

*SUMMER INTERNSHIP REPORT*

**Moving Towards Cost Reflective Tariff:  
An Analysis of Four States**

UNDER THE GUIDANCE OF

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## DECLARATION

I, Kumar Gaurav, Roll No1031256 student of MBA (POWER MANAGEMENT) 2012-14 batch of the National Power Training Institute, Faridabad hereby declare that the Summer Training Report entitled –

“MOVING TOWARDS COST REFLECTIVE TARIFF: AN ANALYSIS OF FOUR STATES” is an original work and the same has not been submitted to any other Institute for the award of any other degree.

A Seminar presentation of the Training Report was made on \_\_\_\_\_ and the suggestions as approved by the faculty were duly incorporated.

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Director/Principal of the Institute

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## Executive summary

Electric power is a vital pre-requisite in any modern economy and is important for socio-economic development. Dramatic changes in sector regulation and structure has taken place from time to time to keep this development process continuous. At the same time to improve the health of the sector and to ensure investment in the sector, reforms and amendments were brought in the act and regulations. One major reform which took place was creation of **ELECTRICITY REGULATORY COMMISSION** in both centre and state level for regulating the power sector and especially the tariff. Before the creation of ERC the job of **TARIFF** setting was in the hands of state government and they used this authority to their own benefit. The main aim before creation of ERC was setting up of fair and transparent tariff for different sections of societies.

“Recovery of cost from tariff from each category of consumers” this is what clearly written in Electricity regulatory commission act 1998, Electricity Act 2003, National Electricity Policy 2005, National Tariff Policy 2006. In other words it is also known as cost reflective tariff or Tariff Rationalization i.e. the cost has to be recovered from particular category of consumer imposing the cost on the system for getting the power supply. Traditionally, in the Indian context, tariffs for domestic and agricultural consumers have been heavily subsidised either by the state through subsidies and subventions or through cross subsidisation by other consumer categories or within the category, primarily the consumers using electricity at high voltages or consuming more number of units. The target was also set by National Tariff Policy 2006 to bring tariff in the range of  $\pm 20\%$  of the average cost of supply latest by 2010-11 which passed away without much achievement. With the advent of the Electricity Act 2003 and various policy initiatives thereof, it has now become mandatory for the Electrical utilities to gradually reduce the cross subsidy and move the tariffs in the State towards the “Cost of Supply”.

In this project a detailed analysis of the gap, which is found by the difference of cost of supply and average tariff has been done to find whether there is any effect of reforms on tariff rationalization and also to check out that whether tariff has come within the range of  $\pm 20\%$  of the average cost of supply. This also includes the cost of service model study done by FEEDBACK Infra Energy division for TANGEDCO.

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# Chapter 1

## 1.1. Introduction

Electricity is an important basic infrastructural element, required for industrial development. Inadequate supply of power will lead to idle capacity, low production, and scarcity of essential goods, inflation, and a steady decline in the future growth prospects of the Indian economy. Electric energy occupies the top grade in the energy hierarchy. It finds innumerable uses in home, industry, agriculture even in transport. The per capita consumption of electricity in any country is an index of the standard of living of the people in that country.

<sup>1</sup>One of the reasons which forced the government for reform and restructuring is the interference from state government/politicians in tariff formulation. The clear lesson from the recent Indian experience is that the most critical challenge faced by the power sector lies at the distribution end of the Generation --> Transmission --> Distribution value chain. The dismal and deteriorating financial health of the power distribution entities is already seen to be the key factor that has led to inadequate investments in the sector. It is well known that timely tariff hikes in the power sector are probably its most politically sensitive issue. The glaring fact is that many states have not revised tariffs in the last 5 to 6 years, and some for even over a decade. With average cost of supply growing at over 7% (CAGR) in recent years, the situation has become completely untenable! Today, the distribution entities across the country, whether in the public or in the private sector, urgently require tariff hikes of 50 to 60% in order to meet their operating costs, and serve the economy with reliable supplies of power. But the fact is that this hike would still leave unattended the issue of past losses that have accumulated over a period of time due to irrationally low tariffs. It is equally important to take note of the recent positive signs that governments and policy-making establishments have begun to show as proof of their acknowledgment of the dire necessity of tariff reform. Even before the commencement of financial year 2012-13, seven states revised tariff by 7 to 37 % (Tamil Nadu, Haryana, Andhra Pradesh, Bihar, Orissa, Tripura, and Madhya Pradesh). It is interesting to note that 9 more states

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<sup>1</sup> Power tariff reforms: need of the hour in India, Energetica India, June 12

have filed tariff revision petitions and are expected to announce new rates for sale of power in the near future. One factor that has led to this more rational view is to do with the stringent measures made mandatory by banks & NBFC's for disbursal of any fresh loans to the distribution companies, and the empowerment of state power regulators to revise tariffs by the relevant appellate tribunals.

This implies that permanent mechanisms and practices to pass through to consumers any variation in power costs. The critical consideration here is that purchase costs for power typically constitute up to 80 % of the total cost. of the distribution operation. Since the 'truing up' process, involving a fix on the gap between cost of power purchases and the revenues from sales, can take as much as a few years for reasonable estimation, it is important to institute and implement Mechanisms that enable immediate pass through of any variation in power costs. This will avoid build up of so-called 'regulatory assets' (actually amounting to current operating losses) and cash flow problems which are the excruciating experience for most distribution companies at present.

Everybody agrees upon the need for reduction in cross-subsidies between diverse consumers. The high level of subsidy to the domestic and agricultural segments complicates the problem further. One testimony to the twisted deal in such arrangements is provided by the fact that 24% of entire electricity supplied flows to the agricultural sector, but yields less than 6 per cent of the total revenues. The hard fact that domestic and agricultural consumers have to face relatively higher hikes in the electricity they consume cannot be denied for long, or permanently. A beginning has been made in Tamil Nadu, which has increased tariff on electricity supplied to its agricultural consumers by 589%, to Rs 1.75 per unit.

Regulatory Commissions have been constrained from more efficient tariff setting due to the non responsiveness of public utilities to economic signals, continued poor quality, high cost and inefficiency of supply. Tariff reform can improve allocative efficiency by providing better price signals. Efficient tariff design has played a significant role in assisting the process of tariff rationalization. Gujarat has accompanied the stiff tariff increase with an innovative tariff design which incentivises agricultural consumers, to install meters, through a preferential rate for metered supply as compared to unmetered supply. This was done by designing the flat HP based tariff in a manner that it translates into a higher per kWh charge as compared to the metered tariff. Commissions have also simplified the tariff structure, which over the years had becoming increasingly complex with multiple customer classes and slabs. State-owned power distribution

companies (discoms) have become more punctual in the filing of annual tariff revision petitions before regulators. As many as 19 states have filed tariff petitions for 2013-14 with regulators and, of these, nine have already issued revised tariff orders. Last year, too, discoms in all states and union territories except Assam moved regulators for tariff revision.

## 1.2. Objective of Project:

The objective of the project is:

- To see whether early reforms state has performed better than late reforms state.
- To find out the need for Tariff rationalization.
- To identify the barriers in moving towards Tariff rationalization.
- To find out the best suitable ways to achieve tariff rationalization.
- To study cost of service to determine actual cross-subsidy level prevailing.

### **1.3. Scope of the project:**

- To see whether reforms have helped in achieving tariff rationalization in Andhra Pradesh, Gujarat, Punjab and Tamil Nadu.
- To calculate the actual cross-subsidy level with category-wise cost of service to be followed by different utilities in the near future.
- To see the changes early reforms states Andhra Pradesh and Gujarat have brought in comparison to late reform state Punjab and Tamil Nadu.

## 1.4. Organization Profile

**Administrative Staff College of India (ASCI)** was started jointly by the Government of India and the representatives of industry as an autonomous institute in the year 1956 to impart training in the field of management development. It is located at the palace of the erstwhile Prince of Berar known as Bella Vista at Hyderabad. Initially Government Of India envisaged setting up the college in Britain. The first session was to commence in 1948 at Henley. However a committee of the All India Council for Technical Education in 1953 recommended that the Administrative Staff College be established in India. ASCI specialize in training of civil servants and managers of corporate and government sectors and urban management. The research and consultancy activities of ASCI were started in 1973 with aid from Ford Foundation. Ever since it was established in 1956, ASCI fuelled the process of professionalizing management, by synergizing a symbiotic blend of management development [training], consultancy and research. This unique blend coupled with information technology pursuit is structured to develop strategic thinking, reformist leadership, and state-of-the-art skills among practicing managers in India and the developing world. It thus envisages achieving competitive dominance by confronting existing and emerging challenges and effectively managing regulatory, government, commercial and non-commercial organizations. Over 75,000 participants from industry, government and non-government organizations in India and the developing world have taken advantage of nearly 200 management development programs offered by ASCI every year and over 300 organizations have reaped benefits from its research and consultancy services. ASCI provides consultancy to industry, business and government in general management as well as functional and sectoral areas of the management. The objectives of ASCI Consultancy is to provide professional services for improving management practices in the organizations leading to improved economic performance and long-term effectiveness.

The ASCI Consultancy Team generally comprises of faculty members representing different functional and sectoral areas of management and uses a multi-disciplinary approach to problem solving. Almost all the faculty members in the College are involved in consulting assignments so that they will get enough opportunities to experiment with new ideas and approaches in achieving economic performance and long-term effectiveness in problem-solving for the clients. This approach also provides an opportunity for the faculty to enrich their teaching inputs.

ASCI have undertaken several consultancy assignments for national and international clients. The principle objective of this service is to provide a multi-disciplinary approach in finding solutions to serious problems that plague industry, business, and government. Some of the areas in which consulting assistance has been provided by ASCI include strategic planning, organizational restructuring, human resources management and development, restructuring, health management, organization management, forest management, energy management, business process re-engineering and improving of service delivery of various Government institutions. At any point of time while the number of projects under implementation is around 50, over 1000 assignments have been carried out since 1965 till date. The project clientele of ASCI is a virtual “who’s who” list, comprising such prestigious agencies and sponsors as the State and Central Governments, their various ministries/departments, constituent establishments, public enterprises, statutory organizations as well as autonomous bodies. ASCI is trusted with work by the International agencies too, like the constituent organizations of the United Nations, the World Bank Institute, Department for International Development (DfID, UK), the Japan Bank for International Cooperation (JBIC), etc.

## Chapter 2

### 2.1. Literature Review:

**Lalit Jalan et al (2012)** stated that the logic behind rationalization of power tariffs has to be put to work on a perennial basis. This implies that permanent mechanisms and practices to pass through to consumers any variation in power costs. The critical consideration here is that purchase costs for power typically constitute up to 80 % of the total cost of the distribution operation. Since the 'truing up' process, involving a fix on the gap between cost of power purchases and the revenues from sales, can take as much as a few years for reasonable estimation, it is important to institute and implement mechanisms that enable immediate pass through of any variation in power costs. This will avoid build up of so-called 'regulatory assets' (actually amounting to current operating losses) and cash flow problems which are the excruciating experience for most distribution companies at present. Everybody agrees upon the need for reduction in cross-subsidies between diverse consumers. The high level of subsidy to the domestic and agricultural segments complicates the problem further. One testimony to the twisted deal in such arrangements is provided by the fact that 24% of entire electricity supplied flows to the agricultural sector, but yields less than 6 per cent of the total revenues. The hard fact that domestic and agricultural consumers have to face relatively higher hikes in the electricity they consume cannot be denied for long, or permanently. Once again there are a few signs of rational regulation, albeit early ones. A beginning has been made in Tamil Nadu, which has increased tariff on electricity supplied to its agricultural consumers by 589%, to Rs 1.75 per unit.

**Anand Kumar et al (2010)** talks about

- Recovery of prudent cost
- Minimizing the gap between tariff and cost.
- Effective subsidy allocation
- Simplifying slab structure.
- Reducing cross subsidy.
- Rationalization and simplification of tariff
- Functional incentives and penalties.

Cost of supply depend on load factor, voltage and technical and commercial losses, peak contribution etc. Simplification of slab structure which will provide Economic Support for lifeline consumers and encourage efficient consumption

**FEEDBACK et al (2013)** Cost of service study seeks to allocate all the costs of a utility to each of the customer classes it serves. Such allocation reflects the costs attributable to electricity supplied and related services provided to categories. The costs can then be used as an input into tariff design or to determine cross subsidy, if any, existing in tariffs. The determination of cost of service for each of customer categories requires disaggregating the utility's costs into functions, services and categories. In setting tariffs, cross-subsidies have been retained with the ostensive objective of balancing the effect of price increase on certain categories of consumers who have been paying lower tariffs historically. Efforts to make the reforms successful in power sector will have to take note of the need to reduce and eventually phasing out cross-subsidies. There is a need that the tariff of all subsidized categories of consumers would need to be rationalised in phased manner, such that the consumers who are enjoying subsidy for years accept the tariff increase supplemented with improved quality of supply. It will also have to be ensured that there is no disparity in quality & quantity of power supply amongst all the consumers, including these subsidized category consumers. Consumers shall be liable to bear the cost of supply and the loss levels expressing the efficiency of the respective consumer category only. Cost of Supply shall be determined on the actual cost to supply to each of the consumer class without subsidies and cross subsidies. Such determination of actual costs requires apportionment of a utility's costs to the various customer classes it serves.

