58.68	61.92	64.85	67.84	69.76
West Bengal	36.03	40.83	47.35	51.71	53.84	56.62	59.99	63.71	67.7	72.06	76.24
All India	57.64	61.41	64.54	67.53	70.62	73.22	75.13	77.96	80.59	82.78	84.53
mean	**64.08625**	**67.698125**	**70.319375**	**72.990625**	**75.425625**	**77.649375**	**79.71**	**82.078125**	**83.98**	**85.750625**	**87.2125**
sd	**24.096655**	**23.226237**	**21.916975**	**20.474381**	**19.372201**	**18.849416**	**18.107616**	**17.002065**	**15.871814**	**14.450185**	**13.085573**

Raw data for percentage of village electrifird (1991 to 2000)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Andhra Pradesh	95.84	95.79	95.89	95.91	95.95	97.925	99.9	99.95	100	100
Assam	84.66	84.91	84.93	85.21	86.87	81.885	76.9	76.95	77	77.09
Bihar	66.76	67.05	67.3	67.57	67.38	69.09	70.8	70.85	70.9	70.99
Gujarat	96.9	97.03	97.16	97.16	97.16	98.28	99.4	99.7	100	91.66
Haryana	100	100	100	100	100	100	100	100	100	100
Himachal Pradesh	100	100	100	100	100	98.9	97.8	98.85	99.9	100
Karnataka	100	100	100	100	100	99.25	98.5	98.55	98.6	97.19
Kerala	100	100	100	100	100	100	100	100	100	98.88
Madhya Pradesh	87.5	89.75	91.88	94.34	94.36	94.38	94.4	94.9	95.4	100
Maharashtra	92.31	92.55	92.67	92.76	93.82	96.91	100	100	100	97.1
Orissa	70.26	74.4	78.1	80.19	86.04	77.92	69.8	71.55	73.3	92.3
Punjab	100	100	100	100	100	100	100	100	100	100
Rajasthan	78.45	79.5	81.35	82.56	83.36	85.98	88.6	90.4	92.2	100
Tamil Nadu	99.71	99.69	99.92	99.92	99.92	99.96	100	100	100	96.08
Uttar Pradesh	71.46	73.11	74.55	76.26	77.38	77.29	77.2	77.9	78.6	100
West Bengal	77.34	78.23	78.77	79.15	78.92	78.06	77.2	77.4	77.6	79.33
All India	85.55	86.3	87.22	88	89.01	86.955	84.9	85.45	86	78.17
mean	**88.18125**	**88.9075**	**89.615625**	**90.195**	**90.88875**	**90.30375**	**89.71875**	**90.15625**	**90.59375**	
sd	**12.154691**	**11.473159**	**10.9177**	**10.531431**	**10.115596**	**10.572091**	**11.671859**	**11.467619**	**11.292326**	

APPENDIX 3

Raw data for Percentage of Rural population below poverty line

Percentage of Rural population below poverty line

	1973-74	1977-78	1983	1987-88	1993-94	1999-00
Andhra Pradesh	48.41	38.11	26.53	20.92	15.92	11.05
Assam	52.67	59.82	42.6	39.35	45.01	40.04
Bihar	62.99	63.25	64.37	52.63	58.21	44.3
Gujarat	46.35	41.76	29.8	28.67	22.18	13.17
Haryana	34.23	27.73	20.56	16.22	28.02	8.27
Himachal Pradesh	27.42	33.49	17	16.28	30.34	7.94
Karnataka	55.14	48.18	36.33	32.82	29.88	17.38
Kerala	59.19	51.48	39.03	29.1	25.76	9.38
Madhya Pradesh	62.66	62.52	48.9	41.92	40.64	37.06
Maharashtra	57.71	63.97	45.23	40.78	37.93	23.72
Orissa	67.28	72.38	67.53	57.64	49.72	48.01
Punjab	28.21	16.37	13.2	12.6	11.95	6.35
Rajasthan	44.76	35.89	33.5	33.21	26.46	13.74
Tamil Nadu	57.43	57.68	53.99	45.8	32.48	20.55
Uttar Pradesh	56.53	47.6	46.45	41.1	42.28	31.22
West Bengal	73.16	68.34	63.05	48.3	40.8	31.85
mean	**52.13375**	**49.285625**	**40.504375**	**34.83375**	**33.59875**	**22.751875**
sd	**13.27431**	**15.981401**	**16.727163**	**13.515103**	**12.30775**	**14.099477**
cv	**25.46**	**32.43**	**41.30**	**38.80**	**36.63**	**61.97**