**KPTCL et al** says One of the main factors for the poor financial situation of the power sector is the tariff structure. It is expected that the regulatory commission will bring about rationalization of tariffs taking into account, inter-alia, the extent of subsidy the Government provides, the inherent operational efficiency of the utilities and the capacity to reduce T&D and commercial losses. Efforts will be made to ensure that as far as possible the newly formed utilities are not burdened with historic liabilities. It is the intention of the Government of Karnataka that the utilities, particularly distribution of companies, start their operations with a clean balance sheet.

**Shahid Hasan et al 2012** says It was hoped that by creating independent regulatory bodies, the government's age-old prerogative of designing and deciding electricity tariffs, keeping in mind

its political constituencies, would come down. But we have not been able to insulate the functioning of regulatory institutions from political economy linkages. As part of the reforms blueprint, it was envisaged that dependence on the government for subsidy support would come down in future. However, the results have been just the opposite. The subsidy requirements of restructured companies increased significantly in the post-reform period from Rs 14,000 crore in 2002-03 to Rs 34,000 crore in 2009-10, which is either not paid fully or on time, eventually affecting the cash flows of electric utilities. One of the reasons for this situation is the direct or indirect unwillingness shown in correcting tariffs in the past. While prices of almost everything, including essential commodities, have gone up, electricity rates have not been revised appropriately with respect to rising cost of electricity production. The conventional practice followed by regulators to avoid any appreciable tariff increase has been to defer part of revenue requirements by parking them as "regulatory assets", which need to be recovered in future. Why should a consumer pay for electricity charges in future for the electricity consumed by someone else in the past? It's only recently that some regulators have realized this problem and allowed price increase. Instead of free or subsidized power, the state should pursue a rational pricing mechanism, in combination with improved service and delivery of power. Section 61 (g) of the EA 2003 stipulates tariff to progressively reflect the cost of supply of electricity, and reduce and eliminate cross-subsidies within a period to be specified by the commissions. Fundamentally, it makes great sense, but its operationalisation in letter and spirit along with the freedom to indicate and provide subsidies to any consumer or class of consumers becomes very weak. Of course, we can't completely ignore some disadvantaged class of consumers in our society, but regulators are yet to spell out a roadmap for gradual reduction of cross-subsidies. It is now important to define the timeframe, rather than leave such important provisions vague. There is an urgent need for regulators to gradually reduce the level of cross-subsidy and ensure that tariff to various consumer categories reflect cost. This should, however, not be at the cost of quality and reliability of supply. It is important to understand that if the costs are not met, the discoms will reluctant to arrange for additional power. There will also be a significant impact on the financial viability of the utilities --- in particular, the distribution companies. All States have set up independent regulatory commissions and have also initiated a tariff revision exercise, but reduction of cross-subsidies and movement of tariffs towards cost of supply has been rather slow.

## 2.2. Review of legislation and Policies

### 2.2.1. Electricity Regulatory Commission Act 1998

An Act to provide for the establishment of a Central Electricity Regulatory Commission and State Electricity Regulatory Commissions, rationalization of electricity tariff, transparent policies regarding subsidies, promotion of efficient and environmentally benign policies and matters connected therewith or incidental thereto.

It also aims at improving the financial health of the State Electricity Boards (SEBS) which are losing heavily on account of irrational tariffs and lack of budgetary support from the State Governments as a result of which, the SEBs have become incapable of even proper maintenance, leave alone purposive investment. Further, the lack of creditworthiness of SEBs has been a deterrent in attracting investment both from the public and private sectors. Hence, it is made mandatory for State Commissions to fix tariff in a manner that none of the consumers or class of consumers shall be charged less than fifty per cent. of the average cost of supply, it enables the State Governments to exercise the option of providing subsidies to weaker sections on condition that the state Governments through a subsidy compensate the SEBS. As regards the agriculture sector, it provides that if the State Commission considers it necessary it may allow the consumers in the agricultural sector to be charged less than fifty per cent, for a maximum period of three years from the date of commencement of the Ordinance. It also empowers the State Government to reduce the tariff further but in that case it shall compensate the SEBs or its successor utility, the difference between the tariff fixed by the State Commission and the tariff proposed by the State Government by providing budgetary allocations. Therefore, it enables the State Governments to fix any tariff for agriculture and other sectors provided it gives subsidy to State Electricity Boards to meet the loss.

Sec(29)(2) says that the State Commission shall determine by regulations the terms and conditions for the fixation of tariff, and in doing so, shall be guided by the following, namely: -

- Sub clause(c) That the tariff progressively reflects the cost of supply of electricity at an adequate and improving level of efficiency;

- Sub clause(e) The interests of the consumers are safeguarded and at the same time, the consumers pay for the use of electricity in a reasonable manner based on the average cost of supply of energy;

### 2.2.2. Electricity act 2003

- Subsection (g) of **Section 61** of EA 2003 stipulates that the tariff should progressively reflect cost of supply of electricity and also reduces cross subsidies in the manner specified by the Appropriate Commission;
- **Section 62(3)** provides for the factors on which the tariffs of the various consumers can be differentiated. Some of these factors like load factor, power factor, voltage, total electricity consumption during any specified period or time or geographical position also affects the cost of supply to the consumer. Due weightage can be given in the tariffs to these factor to differentiate the tariffs;
- As per the Section 62 of the EA 2003, the SERC is required to determine the retail tariff to be charged by the Distribution Licensees from its consumers. The Commission while determining the tariffs is required to give considerations to the factors (load factor, power factor, voltage, total consumption of electricity during any specified period or the time at which the supply is required or the geographical position of any area, the nature of supply and the purpose for which the supply is required.) listed in Section 62(3), 61(c) and 61(e) of the EA 2003, which are essentially cost determinants and economically efficient tariffs should consider the cost impact of these factors only without providing for any cross subsidies.
- The Tariff may be fixed as per the consumer's load factor, power factor, voltage, total consumption of electricity and should reflect the Cost of Supply to the concerned consumer category.
- The EA 2003 recognizes the fact that tariffs of some consumer categories are presently below cost of supply and tariff shock due to abrupt elimination of subsidy may not be in the interest of such consumers therefore it provides for progressive reduction in cross subsidy. As said earlier, the tariffs must reflect the underlying cost of supply and if the

State Government wishes that any particular consumer category is to be charged lower than the cost of supply then as per Section 65 of the EA 2003 the State Government has to provide subsidy to such consumers. The EA 2003 has preferred direct subsidy over cross subsidy. However the amendment to the section 61 replacing the word elimination with reduction provides for some amount of continued cross subsidy.

### 2.2.3. National Tariff Policy

- The National Tariff Policy (NTP) prescribes the principles to be adopted by the Commission for determining tariffs for generation, transmission, distribution and retail consumers.
- Section 8.3 (2) reads -  
*For achieving the objective that the tariff progressively reflects the cost of supply of electricity, the SERC would notify roadmap within six months with a target that latest by the end of year 2010-2011 tariffs are within  $\pm 20$  % of the average cost of supply. The road map would also have intermediate milestones, based on the approach of a gradual reduction in cross subsidy;*
- The NTP provides that tariffs is required to reflect efficient costs and gradual reduction of cross subsidy inherent in existing tariffs but consumers below poverty line (BPL) for life line consumption can have cross subsidized tariff rates. Also, a direct subsidy support by the State Government to the other poorer categories of consumers for pre-identified level of consumption is allowed.
- The clause 8.5 which defines cross subsidy charge as the difference between the (i) tariff applicable to the relevant category of consumers and (ii) the cost of the distribution licensee to supply electricity to the consumers of that category provides an indication how to compute cross subsidy.
- The NTP recognizes data and other issues in the determination of cost of supply consumer category wise and alternatively provides that tariff should be within  $\pm 20$  % of the average cost of supply.

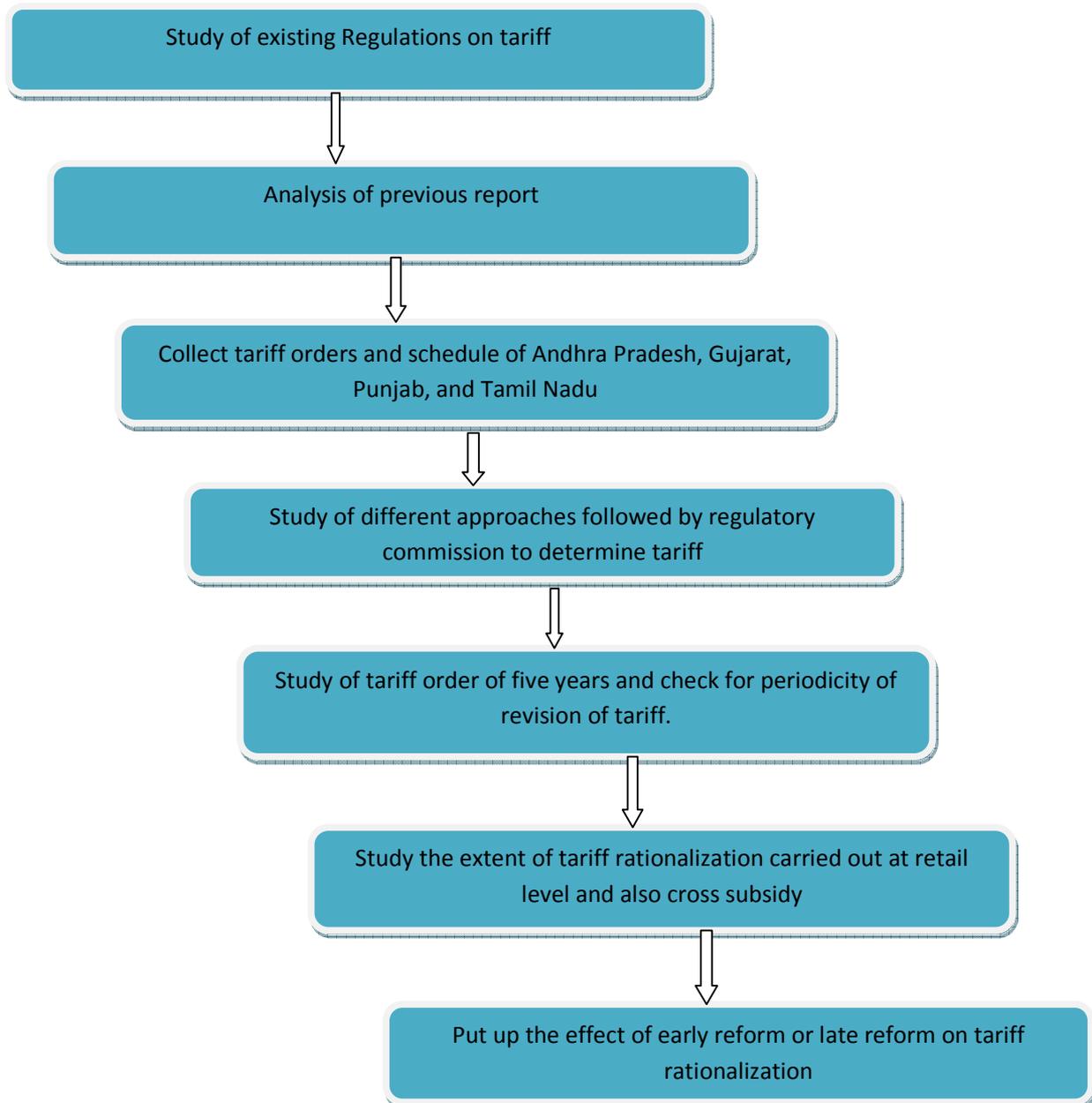
For example if the average cost of service is Rs 3 per unit, at the end of year 2010-2011 the tariff for the cross subsidised categories excluding BPL consumers should not be lower than Rs 2.40

per unit and that for any of the cross-subsidising categories should not go beyond Rs 3.60 per unit.

#### 2.2.4. National Electricity Policy

- The Commission while discharging its functions as required by the Electricity Act 2003 is to be guided by the National Electricity Policy (NEP). The NEP provides guidance and clarifications on issues which either have not been or have been inadequately addressed in the EA 2003. The relevant clauses in the context of this study are:
- Clause 5.5.1 reads that there is an urgent need for ensuring recovery of cost of service from consumers to make the power sector sustainable;
- Clause 5.5.2 stipulates that consumers below poverty line, who consume below a specified level, say 30 units per month, may receive a special support through cross subsidy. Tariffs for such designated group of consumers will be at least 50% of the average cost of supply. This provision will be re-examined after five years;
- Further, the National Electricity Policy provides for reducing the cross subsidies progressively and gradually. The gradual reduction is envisaged to avoid tariff shock to the subsidized categories of consumers. It also provides for subsidized tariff for consumers below poverty line for minimum level of support. Cross subsidy for such categories of consumers has to be necessarily provided by the subsidizing consumers
- The thrust of the NEP is that the tariffs should reflect cost and existing cross subsidies should progressively and gradually reduce. However there can be cross subsidy support for very poor categories of consumers.