APPENDIX 4

Raw data for Per Capita Net State Domestic Product of Agriculture Sector

	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90
Andhra Pradesh	594.81	714.06	691.78	709.52	629.97	618.31	536.16	597.89	706.67	707.73
Assam	567.85	552.76	581.39	604.01	555.24	586.41	548.32	578.91	558.61	593.32
Bihar	437.47	399.36	374.44	439.98	479.83	471.17	506.68	393.93	440.67	395.61
Gujarat	721.13	843.40	700.43	845.17	831.68	606.08	594.38	291.77	838.53	718.23
Haryana	1274.39	1225.64	1249.05	1254.21	1255.41	1400.02	1295.80	1086.27	1528.38	1456.55
Himachal Pradesh	634.79	667.67	570.63	652.17	587.94	659.34	708.92	591.14	623.33	792.57
Karnataka	651.23	714.12	679.18	700.02	747.04	631.49	721.84	705.72	734.65	739.23
Kerala	510.25	507.74	493.89	449.19	493.29	508.66	476.51	485.88	552.40	539.26
Madhya Pradesh	592.53	603.43	617.33	694.98	609.88	669.12	592.25	647.31	686.23	626.11
Maharashtra	602.14	621.62	570.90	592.45	563.63	547.33	454.40	596.33	624.66	764.83
Orissa	617.08	622.72	529.55	696.72	587.78	683.31	639.06	563.43	656.37	725.22
Punjab	1295.94	1419.73	1437.11	1389.40	1526.87	1634.84	1597.26	1643.26	1687.64	1833.22
Rajasthan	622.76	659.40	636.71	832.56	710.09	637.86	595.07	463.52	834.46	734.03
Tamil Nadu	368.00	461.62	344.43	411.72	480.26	434.04	435.48	435.84	424.28	477.39
Uttar Pradesh	637.89	636.19	650.69	662.50	646.00	637.88	639.22	636.37	688.34	661.30
West Bengal	488.10	410.89	436.70	545.60	547.17	563.22	570.27	597.90	620.66	612.41
mean	**663.52053**	**691.27168**	**660.26452**	**717.5121**	**703.25551**	**705.56801**	**681.97607**	**644.71633**	**762.86648**	**773.5632**
sd	**257.84452**	**274.67546**	**289.14291**	**268.10677**	**289.27186**	**327.50344**	**314.20686**	**316.81269**	**350.43369**	**363.3654**

Raw data for Per Capita Net State Domestic Product of Agriculture Sector

	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99
Andhra Pradesh	670.12	671.67	649.40	710.55	668.36	713.18	738.52	604.51	733.55
Assam	588.37	591.69	584.24	581.99	575.68	573.22	583.52	578.66	579.28
Bihar	463.02	376.99	332.03	337.15	365.00	309.01	303.34	297.77	292.31
Gujarat	653.99	516.72	791.65	572.82	816.68	614.16	712.08	708.45	707.76
Haryana	1580.96	1532.51	1537.04	1542.25	1644.72	1498.14	1640.04	1474.95	1487.85
Himachal Pradesh	742.20	695.81	675.89	651.13	667.19	707.97	713.07	718.20	723.38
Karnataka	678.91	798.55	813.14	869.19	845.72	832.64	855.14	832.73	845.62
Kerala	607.63	618.88	613.29	630.79	665.17	678.19	690.92	709.53	724.92
Madhya Pradesh	730.77	630.45	676.42	774.91	740.69	728.17	748.43	709.13	716.88
Maharashtra	699.62	538.61	753.29	800.09	718.07	753.44	869.35	624.29	625.56
Orissa	474.29	548.91	478.24	550.25	535.42	508.39	356.96	476.76	470.74
Punjab	1776.25	1877.29	1883.37	1912.44	1908.87	1844.48	1991.52	1879.78	1926.83
Rajasthan	883.56	731.61	865.59	668.15	879.08	802.55	1005.00	1001.17	904.76
Tamil Nadu	488.72	540.03	546.22	593.88	645.25	534.67	504.98	619.87	643.44
Uttar Pradesh	694.59	699.26	670.95	685.56	690.10	674.46	732.49	679.35	681.81
West Bengal	582.93	651.04	642.34	694.91	775.01	768.86	823.70	825.97	857.74
mean	**769.74671**	**751.25259**	**782.06897**	**786.0043**	**821.31322**	**783.84485**	**829.31502**	**796.32056**	**807.65161**
sd	**372.63941**	**390.4298**	**390.01748**	**392.36761**	**396.15223**	**375.28632**	**430.27868**	**384.43075**	**389.31345**