### 2.3. Research Methodology:



**Figure 1 Research Methodology**

## Chapter 3

### 3.1. Cost of Power Supply and their components

The cost of supply of electricity represents the cost incurred by the utility to supply electricity to ultimate consumers. The components considered for calculations include O&M expenditure, establishment & administration cost, interest payment liability, depreciation, fuel cost and the expenditure on power purchase. The fuel cost incurred by the utilities is accounted for in the calculation of the total cost of supply only in states where the generation and distribution are still integrated under a single company. For states where generation and distribution are unbundled, instead of the fuel cost, the cost of power purchase has been indicated.<sup>2</sup>

#### Components of Cost

All components of cost namely expenditure on power purchase, O&M expenses, establishment and administration expenses, fuel cost, depreciation and interest payments, have been taken into account in the determination of the cost of supply. This section presents a detailed discussion on each of the component of the cost of supply.

#### 3.1.1. Expenditure on Power Purchase

The share of expenditure on power purchase in the total cost of supply has increased from 39 percent in 1998-99 to 70 percent in 2009-10. One possible reason for increase in share of expenditure in power purchase is that many states have unbundled electricity generation and distribution since the 1990s, and so the share of power purchase has increased. The expenditure on power purchase expressed in terms of expenditure incurred per unit of electricity sold, has increased from 152 paise/kWh sold in 1998-99 to 334 paise/kWh sold in 2009-10.

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<sup>2</sup> Annual report 2011-12 on the working of the state power utilities and electricity department, Ministry of power

### **3.1.2. Expenditure on O&M works**

O&M cost consist of Administrative and General expense (A&G), Repair and Maintenance cost (R&M), Employee Costs. The costs are generally Benchmarked with past performance and specified in regulations. A&G expense consist of rent, insurance, managerial salaries. The share of O&M in the cost of power supply has reduced from 3.57% in 1998-99 to 1.62% in 2009-10. It is expected to further decrease to 1.57% in 2011-12. The share of O&M in total cost of supply varies across states.

### **3.1.3. Nature of fixed costs**

The share of fixed costs, viz., depreciation , Interest on working capital and interest on loans, in the average cost of supply has declined over the years. While the share of depreciation declined from 6.4% in 1998-99 to 3.67% in 2009-10, the share of interest cost, i.e. interest payable to the financial institutions and the State Governments came down to about 6.5% in 2009-10 from a level of 13.5% in 1998-99. While the share of depreciation is expected to stay relatively constant, the share of interest payments is expected to increase to 7.9% in 2011-12 from 6.5% in 2009-10.

### **3.1.4. Expenditure on fuel**

Expenditure on fuel refers to the fuel cost incurred in generation of power by the state utilities. The share of fuel cost in the total cost of supply was 20 percent in 1998-99, and has since decreased to 5 percent in 2009-10. The reason for decline in share of fuel cost is that most states have unbundled the electricity generation and distribution since the 1990s, and so the fuel cost does not appear in the calculation of the cost of power supply. For these states, like Punjab and Tamil Nadu we can say that the electricity generation and distribution are not totally unbundled as of 2009-10, and the distribution utilities still generate some electricity.

## **3.2. Types of cost of supply**

- 1) Average cost of supply**
- 2) Voltage wise cost of supply**
- 3) Category wise cost of supply**

### 3.2.1. Average cost of supply:

Average cost of supply is calculated by dividing Aggregate revenue requirement of the distribution licensee considered by the commission for recovery through retail tariff with total energy sales forecast for that year. Usually, the approach adopted by many SERC's and utilities is to consider the average cost of supply method to calculate the Cross Subsidy as the data required to calculate the cost of supply category wise and voltage wise is not available. However, the average cost of supply is not the efficient way of determination of cost of supply as it does not give the actual cost imposed by category of consumer on the system. Average cost of supply is not the real figure because the cost imposed on the system by every category is not the same. This method requires no effort or little effort to calculate the cost of supply. Looking at the conditions of the discoms, in a near future we cannot expect them to move towards voltage wise and category wise cost of supply which is better method than this and has been adopted by states which have undergone early reforms.

### 3.2.2. Voltage wise cost of supply

In this all the consumers connected to particular voltage level have the same cost of supply. This is the first step in determining consumer-wise cost of supply. For voltage-wise cost determination, it is important that the accounting system of the licensees are oriented towards capturing costs voltage-wise at the point of origin as and when these are incurred. For explaining the voltage wise cost of supply there is a example of DERC which follow this method. Before we move on to the example we should know that distribution business in Delhi has been divided into “**retail supply business**” and “**wheeling business/wire business**”. This is also seen as a step towards encouraging open access within the State. Many SERCs have framed a methodology for segregation of Distribution Licensee ARR into Wheeling and Retail Supply Business ARR. However, due to lack of clear segregation of various expense parameters, SERC's have followed divergent approach.

**Wheeling Business function:**

- a) Involves transporting of electricity from transmission systems ( transmission ends at 66 kv) to consumers.
- b) Setting up of physical network poles, wires, transformers, etc to provide electricity to consumers.
- c) Obtain right-of-way in order to set up network, company should approach the local authorities for obtaining permission.
- d) New connections- extension or erection of network so that new area loads are added to the system.
- e) Maintenance of network-so that the network is in good condition, available to dispatch electricity.
- f) Quality of supply- maintaining proper conductor, transformer loading, assure quality power.

**Retail supply function:**

- a) Retailing is the sale of electricity to final consumers
- b) Procurement of electricity from wholesaler or bulk supplier
- c) Pricing of electricity.
- d) Connection of consumes from the network- on payment of certain charges and categorization of consumers.
- e) Metering of energy used by consumers-setting up of meter in consumer premises their maintenance, meter reading.
- f) Billing
- g) Collection
- h) Disconnection of service.

As a step towards encouraging open access within the State, many SERCs have framed a methodology for segregation of Distribution Licensee ARR into Wheeling and Retail Supply Business ARR. However, due to lack of clear segregation of various expense parameters, SERC's have followed divergent approach. While few of the SERCs have considered segregation of each expense parameter based on the nature of the expense, others have considered all expenses except power purchase and transmission expense as part of wheeling business.

### Allocation of Wheeling ARR

<sup>3</sup>The Commission has considered the gross energy sales (MU) approved for DISCOM for the year and has allocated the same to different voltage levels in the proportion of energy sales (MU) to these voltages to total sales in that year as submitted by the respective DISCOM

**Table 1 Approved Energy sales (MU)**

Particulars	FY 11-12
Above 66kv level	190
At 33/66 kv level	61.51
At 11kv level	872.37
At LT level	5809.07
Total	6932.95

The Commission has, thereafter, grossed up the energy sales (MU) at the specific voltage level with the respective distribution losses (%) at that level to arrive at the Energy Input (MU) for that level. Since the accurate baseline data for the voltage wise distribution losses is not available, the Commission has considered the estimates of the same after considering the submissions made by the DISCOMs, and approved distribution losses. The summary of the voltage wise distribution losses considered by the Commission is as follows.

**Table 2 Distribution loss %**

Particulars	FY 11-12
Above 66kv level	0.00
At 33/66 kv level	1.45
At 11kv level	4.95
At LT level	14.05

The voltage wise distribution losses considered above are estimates and may not reflect the actual picture. The summary of Energy Input (MU) for the respective voltage levels are shown below:

**Table 3 Approved Energy Unit (MU)**

Particulars	FY 11-12
Above 66kv level	190
At 33/66 kv level	62.42

<sup>3</sup> NDPL ARR for 2011-12

At 11kv level	917.81
At LT level	6758.84
Total	7929.06

Based on the voltage wise assets allocation, the Commission has allocated the Wheeling ARR to the assets at respective voltage levels, which is summarized below:

**Table 4 Wheeling cost allocation asset wise (Crs)**

Particulars	FY 11-12
Above 66kv level	0
At 33/66 kv level	94.65
At 11kv level	241.85
At LT level	117.26
Total	453.76

The Wheeling cost apportioned above to a particular assets category is thereby reallocated to different voltage levels in proportion of their contribution to the energy input at that level as shown below:

**Table 5 Wheeling cost allocated to different voltage (Crs)**

Particulars	FY 11-12
Above 66kv level	0
At 33/66 kv level	0.76
At 11kv level	40.14
At LT level	412.86
Total	453.76

Based on the energy sales at the respective voltage level the Commission has determined the Wheeling Charge per unit for different voltages for FY 2011-12.

**Table 6 Wheeling charge (Paise/kwh)**

Particulars	FY 11-12
Above 66kv level	0
At 33/66 kv level	12.41
At 11kv level	46.01
At LT level	71.07
Total	65.45

The Commission has allocated the Retail Supply ARR (excluding Supply Margin) and the Supply Margin approved in the ratio of energy input determined above for different voltage levels. The Commission has thereafter, determined the Retail Supply charge and Supply Margin charge for a particular voltage level by considering energy sales at that voltage level. The summary of the same is shown below.

**Table 7 Retail supply charge (Paise/kwh)**

<b>Particulars</b>	<b>FY 11-12</b>
Above 66kv level	405.93
At 33/66 kv level	411.91
At 11kv level	427.07
At LT level	472.3
Total	464.26

**Table 8 Supply margin charge (Paise/kwh)**

<b>Particulars</b>	<b>FY 11-12</b>
Above 66kv level	28.59
At 33/66 kv level	29.01
At 11kv level	30.08
At LT level	33.26
Total	32.69

The cost of supply determined by the Commission for the different voltage levels is shown below.

**Table 9 Cost of supply for NDPL (Paise/kwh)**

<b>Particulars</b>	<b>Wheeling</b>	<b>RST</b>	<b>SM</b>	<b>Total</b>
Above 66kv level	0	405.93	28.59	434.52
At 33/66 kv level	12.41	411.91	29.01	453.33
At 11kv level	46.01	427.07	30.08	503.16
At LT level	71.07	472.3	33.26	576.63
Total	65.45	464.26	32.69	562.4

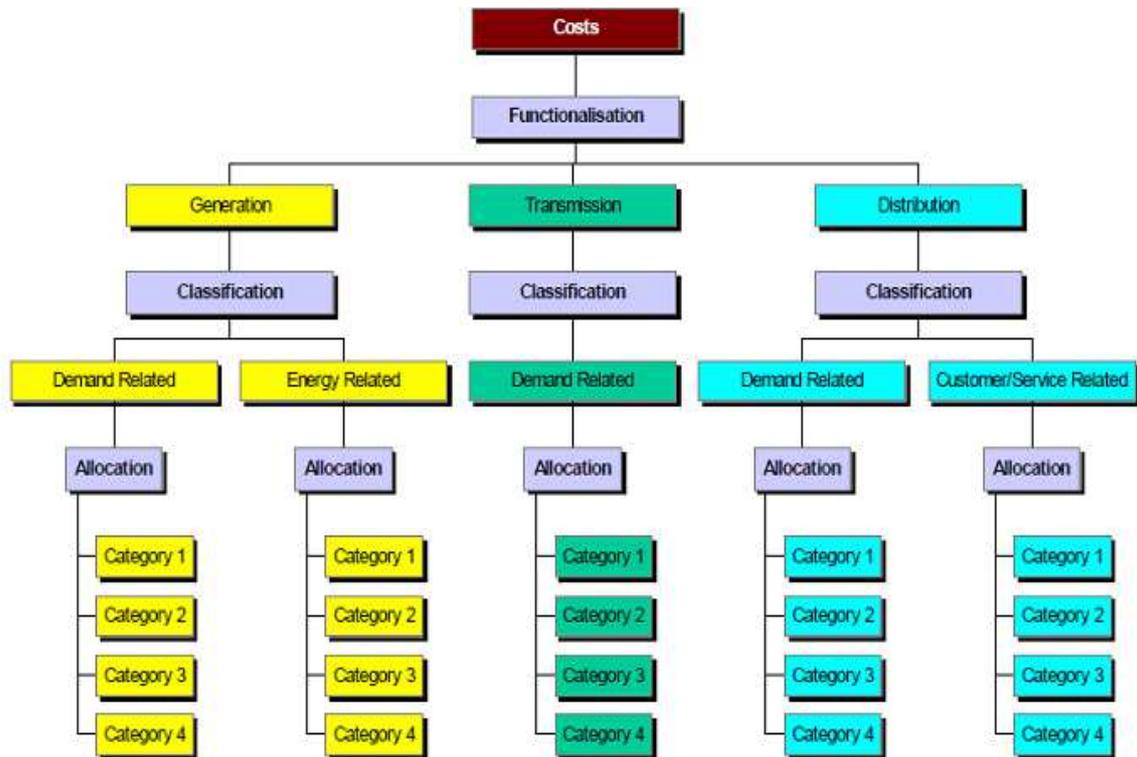
### 3.2.3. Category wise cost of supply:

<sup>4</sup>A basic principle that has been widely accepted in electricity sector regulation is that the tariffs for various categories of customers should be, as far as practicable, equal to the costs imposed by that category of customers on the system. This is what is currently understood as Cost of Service (CoS). The CoS enables identification of costs attributable to each consumer category and therefore the basis for tariff fixation. The model is based on the embedded cost approved by the Commission as the revenue requirement of the ensuing year that needs to be recovered by way of tariff adjustments.