APPENDIX 5

Raw data for Agriculture Electricity Consumption

Year	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90
Andhra Pradesh	977.13	1004.55	1465.18	1626.58	2439.22	2697.52	3501.25	4155.63	4629.58	5477.01
Assam	4	10	8.96	8.56	8.68	7.17	22.1	12.87	13	25.57
Bihar	434.63	493.73	618.05	646.28	603.65	799.51	970.19	1149.28	1372.85	1459.47
Gujarat	1333.99	1316.23	1387.31	1427.82	1633.38	1723.1	2203.29	3856.63	4414.97	5154.65
Haryana	953.77	1159.4	1327.41	1301.38	1375.22	1366.49	1624.05	2176.28	2157.85	2543.26
Himachal Pradesh	5.77	6.51	9.18	11.98	17.65	21.02	22.69	23.51	23.35	25.77
Karnataka	392.97	427.15	479.34	533.9	618.86	1169.41	2237.13	2490.18	2871.83	3568.46
Kerala	79.8	105.04	107.2	93.57	97.99	101.01	131.16	146.37	186.2	212.73
Madhya Pradesh	344.87	393.82	586.65	557.4	696.11	770.7	1040.99	1127.1	1303.64	1050.59
Maharashtra	1724.37	1878.74	2345.09	2541	3373.4	3666.67	4057.27	4459.21	5286.36	6148.26
Orissa	58.73	64.19	73.37	74.42	72.17	75.43	167.42	189.35	113.3	164.72
Punjab	1849.75	1860.07	2115.03	2189.07	2364.22	2768.67	3570.77	4242.42	4220.43	5186.58
Rajasthan	1009.11	1031.28	1188.37	1307.41	1402.07	1460.12	1588.23	1828.62	2159.43	2105.74
Tamil Nadu	236.66	2475.73	2506.6	2211.5	2423.96	2824.45	3078.27	3118.96	3574.07	3233.23
Uttar Pradesh	2791.67	2833.24	3411.74	3518.41	3625.67	3736.98	4953.7	5883.41	6041.94	7267.38
West Bengal	72.37	66.32	94.16	100.59	111.98	119.06	145.17	234.43	257.25	180.8
mean	**766.84938**	**945.375**	**1107.7275**	**1134.3669**	**1304.0144**	**1456.7069**	**1832.105**	**2193.3906**	**2414.1281**	**2737.7638**
sd	**815.48306**	**916.39199**	**1048.5001**	**1066.3155**	**1225.2242**	**1315.9744**	**1610.2014**	**1903.9915**	**2065.2496**	**2471.0208**

Raw data for Agriculture Electricity Consumption

	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01
Andhra Pradesh	6459.68	7218.94	8094.58	9366.8	11269.75	11757.42	8210.44	9798.78	10307.21	11285.1	11747.96
Assam	26	35.92	30	42	42.69	43.92	45.58	25.32	55.32	46.35	40.68
Bihar	1462.97	1644.11	1549.27	1384.24	1395.59	1292.3	1331.15	1507.14	1384.02	1525.94	1548.63
Gujarat	5679.84	6976.58	7803.53	8667.1	8477.68	10151.59	10086.78	10774.84	12208.37	14934.72	15489.28
Haryana	2711.78	3535.49	4062.7	3959.11	3653.42	3904.33	4089.13	3842.84	4039.66	4590.91	4535.3
Himachal Pradesh	26.16	29.8	14.14	13.56	11.94	12.24	11.38	10.53	12.03	16.54	19.2
Karnataka	4420.65	4558.63	5373.51	6104.8	7401.1	7416.27	6957.07	9171.53	7067.51	6385.73	7435.22
Kerala	207.62	224.13	235.15	261.17	271.48	321.92	329.08	340.81	354.13	475.13	350.21
Madhya Pradesh	2524.13	3405.74	3749.96	5668.67	6928.57	8260.49	8875.2	10004.66	12154.82	10154.55	4897.74
Maharashtra	6604.45	8406.46	8068.33	8922.68	11735.51	13620.53	14136.67	15630.45	16217.75	10623.06	9876.22
Orissa	182.56	271.49	280.14	340.52	427.25	491.98	159.21	194	254	217	196
Punjab	5095.6	5543.18	6144.14	6345.28	6600.3	5734.81	6348	6049.31	7531.31	8233.06	5534.35
Rajasthan	2366.82	2985.41	3097.19	3663.03	3718.32	4365.33	4737.37	4980.35	6032.18	6560.25	7046.3
Tamil Nadu	4057.97	4509.84	5226.46	5706.15	6296.05	6730.28	6936.12	7281.02	7587.64	8875.23	9311.65
Uttar Pradesh	7759.4	8229.49	8536	8963	9541.06	9888	9846	9455	9983	5400.47	5259.71
West Bengal	454.01	651.86	738.27	801.08	1023.47	1237.23	1372.73	1482.94	1216.75	1308.45	998.97
mean	**3127.4775**	**3639.1919**	**3937.7106**	**4388.0744**	**4924.6363**	**5326.79**	**5216.9944**	**5659.345**	**6025.3563**	**5664.5306**	**5267.9638**
sd	**2646.2889**	**3004.3472**	**3198.6553**	**3547.6136**	**4131.279**	**4545.0187**	**4389.4103**	**4840.0021**	**5198.4441**	**4746.2115**	**4686.8492**