With the focus now shifting to cost- reflective tariffs, it has now become necessary to compute the cost to serve to individual consumer categories and the gradual reduction of the cross subsidies existing between the consumer categories today. A basic principle that has been widely accepted in electricity sector regulation is that the tariffs for various categories of customers should be, as far as practicable, equal to the costs imposed by that category of customers on the system. Cost of service study seeks to allocate all the costs of a utility to each of the customer classes it serves. Such allocation reflects the costs attributable to electricity supplied and related services provided to categories. The amount of cross subsidy received/ contributed by various consumer categories is dependent on the way the cost of supply is defined. The determination of cost of service for each of customer categories requires disaggregating the utility's costs into functions, services and categories. Usually, the approach adopted by many SERC's and utilities is to consider the average cost of supply method to calculate the Cross Subsidy as the data required to calculate the cost of supply category wise and voltage wise is not available. A systematic approach to the CoS study shall involve three steps of functionalization, classification and allocation of costs to various customer categories. For ex The cost of service (CoS) for FY 2012-13 is computed through allocation of approved ARR for FY 2012-13 among different consumer categories based on the evening peak and the load and coincidence factors for each category of consumers. This cost differs for each consumer category on account of factors such as variations in contribution to peak, voltage of supply, load factor, contracted capacity etc

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<sup>4</sup> Technical paper on category-wise cost of service study, by Feedback Infra Energy Division



**Figure 2 cost of service**

This method calculates cost of supply in three steps

- a) Functionalization, which means separating the assets and expenditures into the functional areas generation, transmission and distribution.
- b) Classification, which for each functional area breaks out the assets and expenditures into three classes, demand, energy and customer related items.
- c) Allocation, which for each class breaks out the assets, expenditures, revenues and subsidies into customer categories to be served.

### **Functionalisation of Costs:**

<sup>5</sup>The first stage of a cost of service study shall involve functionalisation of all the costs of the TANGEDCO to various functions such as power generated, purchased and distribution (termed as “Functionalisation”). It is relatively easy to capture these costs from the books of accounts as the chart of accounts maintained by the company would provide for capture of these assets/ costs separately. Within the assets and costs it is however, difficult to capture the voltage class wise assets and costs as the accounts of company does not capture this information. But TANGEDCO has carried out the assessment of the fixed assets voltage wise and therefore a data will be collected on a sample basis based on the information available. This will enable TANGEDCO to bifurcate its assets and costs as relating to LT network and HT network. This logic has been largely used for functionalization of assets and costs for this exercise. The power purchase costs include the costs of transmission of power from the generating stations to the transmission-distribution interface point. Also, though TANGEDCO is carrying the generation and distribution function, the expenses related to State own Generating station such as Fuel is considered as variable charges in power purchase cost and the other cost has been added with the expenses of distribution. Also, the transmission cost has been considered in the fixed cost of power purchase for last 5 months of FY 2010-11 and an initial expense during the time of erstwhile TNEB has been considered in the respective head of account.

### **Classification of Costs:**

<sup>6</sup>The costs are classified as being demand, energy or customer/service related. Such a classification is done on the basis of the cause of such costs, as specified below:

- Costs which are triggered by peak demands imposed on the system are classified as “demand related”
- Cost related to level of power purchase as “energy related”
- Cost related to number and type of customers as “customer related”.

Classification of Generation and Power Purchase Costs

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<sup>5</sup> Technical paper on category-wise cost of service study, by Feedback Infra Energy Division

<sup>6</sup> Technical paper on category-wise cost of service study, by Feedback Infra Energy Division

The distribution system apart from serving the demand also provides various services to the customers such as metering, billing, break down repair etc. Hence, distribution costs need to be classified as partly demand related and partly customer related;

- Distribution related components like meters could be considered 100% consumer related;
- Distribution assets that are used by a single consumer (e.g., Service Lines) and cost associated with it could be classified as entirely consumer related;
- 100% Demand Related - classifies all other costs as entirely demand related on the rationale that distribution networks are set up to meet the local maximum demands;
- Partly Demand and Customer Related - attempts to work out appropriate ratios for each component of distribution costs for classification into demand related and customer related costs;

The distribution system apart from serving the demand also provides various services to the customers such as metering, billing, break down repair etc. Hence, other distribution costs need to be classified as partly demand related and partly customer related. The distribution costs such as repair and maintenance, employee cost & administrative and general expenses have been equally apportioned (50:50) into customer cost and demand related costs, as these vary with the number and the type of customer as well as with their demand. Rest of the distribution expenses are classified into demand related as they are only dependent on how much demand needs to be cater and not on number of consumers.

### **<sup>7</sup>Cost Classification and Functionalisation**

Cost of classification	Explanation
Demand	Triggered by fixed demand and peak in nature
Energy	Vary with volume of energy released
Customer	Depend on the number and type of customer served

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<sup>7</sup> Technical paper on category-wise cost of service study, by Feedback Infra Energy Division

Functions	Cost classification
Power Purchase	Demand Related Energy Related
Transmission	Demand Related
Distribution	Demand Related Customer related

Demand related costs will include a major portion of depreciation, interest on capital borrowings, income tax, RoR etc. Customer related costs generally include R&M expenses, Employee costs, A&G expenses, Bad debts, interest on consumer security deposits & other debits that are directly attributable to consumers. It is submitted that there are no set of prescribed rules for functionalisation and classification of costs. It depends on the experience and judgement of the utility to classify costs in the best manner possible.

### **Allocation of Costs:**

The functionalised and classified costs are then allocated to various customer classes of the utility based on allocation factors derived from demand, consumption of energy and number of customers such as Energy usage and a measure of demand (peak, average etc.), Load Pattern, etc. Such allocation arrives at the cost of service for each customer class.

The classified costs may be allocated on the basis on time differentiated allocation factors. The energy and demand related costs are split into several costing periods. The energy usage and a measure of demand (peak, average etc.) within such periods form the basis for allocation of costs.

### **Load profile of each category of consumers**

<sup>8</sup>Based on load curves, load duration and consumption of particular feeder, a profile of a particular consumer category is assessed.

### **Allocation of Demand Related Costs**

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<sup>8</sup> Technical paper on category-wise cost of service study, by Feedback Infra Energy Division

The choices for allocation criteria for demand related costs presents a number of options that may have significant impact on the cost allocation to various classes. The choice will depend upon data availability, characteristics and constraints associated with TANGEDCO and the objectives of the study. The following are the allocation criteria for demand related costs –

Range of Methods-

➤ **Co-incident Peak Contribution**

The category coincident demand or contribution to the system peak demand may be defined as the demand in MW for each category of customer that occurs at the time of the system's peak demand. The sum of all such demand for every customer category plus losses will be equal to the peak demand of the system.

➤ **Non-Coincident Peak**

The non - coincident demand may be defined as the demand in MW for each category of customer regardless of when it happens. This non-coincident demand will be greater than or equal to the category's contribution to the system's maximum demand. Thus, the sum of all such demand for every customer category will be greater than the peak demand of the system.

**Choice of Methods**

All energy related costs have been allocated on the basis of the class-wise energy consumption. All customers' related costs have been allocated on the basis of number of customers with category wise weights. The appropriate allocation criteria for demand related costs are as follows

**Demand related power purchase costs**

<sup>9</sup>The power purchase, serves the entire system and further investments are triggered by increase in the peak demand of the system as a whole. Hence, category co-incident peak demand is the appropriate criteria for allocation of such costs. However, in case the data with regards to the category co-incident peak are not available, the Average and Excess method as discussed earlier will be considered as a suitable alternative.

**Demand related other distribution costs**

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<sup>9</sup> Technical paper on category-wise cost of service study, by Feedback Infra Energy Division

The distribution network services local maximum demands and investments are triggered by the local (in other words, non co-incident) peaks in demand. Therefore, the category non co-incident peak demand for each class is the most appropriate basis for allocation of demand related other distribution costs.

### **Demand related Total Distribution costs**

Allocation factors for demand related total distribution costs will be worked out based on weightages of power purchase and other distribution costs.

### **Allocation of Energy Related Costs**

Energy related costs shall be allocated in the ratio of energy consumed by the customer classes. The energy consumed shall include sales to categories and allocated losses to such categories.

### **Allocation of Losses**

Though sales to each of the classes shall be easily available, but allocation of losses shall require considerable judgment. The allocation of technical losses is largely dependent upon the voltage at which a customer category is connected. However, before allocating technical losses, commercial losses shall be allocated to various categories. The technical losses shall then be allocated in the ratio of sales plus commercial losses for a category.

### **Determination of Technical & Commercial Losses**

The total transmission and distribution losses of TANGEDCO for FY 2010-11 were 20.91% including both technical and commercial losses. Distribution Losses (Total Losses -Transmission Losses) shall be broken up into technical and commercial losses. Technical Losses shall be further broken up into HT and LT level losses.

### **Allocation of Commercial Losses**

<sup>10</sup>Commercial losses are determined as the difference between total losses and technical losses. The commercial losses shall be allocated to the customer categories in ratio of sales. Thus, no

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<sup>10</sup> Technical paper on category-wise cost of service study, by Feedback Infra Energy Division

commercial losses shall be allocated to the energy transferred at lower voltage level as the consumers using such energy are not responsible for commercial losses at the higher voltage.

### **Allocation of Technical Losses**

Technical losses at HV and LV levels are allocated to the categories in ratio of sales to customer categories connected at that voltage and energy transferred to the immediate lower voltage level.

The above method for allocation of technical losses shall be done in two steps.

- Firstly, the losses shall be allocated to various voltages levels in the ratio of voltage level sales and transfer (to next category).
- Then, the losses allocated to various voltage levels shall be allocated to the respective categories in the ratio of category sales.

### **Allocation of Customer related Costs**

Customer related costs, primarily, include the costs of providing servicing other than supply of electricity, namely – metering, billing, collection, fault repair etc. These costs, though directly relate to the number of customers in a particular category, vary significantly with across categories. For instance, the per customer servicing costs for HT Industrial category will be much higher than that for a Residential category customer.

### **Category-wise Customer Weightages**

- a) To address the variance in per customer service costs across categories, category wise weight-ages shall be derived to determine allocation factors for customer related costs.
- b) The weight-ages shall be a function of two parameters - Sales per Customer and Load per Customer.
- c) The average of these two ratios for each category shall give the 'Category Wise Customer Weightage'.
- d) The minimum & maximum limit for such ratios will be set at 1 and 200 respectively. The average of these two ratios for each category gives the 'Category Wise Customer Weightage'.

## Chapter 4

### 4.1. Tariff Rationalization

Tariff rationalization is also known as “cost reflective tariff” and it means that tariff should be set in such a manner that it reflects the true cost of supply. It is one of the key features of reforms and restructuring. The extent of tariff rationalization carried out at the retail level has been captured in terms of calculating average realization for each consumer category as a % of average cost of supply while also capturing consumer category-wise tariff levels vis-à-vis average cost of supply in absolute terms. It has also been proven in economic theory that tariffs that reflect the cost of supply to the consumer category provide economic signals for the optimum use of electricity and investment in the sector. Further cost reflecting prices will be fair to consumers receiving the supply at higher voltages as the cost of supply at higher voltages is lower than the cost of supply at lower voltages, on account of higher distribution losses at lower voltages, and the incidence of costs getting passed on to the lower voltages since energy flows from higher to lower voltages.

One of the key objectives of setting up the SERCs is rationalization of tariffs. This is a critical Activity, as the tariff structure is marked by high levels of cross subsidies and no. of consumer Categories/ slabs. The Act and the NTP issued there under thrust upon reducing the subsidy with Tariff progressively reflecting the cost of supply of electricity. The NTP mandates the SERC to notify roadmap within six months with a target that latest by the end of year 2010-11 tariffs are within  $\pm 20$  % of the average cost of supply. Most of the SERCs have taken initiatives for reducing the cross subsidy and rationalizing the no. of consumer categories/ slabs while also creating new consumer categories, as and when required. However, a clear roadmap with milestones to bring down the cross subsidy levels to within  $\pm 20$  % of the average cost of supply has not been notified by any SERC.

Majority of the SERCs are currently considering the Average Cost of Supply for determination of tariff in each category in absence of voltage wise/ category wise information availability from the distribution licensees. However, a few of the SERCs like APERC and AERC have shifted to

category wise Cost of Supply and states like DERC have shifted to voltage wise cost of supply for each category of consumer<sup>11</sup>.

#### Methods to achieve Tariff rationalization

- 1) Two part tariff
- 2) Time of day tariff
- 3) Reliability charges

**Two part tariff:** This tariff structure separates capacity charge (usually fixed charge) which is priced at Rs/Kw with energy charge (usually variable charge) which is priced at Rs/Kwh. The total electricity bill is the sum of capacity charge multiplied by connected load plus energy charge multiplied by energy usage during a month.

#### The benefits of two part tariff

- 1) Two part tariff considered a balanced approach by regulators for recovery of cost.
- 2) Ensures protection of interest of licensee as well as that of consumers.
- 3) Encourage consumers not to over declare their loads.
- 4) Fixed cost component ensures minimum recovery of cost.
- 5) For consumers with high consumption, two part tariff helps in lowering average per unit cost.

Two part tariff brings rationalization of average tariff for all categories of consumer. With each additional purchase of unit of electricity the average tariff goes down whereas if the customer maintains a very low utilization factor the average tariff goes up and also protects the interest of the licensee by recovery of fixed cost.

#### **Time of day tariff:**

Time of Day (or TOD) tariff is a tariff structure in which different rates are applicable for use of electricity at different time of the day. It means that cost of using 1 unit of electricity will be

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<sup>11</sup> Final report on study on analysis of tariff orders & other orders of state electricity regulatory commissions

different in mornings, noon, evenings and nights. This means that using appliances during certain time of the day will be cheaper than using them during other times.

In India, Time of Day (TOD) tariff that was used mostly for industrial sector is now slowly being introduced for commercial sector as well. Recent news articles in some of the leading newspapers in India suggest that utilities are contemplating implementing time of day tariff for commercial customers (along with the industrial customers in State where it has not been introduced so far). Some states have already implemented it and others are planning. And as the demand for electricity is increasing every day, the day is not far when the residential customers might also see the same.

Time of Day tariff is implemented to reduce consumption of electricity during peak hours. To do this, electricity is made expensive during peak hours so that consumers use less of it. Utilities also reduce the electricity charges during off peak hours as an incentive for people to use electricity during the off peak hours. This in turn will also help to achieve tariff rationalization as the industry or commercial consumers consuming electricity during off peak hours will have to pay at lesser rate in comparison to during peak hours.

#### Benefits of time of day tariff

- 1) Flattening of Load curve i.e maintaining uniform load throughout the day.
- 2) Preventing the electricity grids from getting jammed during peak hours.
- 3) Consumers will be charged as per the cost of supply i.e high rate during peak hours and low rate during off peak hours thus helps in achieving tariff rationalization.
- 4) Time-of-Day rates provide a financial incentive to use less electricity during the peak hours.

#### **Reliability charges:**

Shortage of power in India is not a new problem which results in hours of load shedding making the life of consumers miserable. We have different categories of customers with load and energy requirement. Among them there are few consumers who like to enjoy uninterrupted and zero

load shedding. At times these shortages have to met by buying power at higher than the normal rates. In this occasion consumers who are willing to pay higher rates will be provided uninterrupted power. This higher rate is nothing but Reliability charges. Additional reliability surcharge per unit over and above the existing tariffs for consumers seeking 24X7 power is levied by regulatory commission. This charge also helps in achieving tariff rationalization which ensures tariff is cost reflective.

#### 4.2. Cross subsidy:

Cross subsidy means that when one category consumers pays for other category of consumers. Here the one who pays for other consumers are the paying consumers/ financially sound generally industrial and commercial consumers and the one for whom it is being paid are the weaker sections of the society generally agricultural and part of domestic consumers called inter category cross subsidy. The amount of cross subsidy depends on the cost of supply for a particular category of consumers.

Within a domestic category there are different slabs based on the units consumed and each slabs have different charges. For ex. Domestic consumer who is consuming above 400 units is cross subsidizing the one who is consuming 0-200 units.

Domestic Tariff		
Upto 2KW connected load	Fixed charge	Energy charge
0-200 units	40 Rs/month	370 paise/kwh
201-400 units	40 Rs/month	480 paise/kwh
above 400 units	40 Rs/month	640 paise/kwh

This process is followed from long back and is still continued. Even though Electricity Act 2003 talks about gradual reduction in cross subsidy and for which a road map has to be prepared by regulatory commission, there is no step taken by commission in doing so.

#### Impacts of Cross-subsidy

- a) Higher cost of electricity for industrial consumer reduces industrial growth in the country and also makes them less competitive in the global market.
- b) Manufacturing cost increases which leads to higher product cost.

- c) High levels of cross subsidy creates problem in implementing open access.
- d) Inefficient and unproductive use of scarce electricity and also sends a wrong signal to consumers who pay less.
- e) Undermines the operation of utility in the long run because the cross-subsidizing and revenue yielding categories leave the utility's system and switch to self generation.
- f) It is a constraint towards development of competitive market.

### 4.3. Regulatory asset

It is a mechanism to carry forward the revenue requirement for a particular year and which does not add to the tariff design for that particular year. Suppose the approved ARR for the subsequent year is Rs X and the revenue from the existing tariff is Rs Y, the difference between Rs X and Rs Y is the revenue gap which is tried to fill by tariff revision, government subsidy and efficiency improvement. Even if by doing all these the gap does not cover, that is treated as regulatory asset.

It is the conventional practice followed by regulators to avoid any appreciable tariff increase has been to defer part of revenue requirements by parking them as "regulatory assets", which need to be recovered in future. However, there is no rationale behind a consumer paying for electricity charges in future for the electricity consumed by someone else in the past.

#### **Other Alternative proposal to recover Regulatory asset**

**Sell/lease of unused assets:** The Honorable Commission may allow the Petitioner to sell/lease its unused assets such as the land in Tripulia for commercial or domestic purposes. The revenue generated from such source may be utilized against recovery of the accumulated Regulatory asset.

**Fuel surcharge adjustment:** This mechanism should be introduced on quarterly and half yearly basis in retail supply tariff to pass through any variation in power purchase cost.

#### **Reasons to create regulatory asset**

- 1) Primary reason behind creation is to prevent the consumer from tariff shock.
- 2) Distribution is not able to reduce their losses, their performance is not improving over the years which force the commission to create Regulatory asset.
- 3) Also when such situation generally arises when the projected revenues are significantly lower than the revenue requirement and it is not feasible to recover to recover the entire amount either through increase in tariff or through government subsidy during that year.

### **Guidelines for Regulatory asset as stipulated in 8.2.2 of National tariff policy**

The facility of a regulatory asset has been adopted by some Regulatory Commissions in the past to limit tariff impact in a particular year. This should be done only as exception, and subject to the following guidelines:

- a) The circumstances should be clearly defined through regulations, and should only include natural causes or force majeure conditions. Under business as usual conditions, the opening balances of uncovered gap must be covered through transition financing arrangement or capital restructuring;
- b) Carrying cost of Regulatory Asset should be allowed to the utilities.
- c) Recovery of Regulatory Asset should be time-bound and within a period not exceeding three years at the most and preferably within control period.
- d) The use of the facility of Regulatory Asset should not be repetitive.
- e) In cases where regulatory asset is proposed to be adopted, it should be ensured that the return on equity should not become unreasonably low in any year so that the capability of the licensee to borrow is not adversely affected.

## Chapter 5

### 5.1. Andhra Pradesh:

#### 5.1.1. Background:

The Andhra Pradesh State Electricity Board (APSEB) was formed on 01 April 1959. Until its unbundling in February 1999, APSEB was responsible for electricity generation, transmission, distribution and supply in the state. It functioned under the overall guidance of the state government, interacting with the central power agencies for planning and coordination. APSEB enjoyed a good reputation amongst the other utilities in India – some of the features continue even now. For example, the Plant Load Factor (PLF) of State owned generating stations in AP was 83.2% in 2000, much higher than the national average of 67% or the NTPC figure of 80.4%. Though APSEB's performance on generation side was far better compared to other SEBs, performance on distribution and financial aspects proved to be very poor. By the late nineties the state was facing both energy and peak shortages and the quality of power supply had deteriorated. Other aspects of good performance include fast erection of power stations, and low employee/consumer ratio. The gap between average cost of supply (ACS) and average revenue realized (ARR) grew from 4.2 paise/kwh in 1990-91 to 138.8 paise/kwh in 1999-2000. Despite the significant physical growth, APSEB was finding it increasingly difficult to meet the demand of the State for adequate and reliable supply of electricity due to substantial increase in agricultural and domestic consumption in the state. High transmission & distribution losses, increasing inefficiency in metering & collection, very low tariff to agricultural consumers and high cost of power from private generators are some of the factors that have contributed to the deterioration of financial health. One third of the Board's income was going to meet interest payments increasing burden of interest payments. One of the major impacts of this worsening financial situation was APSEB's inability to raise finances for the required investments in generation and T&D. Increasing financial problems of APSEB was as one of the reasons beckoning to restructuring the power sector in the state on the lines prescribed by the World Bank as it came forward to inject funds in to the sector on its terms and conditions.

### 5.1.2. Reform:

In the background of the deteriorating situation on the power front and the new initiatives by the Government of India to attract private investment, the then State Government of Andhra Pradesh contemplated to restructure the power sector. Reforms in power sector were brought about in multiple steps. State government of Andhra Pradesh constituted a high level committee under the chairmanship of Hiten Bhaya, a former chairman of the Central Electricity Authority, to suggest reforms to be introduced in the power sector. Few of the suggestion are to fix a tariff structure which covers production costs, to run the companies on commercial lines. The Committee did not recommend outright privatization of public utilities and cautioned that substitution of private monopoly in the place of public monopoly would only make the situation worse. The Committee felt that privatization initiative should start initially with management contracts in the distribution business. The Government of Andhra Pradesh (GoAP) approached the World Bank for a structural adjustment loan to tide over the fiscal crisis. Bank suggested comprehensive reforms in the power sector going beyond the recommendations of the Hiten Bhayya Committee. Some important components of the reforms proposed by the World Bank are:

- 1) Corporatizing the power utilities and ensuring that they operate without Governments' interference,
- 2) Increasing the tariff rate to agriculture to at least 50 paise/kWh in the near term and continuing to adjust tariffs to cover costs and reduce cross subsidies,
- 3) Defining a structure for the sector consistent with privatization of distribution and private sector development in generation.

Within six months of the World Bank recommendations, on 14th June 1997, The GoAP released a power sector policy statement indicating proposed policy and structural changes in the power sector. The APSEB was unbundled into APGENCO and APTRANSCO in February 1999. The Electricity Reform Act provided for the constitution of Andhra Pradesh Electricity Regulatory Commission (APEREC). In April 2000, the APTRANSCO was further unbundled into a transmission company and four distributions companies (DISCOMs) managing distribution in four zones of the State, Central, Eastern, Northern and Southern.

Andhra Pradesh started power sector reforms much earlier than most of other states in the country. However, pace of reforms in AP slowed down by year 2004. The signs of slowdown in reforms were visible in suspension of the World Bank loan after stage-I itself and no attempt to privatize distribution. The reasons identified for this slowdown were opposition to the reform agenda, failure of the World Bank led reform process in Orissa and the national level rethinking on the World Bank led reforms. In May 2004, the Congress government came to power in AP by replacing Chandrababu Naidu's TDP. It announced free power to agriculture and promised to review the reforms including power purchase agreements (PPAs) with private generators.

### 5.1.3. Current Status:<sup>12</sup>

**Table 10 Installed Capacity (as on 31/01/2013)**

Central	State	Private	Total
3097 MW	9048 MW	4671 MW	16817 MW

Actual power supply position in 2012-13<sup>13</sup>

Peak deficit(-)/surplus(+)	Energy deficit(-)/surplus(+)
-17.6%	-20.2%

Anticipated power supply position during 13-14

Peak deficit(-)/surplus(+)	Energy deficit(-)/surplus(+)
-12.4%	-9.1%

Peak deficit and energy deficit is expected to come down in year 2013-14 in comparison to previous year. APERC had introduced MYT Framework in Andhra Pradesh from FY 07 onwards with a control period of three years

<sup>12</sup> [http://www.cea.nic.in/installed\\_capacity.html](http://www.cea.nic.in/installed_capacity.html)

<sup>13</sup> Load Generation Balance Report 2013-14, www.cea.nic.in

#### 5.1.4. Data collection and analysis:

**Table 11 Average Tariff (paise/kwh)<sup>14</sup>**

Category	2007-08	2008-09	2009-10	2010-11	2011-12
Domestic	242.29	240.23	261.47	282.03	282.56
Commercial	586.59	575.88	596.77	615.58	616.33
Agricultural	8.17	8.61	9.16	18.7	32.1
Industrial	365.45	373.98	397.81	406.65	418.02

**Table 12 % Growth rate of tariff of different categories over the years**

Category	2007-12
Domestic	4.285085
Commercial	3.561069
Agricultural	2.083333
Industrial	3.897363

**Table 13 category wise cost of supply (paise/kwh)<sup>15</sup>**

Category	2007-08	2008-09	2009-10	2010-11	2011-12
Domestic	353	367	436	440	467
Commercial	365	389	450	455	482
Agricultural	186	218	245	275	293
Industrial	250	256	294	287	333

**Table 14 Gap (paise/kwh)**

Category	2007-08	2008-09	2009-10	2010-11	2011-12
Domestic	-110.71	-126.77	-174.53	-157.97	-184.44
Commercial	221.59	186.88	146.77	160.58	134.33
Agricultural	-177.83	-209.39	-235.84	-256.3	-260.9
Industrial	115.45	117.98	103.81	119.65	85.02

**Table 15 Tariff realization as % category wise of cost of supply**

Category	2007-08	2008-09	2009-10	2010-11	2011-12
Domestic	68.64	65.46	59.97	64.10	60.51
Commercial	160.71	148.04	132.62	135.29	127.87
Agricultural	4.39	3.95	3.74	6.80	10.96
Industrial	146.18	146.09	135.31	141.69	125.53

<sup>14</sup> Annual report 2011-12 on the working of the state power utilities and electricity department, Ministry of power