APPENDIX 6

Raw data for Gross Cropped Area as Percentage of Gross Area Irrigated

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Andhra Pradesh	34.36	34.75	35.36	35.62	38.33	37.55	36.56	38.27	37.66	38.05	40.01
Assam	11.58	11.74	11.82	11.5	11.67	12.07	12.16	12.17	12.2	12.18	12.83
Bihar	35.3	34.94	36.34	36.41	37.3	37.75	39.75	40.43	39.82	39.89	40.12
Gujarat	20.79	21.78	23.09	23.29	24.97	23.3	22.86	23.12	23.83	26.02	26.15
Haryana	60.1	61.05	58.81	66.35	59.85	63.58	65.68	61.82	80.24	62.45	69.72
Himachal Pradesh	17.33	17.38	17.43	17.42	17.4	17.41	17.41	17.42	17.72	17.64	18.05
Karnataka	15.9	16.36	16.55	16.55	17.51	18.92	18.35	19.76	19.8	23.57	22.78
Kerala	13.88	14.48	14.99	14.99	14.99	15.05	17.72	14.86	18.46	17.98	12.69
Madhya Pradesh	10.76	11.55	11.63	11.63	11.63	11.63	13.77	15.89	15.49	17.03	16.92
Maharashtra	11.88	12.04	12.67	11.74	11.41	11.63	11.61	12.16	11.55	13.56	14.01
Orissa	19.89	19.25	19.81	21.42	23.08	25.14	26.67	27.52	28.02	29.99	30.26
Punjab	86.46	84.73	85.23	85.23	84.64	89.58	90.09	90.2	90.5	91.27	91.24
Rajasthan	23.73	21.61	20.01	22.72	22.03	22.11	21.3	24.66	28.54	21.53	23.43
Tamil Nadu	46.02	47.49	44.75	42.27	42.79	42.57	47.5	43.36	42.43	43.85	45.19
Uttar Pradesh	43.94	45.12	44.31	45.58	47.16	49.27	51.25	53.72	57.41	56.26	55.33
West Bengal	25.54	25.94	26.33	26.73	27.11	27.5	27.88	28.26	28.63	28.74	29.02
All India	28.46	28.72	28.76	29.18	29.61	30.39	31.17	32.35	33.41	33.12	33.49

Raw data for Gross Cropped Area as Percentage of Gross Area Irrigated

	1991	1992	1993	1994	1995	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01
Andhra Pradesh	40.41	42.22	41.59	43.19	43.51	40.67	43.12	42.51	44.71	44.12	43.68
Assam	12.3	12.51	12.4	12.36	12.73	14.53	14.37	14.32	14.51	13.98	15.56
Bihar	39.98	40.25	39.99	39.63	41.56	45.72	45.99	45.72	47.82	48.18	47.79
Gujarat	25.69	25.25	27	26.99	26.9	34.71	33.11	33.87	34.46	35.72	33.92
Haryana	76.1	77.6	75.92	76.6	79.59	78.22	78.78	78.61	79.78	84.99	85.41
Himachal Pradesh	18.46	17.53	17.59	17.65	18.99	18.31	18.59	18.26	18.87	18.7	19.09
Karnataka	23.05	24.39	24.37	25.56	25.9	23.79	23.36	24.9	25.35	26.14	26.62
Kerala	12.22	12	12.5	12.5	14.06	15.2	15.43	14.05	14.43	15.69	15.16
Madhya Pradesh	20.01	18.03	18.34	18.79	18.39	26.1	27.38	26.48	27.18	28.54	23.98
Maharashtra	12.1	11.45	11.16	11.1	11.24	15.41	15.41	15.41	17.01	16.86	17.37
Orissa	23.5	21.56	19.23	17.53	16.24	27.19	27.54	26.81	27.99	29.47	33.73
Punjab	93.69	92.84	93.02	93.21	93.25	95.16	94.07	95.58	96.74	90.86	91.54
Rajasthan	24.39	25.92	27.2	28.82	30.25	32.34	32.58	29.9	31.81	35.95	36.32
Tamil Nadu	44.45	46.17	46.19	46.14	46.6	50.79	51.84	53.66	54.85	54.99	56.94
Uttar Pradesh	56.17	56.64	56.97	57.69	58.29	69.19	66.81	69.87	72.93	76.59	80.44
West Bengal	31.06	31.26	33.27	31	31.39	27.76	27.58	26.98	26.81	26.1	25.34
All India	33.8	33.72	33.54	33.5	33.74	38.25	38.66	38.31	39.43	40.23	41.59