<sup>15</sup> [www.aperc.gov.in/tariff](http://www.aperc.gov.in/tariff) order

**Table 16 Energy consumption category wise (MU)<sup>16</sup>**

Category	2007-08	2008-09	2009-10
Domestic	10679.46	11675.78	13218.55
Commercial	2735.18	3884.06	4278.872
Agricultural	15243.42	16603.06	18822.26
Industrial	15386.35	17514.46	18404.53
Total	44044.41	49677.36	54724.21

**Table 17 Revenue (in Crs)**

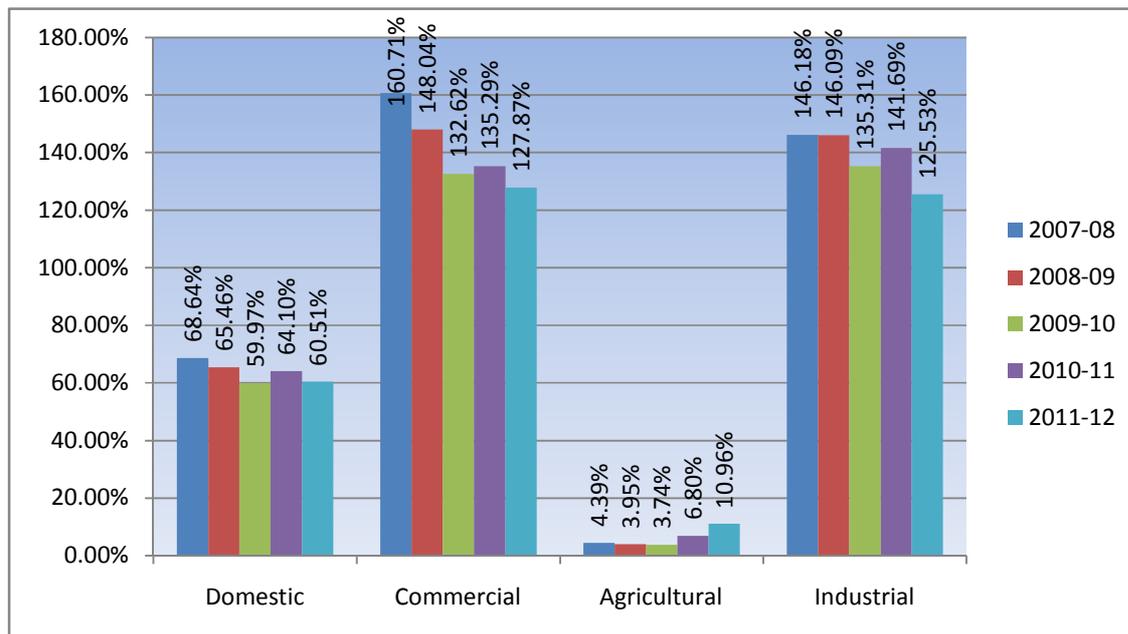
Category	2007-08	2008-09	2009-10
Domestic	2587.526	2804.873	3456.254
Commercial	1604.429	2236.752	2553.502
Agricultural	124.5387	142.9523	172.4119
Industrial	5622.942	6550.058	7321.504
Total	9939.436	11734.64	13503.67

Looking at the Tariff realization as % of cost of supply we can say that AP is moving towards tariff rationalization. In year 2011-12 **commercial and industrial** tariff is near to +20% which shows that they have willingness to reduce cross subsidy. One reason behind, tariff for industrial and commercial category being high is that their consumption coincides with the peak demand which results in higher demand charge. The gap between Cost and tariff is progressively reducing for commercial and industrial consumers. **Agricultural and domestic** category realization is almost constant over the year and are being cross-subsidized by commercial and industrial consumers apart from these they are also receiving subsidy from government. Agriculture consumers they are being provided restricted supply i.e only for few hours a day and during off-peak hours, so their contribution to both fixed and energy charge is less compared to other categories.

Growth in tariff for all the consumers over the years is between 2-4%. Except for domestic and commercial in year 2008-09 average tariff has been increasing and following cost of supply. From 2000-01 APERC is continuously filing tariff order without any gap.

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<sup>16</sup> <http://www.indiastat.com/power/26/stats.aspx>



**Figure 3 Chart for Tariff realization as % category wise cost of supply**

Following analysis is done considering average tariff and average cost of supply to find out the difference between two approaches of cost of supply: average cost of supply and category wise cost of supply

<sup>17</sup>**Table 18 Average Cost of supply**

2007-08	2008-09	2009-10	2010-11	2011-12
269.25	277.5	335	344.75	372.5

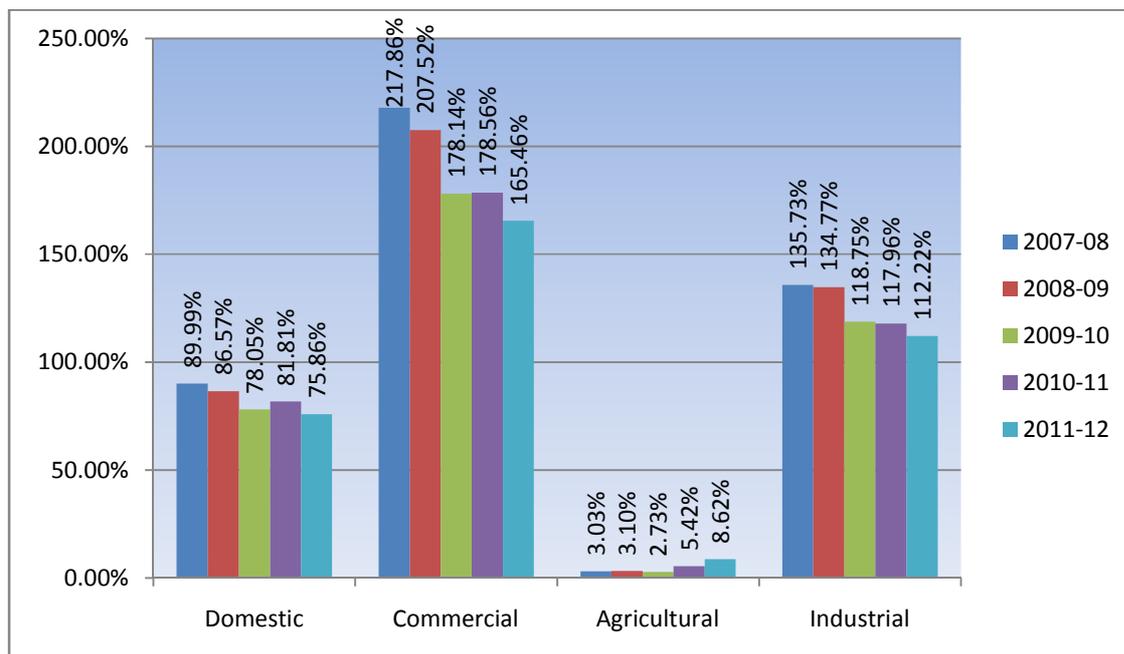
**Table 19 Gap (Paise/kwh)**

Category	2007-08	2008-09	2009-10	2010-11	2011-12
Domestic	-26.96	-37.27	-73.53	-62.72	-89.94
Commercial	317.34	298.38	261.77	270.83	243.83
Agricultural	-261.08	-268.89	-325.84	-326.05	-340.4
Industrial	96.2	96.48	62.81	61.9	45.52

**Table 20 % consumption of domestic and agricultural category**

category	2007-08	2008-09	2009-10	2010-11	2011-12
Domestic	89.99	86.57	78.05	81.81	75.86
Commercial	217.86	207.52	178.14	178.56	165.46
Agricultural	3.03	3.10	2.73	5.42	8.62
Industrial	135.73	134.77	118.75	117.96	112.22

<sup>17</sup> Annual report 2011-12 on the working of the state power utilities and electricity department, Ministry of power



**Figure 4 Chart for Tariff realization as % of average cost of supply**

While looking at the table of tariff realization as % of cost of supply calculated using both average cost of supply and category wise cost of supply we found the difference in domestic category. Category wise cost of supply shows that tariff realization is less for **domestic** while average cost of supply shows the inflated picture, it says that domestic category is paying at least 80% of the average cost of supply and agriculture category is only which is being highly cross-subsidized. I'm just trying to concentrate on the advantage of using category wise cost of supply which is, it gives the better picture than average cost of supply. While **commercial** category still shows that we are nowhere near to +-20% while calculating through average cost of supply as against category wise, it is because average cost of supply does not consider the actual cost that is being imposed by the particular category on the system.

In case of **agricultural** category we can see that the gap is continuously increasing year on year because of the state government's decision to give free power to the agricultural sector. The concept of free power was introduced with the idea to equalise power subsidy to farmers who draw water from borewells to those who use free canal water under irrigation schemes. After free power was introduced, it was made mandatory for a budgeted fund to be allocated so that any fluctuations will be taken care of by the budget. However, many years down the line, corruption is

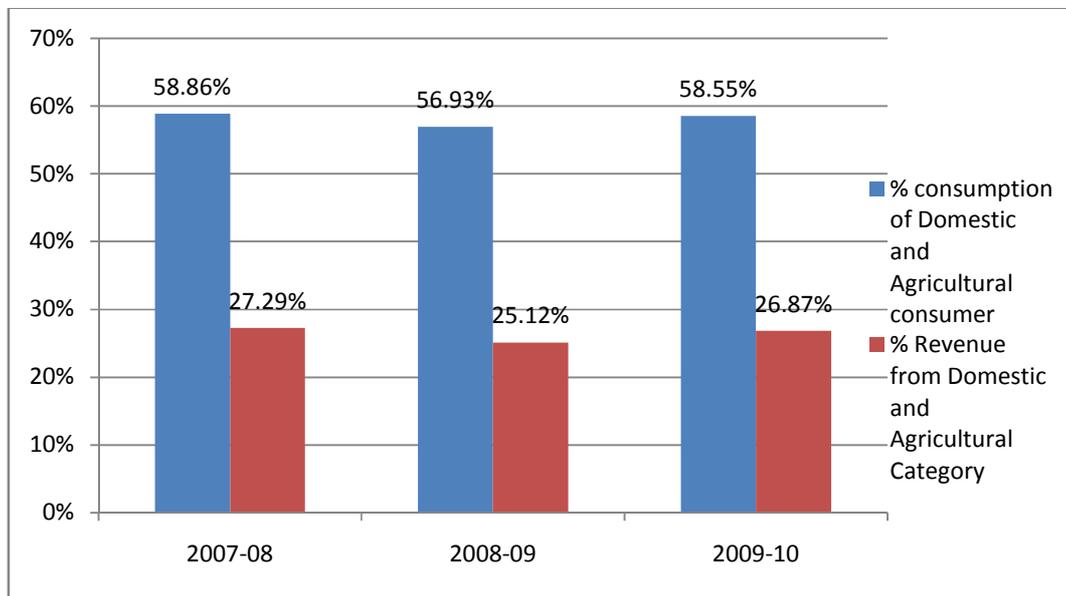
growing and power is being illegally sold, showing a deficit. Utilities are saving money by giving less than five hours of power to the agricultural sector in the state.

**Table 21 % consumption of domestic and agricultural category**

2007-08	2008-09	2009-10
58.86	56.93	58.55

**Table 22 % revenue from domestic and agriculture category**

2007-08	2008-09	2009-10
27.29	25.12	26.87



**Figure 5 Consumption and revenue of domestic and agricultural**

This chart is prepared considering only four categories and is a gross figure. From the graph it can be seen that Domestic and agricultural consumer are consuming more than 50% of energy sales and are contributing to revenue only 25% to 30%.

**Table 23 Profit and loss statement (with Subsidy)<sup>18</sup>**

Particulars	2005-06	2006-07	2007-08	2008-09	2009-10	Total
Revenue (Crs)	11997	13622	16614	22808	24213	89253
Expenditure (Crs)	11813	13712	16557	22656	24178	88917
Profit/Loss (Crs)	184	-90	57	152	35	336

<sup>18</sup> Shunglu commiteereport

It shows that reforms have really helped the state as the consolidated profit as on 31<sup>st</sup> march 2010 is positive in comparison to state like Punjab and Tamil Nadu.

## 5.2. Gujarat

### 5.2.1. Background:

Gujarat Electricity Board (GEB) was established along with the formation of Gujarat State in the year 1960 under Section 5 of the Electricity (Supply) Act 1948. Commencing with generation capacity of 315 MW and a consumer base of 1.40 million consumers, GEB. During 1970s and 80s, the major thrust was on the supply of electricity in the rural areas. It was largely due to GEB's unwavering focus on rural electrification that Gujarat became the first state to achieve the landmark of '100% Electrification of Villages'. Over time, the emphasis of GEB on electrification particularly in the rural areas, new connections and maintenance activities resulted in divergence from concentrating on profitability. Recovery of revenue was then considered as a secondary function. As a result, GEB faced minimum growth of revenue, rising arrears and heavy financial losses. The loss incurred by GEB on this account was estimated at Rs. 14 billion during 1999-00. Transmission and distribution, or T&D, losses were a substantial 35.27 per cent, and load shedding was frequent. GSEB had no funds to add generation capacity on its own, nor was it able to persuade the private sector to invest. The Government of Gujarat (GoG) initiated an ambitious policy of inviting private sector participation (PSP) in the power sector. But the desired PSP did not materialize because the revenues generated by the sector were insufficient to service the large inflow of capital that was required. Due to the drain on its resources caused by supporting an inefficient power sector, the GoG was not able to increase spending on other important areas of infrastructure as well as for social services. There were many other problems like Lack of efficiency in generation of electricity and Political interference in internal functioning of the board.<sup>19</sup>

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<sup>19</sup> <http://www.idfc.com/pdf/publications/Gujarat-Distribution-Reforms-Draft-Report.pdf>

### 5.2.2. Reforms:

In view of the above, GoG decided to reform the power sector in the state with a two-fold objective:

- I. Addressing the concerns of the investors
- II. Creating a business environment conducive to improving the sector's operational efficiency, financial viability, and service to consumers

GoG proposed to achieve its above mentioned objectives through a number of reforms. Some of the important measures which GoG decided to take in order to achieve the targets were:

- I. Greater competition at all levels of the sector wherever practicable
- II. Corporatization and commercialization of existing sector entities
- III. Private sector participation in the generation and distribution segments
- IV. Tariffs enabling cost recovery as well as reasonable profits
- V. An independent regulator
- VI. Transparent, reasonable, direct, and quantified subsidies to vulnerable sections of consumers.

First step towards reform was creation of the Gujarat Electricity Regulatory Commission on 12th November, 1998 under provisions of Electricity Regulatory Commissions Act, 1998. The vertically integrated GEB was unbundled into seven companies one each for generation and transmission, four distribution companies (Discoms) and a holding company known as Gujarat Urja Vikas Nigam Limited (GUVNL). The generation, transmission and distribution companies have been structured as subsidiaries of GUVNL. GUVNL acted as the planning and coordinating agency in the sector when reforms were undertaken. It is now the single bulk buyer in the state as well as the bulk supplier to distribution companies. It also carries out the function of power trading in the state. All companies became fully operational from April 2005 and began conducting their activities independently.

### 5.2.3. Current status:

Power is one of the basic infrastructures necessary for the Industries and socio economic development in the State. Per capita consumption of power in the State of Gujarat in 2009-10 was 1491 Units (as per CEA revised formula).

**Table 24 Installed capacity (as on 31/01/13)**

Central	State	Private	Total
3391 MW	6035 MW	14459 MW	23887 MW

Actual power supply position in 2012-13

Peak deficit(-)/surplus(+)	Energy deficit(-)/surplus(+)
-0.3%	-0.2%

Anticipated power supply position in the country during 13-14

Peak deficit(-)/surplus(+)	Energy deficit(-)/surplus(+)
-0.2%	+6.1%

In year 2013-14 Gujarat is expected to become energy surplus state and peak deficit is also expected to go down. GERC introduced MYT tariffs from FY 09 onwards with control period for three years. In year 2011 GERC came up with five year MYT from 2011-12 to 2015-16

### 5.2.4. Data collection and analysis:

**Table 25 Average Tariff (Paise/kwh)<sup>20</sup>**

Category	2007-08	2008-09	2009-10	2010-11	2011-12
Domestic	305.31	379.45	374.23	372.35	372.9
Commercial	487.82	563.91	562.58	564.8	572.42
Agricultural	119.52	197.49	176.92	176.45	176.07
Industrial	458	537.72	527.47	527.47	531.84

<sup>20</sup> Annual report 2011-12 on the working of the state power utilities and electricity department, Ministry of power

**Table 26 % Growth rate in tariff of different categories over the years**

Category	2007-12
Domestic	5.638296
Commercial	4.276468
Agricultural	13.5848
Industrial	4.0821

**Table 27 Average cost of supply (paise/kwh)<sup>21</sup>**

2007-08	2008-09	2009-10	2010-11	2011-12
391.71	464.25	441.21	425.46	427.47

**Table 28 Gap (paise/kwh)**

Category	2007-08	2008-09	2009-10	2010-11	2011-12
Domestic	-86.4	-84.8	-66.98	-53.11	-54.57
Commercial	96.11	99.66	121.37	139.34	144.95
Agricultural	-272.19	-266.76	-264.29	-249.01	-251.4
Industrial	66.29	73.47	86.26	102.01	104.37

**Table 29 Tariff realization as % of cost of supply**

Category	2007-08	2008-09	2009-10	2010-11	2011-12
Domestic	77.94	81.73	84.82	87.52	87.23
Commercial	124.54	121.47	127.51	132.75	133.91
Agricultural	30.51	42.54	40.10	41.47	41.19
Industrial	116.92	115.83	119.55	123.98	124.42

**Table 30 Energy Consumption category wise (MU)<sup>22</sup>**

Category	2007-08	2008-09	2009-10
Domestic	7564.41	7809.94	8341.19
Commercial	3534.48	3571.7	3919.94
Agricultural	10948.49	11731	12811.18
Industrial	20238.11	20892.4	22555.78
Total	42285.49	44005.04	47628.09

**Table 31 Revenue (in Crs)**

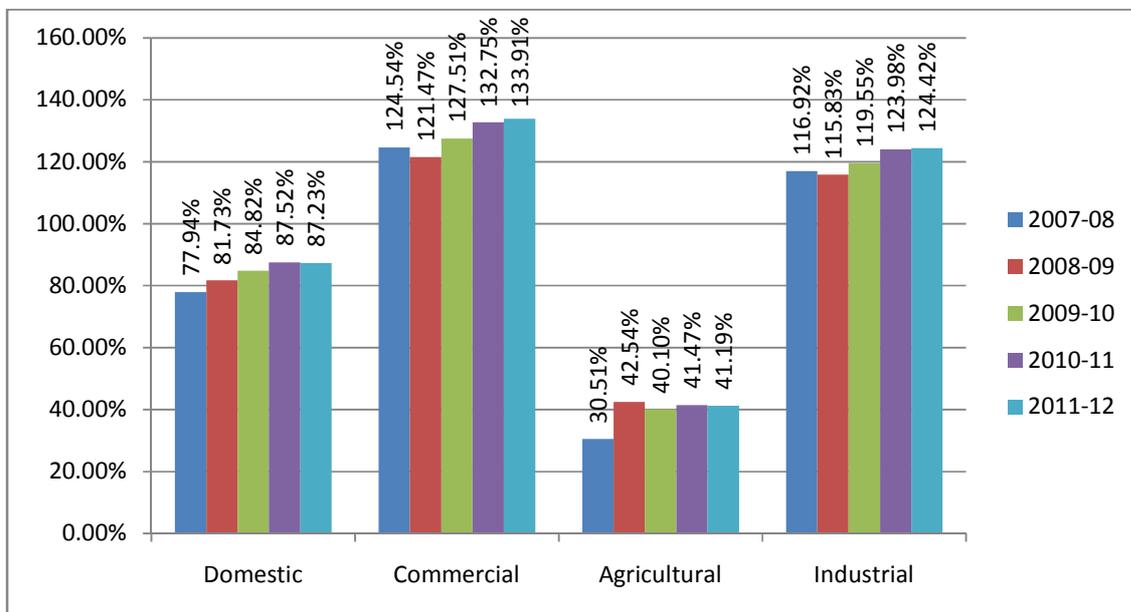
Category	2007-08	2008-09	2009-10
Domestic	2309.49	2963.482	3121.524
Commercial	1724.19	2014.117	2205.28
Agricultural	1308.564	2316.755	2266.554
Industrial	9269.054	11234.26	11897.5
Total	14611.3	18528.62	19490.85

<sup>21</sup> Annual report 2011-12 on the working of the state power utilities and electricity department, Ministry of power

<sup>22</sup> Annual report 2011-12 on the working of the state power utilities and electricity department, Ministry of power

Tariff has increased from 2007-08 to 2008-09 for entire category and after that remained constant till 2011-12 with slight variation. The increase in tariff is mainly due to the increase in average cost of supply from the year 2007-08 to 2008-09. In year 2009-10 fall in the cost of supply can be observed in comparison to previous year and after that remained constant because the gap between requirement and availability of power supply went down on account of capacity addition. From the tariff realization as % of cost of supply table we can say that realization is almost the same over the year for the entire category of consumers. Cost of supply and tariff are varying in same proportion. +20% formula is being followed by Gujarat for domestic and industrial consumer while slight variation is observed in commercial category from 2009-10 onwards. Agriculture category is still being cross subsidized and also receiving subsidy from government. Among all the four category growth rate of tariff over the years is highest for agricultural category i.e. 13% and rest all of them have in the range of 4-6%. From year 2006 onwards discoms are continuously filing tariff revision petition before GERC which was not there before the reform. After 2003 discoms filled the petition in 2006.

**Figure 6 Tariff realization as % of average cost of supply**



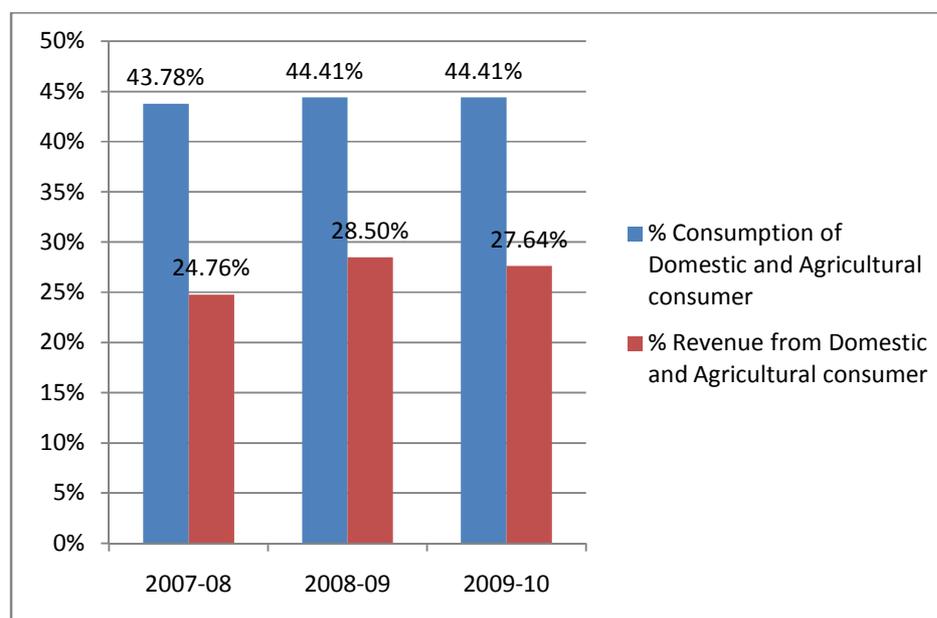
**Table 32 % Consumption of Domestic and Agricultural consumer**

2007-08	2008-09	2009-10
43.78%	44.41%	44.41%

**Table 33 % revenue from domestic and agriculture category**

2007-08	2008-09	2009-10
24.76%	28.50%	27.64%

**Figure 7 consumption and revenue of domestic and agricultural**



The chart shows that domestic and agricultural category are consuming electricity around 44% and are paying in the range of 24-28% of the total revenue.

**Table 34 Profit and Loss statement (after subsidy) (in Rs crs)<sup>23</sup>**

Particulars	2005-06	2006-07	2007-08	2008-09	2009-10	Total
Revenue	10218	12237	13648	16691	17564	70358
Expenditure	10161	12146	13609	16659	17469	70044
Profit/Loss	57	91	39	32	95	314

It can be seen that Gujarat is continuously making profit from year to year and is also following tariff rationalization for entire category except agriculture. This shows that reform has the positive impact on Gujarat which also takes this state to the category of power surplus with total installed capacity of over 23,000 mw. The loss incurred by GEB was estimated at Rs. 14 billion

<sup>23</sup> Shunglu Committee report

during 1999-00. Though GEB started certain initiatives in 2000 but the conditions did not improve much by the year 2004-05. FY 2007-08 and FY 2008-09 are the years when profit is less in comparison to other years it is because the % tariff realization as cost of supply is less in these years only.

### **5.3. Punjab:**

#### **5.3.1. Background:**

More than 85 percent of the public sector investment in Punjab is in the power sector, i.e., the Punjab State Electricity Board (PSEB), which had been running into huge losses over the years due to mismanagement, over-staffing, heavy transmission and distribution losses, unviable electricity tariffs and free power to the agricultural sector, severe power crisis. The CAG (2010) has observed that to meet the chronic power shortage in Punjab, the PSEB resorted to unplanned purchase of power at exorbitant rates resulting in avoidable extra expenditure of Rs.43229.8 million during 2005-10. If the Board had planned well and augmented the power supply in the State in response to demand or resorted to long term power purchase arrangements at a lower cost, huge amount of resources could have been saved. The GOP signed a Memorandum of Understanding (MOU) in March 2001 with the Union Ministry of Power for implementation of power sector reforms with identified milestones like reduction of transmission and distribution losses, 100 percent metering of consumers in the State, monitoring of MOU on quarterly basis, etc. Most of the milestones have not been achieved even after a decade of entering into this agreement.<sup>24</sup>

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<sup>24</sup> [http://www.global.ucsb.edu/punjab/journal/v19\\_1/3-UpinderSawhney19\\_1.pdf](http://www.global.ucsb.edu/punjab/journal/v19_1/3-UpinderSawhney19_1.pdf)

### 5.3.2. Reform:

The GOP set out to carry on the power sector reforms and formed the Punjab State Electricity Regulatory Commission (PSERC) in March 1999 under section 17 of the Electricity Regulatory Commissions Act, 1998 with the objective of rationalization of electricity tariff, advising in matters relating to electricity generation, transmission and distribution in the State. Thereafter the Electricity Act, 2003 was enacted under which the state electricity boards were supposed to bring about massive restructuring of the power sector in order to make them economically viable entities in all the states, as the state electricity boards continued to be in huge losses and were the cause of fiscal deficits in almost all the states. The GOP should have unbundled PSEB after carefully creating awareness amongst all the stakeholders regarding its impact and boldly implementing it by putting all the institutions in place at the earliest; which included the withdrawal of electricity subsidy to certain classes of consumers in the State. Instead it chose the path of procrastination and kept on postponing the inevitable in order to retain the populist policy of free power to farmers as well as relenting under trade union pressure. It sought 13 extensions from the Union government on one pretext or the other. Thereafter in April 2010, the Punjab Cabinet decided to corporatise PSEB by creating two separate companies - Punjab State Transmission Corporation Limited (TRANSCO) to look after the transmission and Punjab State Power Corporation Ltd. (POWERCOM) to manage generation and distribution of power in the State. However both the companies are fully owned and managed by the government and also the staff and their service conditions continue to be the same as PSEB, only they are nominally allocated to the two new organizations. Tariff continues to be determined by the PSERC as in the past and all the subsidies to different sections of the consumers, including the farmers continue as before. So far it seems that this structural change in the power sector has been brought about merely to fulfill the obligation laid out in the Electricity Act, 2003 and has not resulted in any radical power sector reforms and the State continues to face severe power shortage and the two new organizations are also suffering huge losses.

### 5.3.3. Current status:

**Table 35 Installed Capacity (as on 31/01/13)**

State	Central	Private	Total
5129 MW	1876 MW	497 MW	7503 MW

Actual power supply position in 2012-13

Peak deficit(-)/surplus(+)	Energy deficit(-)/surplus(+)
-24%	-5.3%

Anticipated power supply position in the country during 13-14

Peak deficit(-)/surplus(+)	Energy deficit(-)/surplus(+)
-25.6%	-19.7%

Both energy and peak deficit is expected to increase in year 2013-14, but the percentage increase of energy deficit is more than peak deficit. PSERC has not shifted to MYT framework.

### 5.3.4. Data collection and analysis:

**Table 36 Average Tariff (paise/kwh)<sup>25</sup>**

Category	2007-08	2008-09	2009-10	2010-11	2011-12
Domestic	250.88	262.62	290.02	319.04	377.21
Commercial	426.25	449.65	487.2	501.46	519
Agricultural	1.8	0	0	65.36	320
Industrial	364.05	386.42	425.14	430.77	454.72

**Table 37 % Growth rate of tariff of different categories over the years**

Category	2007-12
Domestic	10.83797
Commercial	5.066348
Agricultural	72.39902
Industrial	5.762257

<sup>25</sup> Annual report 2011-12 on the working of the state power utilities and electricity department, Ministry of power

**Table 38 Cost of supply (paise/kwh)<sup>26</sup>**

2007-08	2008-09	2009-10	2010-11	2011-12
343.99	364.45	402.76	427.29	464.93

**Table 39 Gap (paise/kwh)**

Category	2007-08	2008-09	2009-10	2010-11	2011-12
Domestic	-93.11	-101.83	-112.74	-108.25	-87.72
Commercial	82.26	85.2	84.44	74.17	54.07
Agricultural	-342.19	-364.45	-402.76	-361.93	-144.93
Industrial	20.06	21.97	22.38	3.48	-10.21

**Table 40 Tariff realization as % average of cost of supply**

Category	2007-08	2008-09	2009-10	2010-11	2011-12
Domestic	72.93	72.06	72.01	74.67	81.13
Commercial	123.91	123.38	120.97	117.36	111.63
Agricultural	0.52	0.00	0.00	15.30	68.83
Industrial	105.83	106.03	105.56	100.81	97.80

**Table 41 Energy Consumption category wise (MU)**

Category	2007-08	2008-09	2009-10
Domestic	6348.3	6457.82	7006.165
Commercial	1850.18	1896.18	2033.947
Agricultural	10021.06	9324.62	10470.13
Industrial	10559	10436.11	10632.848
Total	28778.54	28114.73	30143.09

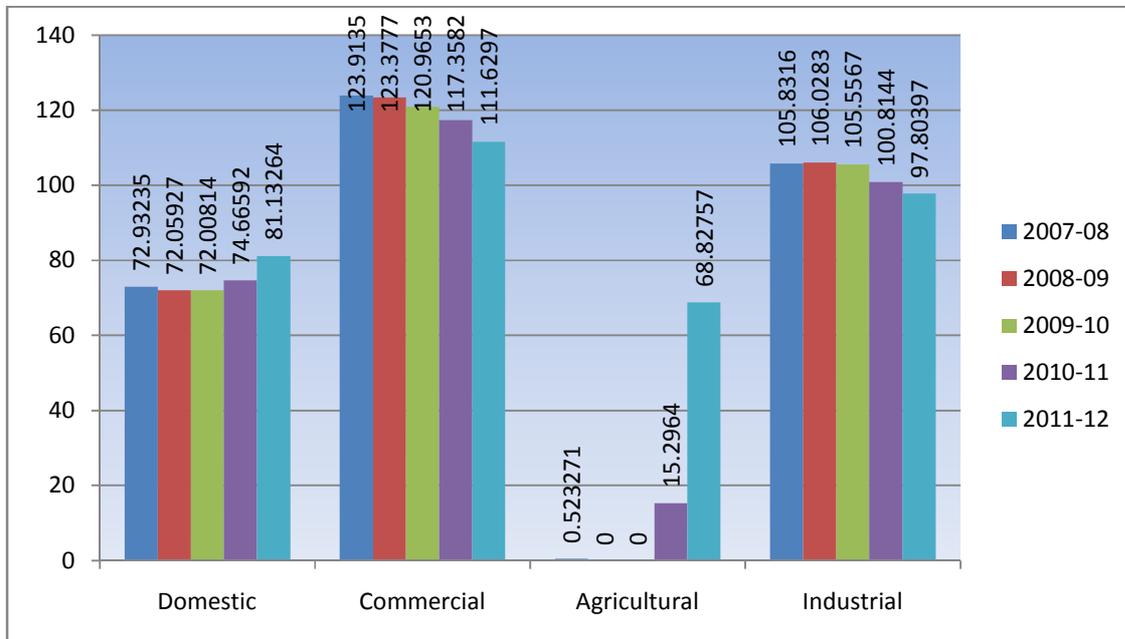
**Table 42 Revenue (in Crs)**

Category	2007-08	2008-09	2009-10
Domestic	1592.6615	1695.9527	2031.928
Commercial	788.63923	852.61734	990.93898
Agricultural	18.037908	0	0
Industrial	3844.004	4032.7216	4520.449
Total	6243.3426	6581.2917	7543.316

Reform which took place in Year 2010 after that we can see that the amount of cross subsidy is going down year on year for each category from 2010-11 and realization is within the limit of +- 20% except the agriculture category. Tariff is continuously increasing with the average cost of supply for entire category over the year. Tariff of domestic and agriculture has increased more in

<sup>26</sup> Annual report 2011-12 on the working of the state power utilities and electricity department, Ministry of power

comparison to industrial and commercial therefore the gap is reducing and we can say that Punjab is moving towards cost reflective tariff.



**Figure 8 tariff realization as % average cost of supply**

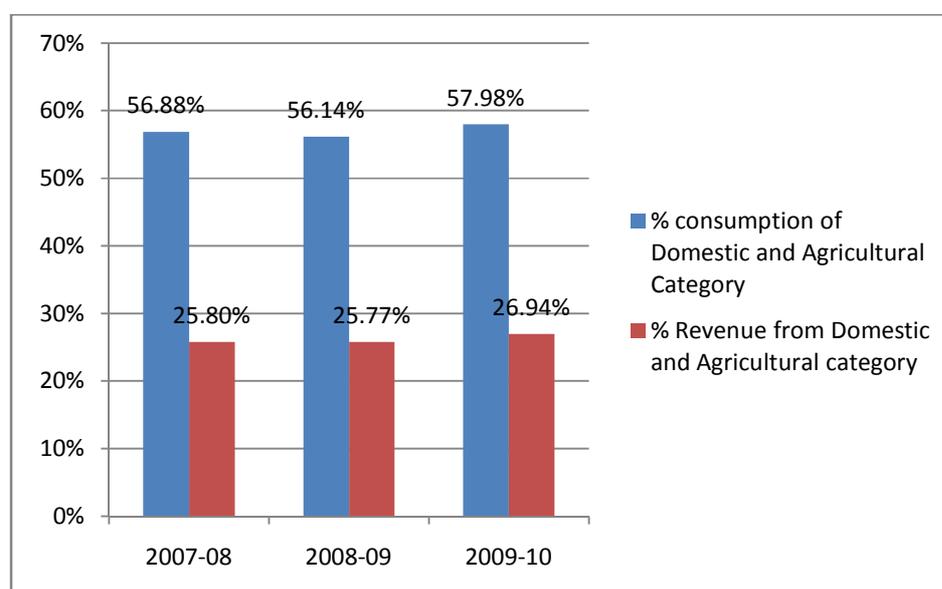
**Table 43 % consumption of domestic and agricultural consumer**

2007-08	2008-09	2009-10
56.88%	56.14%	57.98%

**Table 44 % revenue from domestic and agriculture category**

2007-08	2008-09	2009-10
25.80%	25.77%	26.94%

**Figure 9 Consumption and revenue of domestic and agricultural**



**Table 45 Profit and Loss statement (after subsidy) (in Rs Crs)<sup>27</sup>**

Particulars	2005-06	2006-07	2007-08	2008-09	2009-10	Total
Revenue	8335	8709	11083	11915	12210	52252
Expenditure	8247	10354	12584	12849	13361	57394
Profit/Loss	88	-1645	-1501	-934	-1151	-5142

The increase in financial losses of PSEB can be attributed to following factors:

- Disallowance of sales due to variation in estimation of Agriculture consumption by PSEB and Commission. Reduction of sales to agriculture consumers by Commission at the time of approving and Truing up of the Quantum .This means that the Commission does not approve the sale projected by the PSEB to Agriculture.
- Disallowance of sales due to Commission approving T&D loss of 19.50% as compared to actual T&D loss of 22.21% claimed by PSEB in its ARR petition for FY 2010-11 ( as per the True Up order of FY 2008-09) which then leads to increase in Power Purchase quantum.
- Disallowance of employee cost by Commission on pretext of high employee cost of PSEB. Commission has capped the employee cost till FY 05-06 and for future years

<sup>27</sup> Shunglu Committee report

allowed increase by WPI only. The Board has taken steps like freezing of recruitments against retirement/death cases since 1999.

- Disallowance of interest and finance charge on the pretext of high interest rates. Also Disallowance of short term loans taken by PSEB for employee cost because the Commission has always made an observation that the employee Cost of PSEB has been one of the highest in India.

PSEB purchases power from Bhakra Beas Management Board (BBMB), Central Generating Stations of NTPC, NHPC, NJPC and NPC, Power Trading Corporation and through Bilateral Purchases from other States.

The Power Purchased from Traders and through UI is approved by Commission by taking into account the approved gross purchase of power for the year and the power available from central generating stations and other sources. The rate approved for such power is based on the actual average purchase rate of traded power in the previous year. However, this was not followed consistently by the Commission over FY 05-06 to FY 09-10. The Commission, for some years accepted the Board's projection of UI rates. The Commission, in its later tariff Orders decided that the cost of power purchased from traders in excess of the approved quantum of will be admissible only at an average rate of realization which was fixed by commission and which was lower than the average rate at which approved UI power was allowed.

Commission has not issued any Regulations on short term and medium term power purchase by the PSEB. Since no new capacity has been added, PSEB is purchasing more and more power in short term market to meet its obligation of supply.

Though the Commission True's up the Power Purchase quantum and Cost in the true up exercise but the True up process takes place after a lag of two years. During the lag period the utility has to foot the power purchase bill from its own coffers which has an adverse effect on it financial situation.

The Commission before ascertaining the tariffs in the Tariff Order seeks government stand on the amount of subsidy it will grant based on the agriculture consumption and the free units to SC category.

Commission then works out the total revenue from the consumer tariffs considering the subsidy of State Govt. The Government of Punjab provides subsidy to the Board in the following manner:

- Adjustment from interest due from the Board on Government loans
- Adjustment of Electricity Duty
- Cash Subsidy

## 5.4. Tamil Nadu

### 5.4.1. Background:

Tamil Nadu has been facing massive power deficits. According to the CEA, the state was expected to have a power deficit of around 18% in 2010-11. As a result, the state is now facing huge power cuts. On an average, 3-4 hours of power cuts are being experienced by consumers in the state. The impact of this power shortage is being felt mainly by the industries, leading to a loss in efficiency and production. The gap between requirement and availability of power in Tamil Nadu has altered, had a deficit of around 1% in 2003-04. This deficit has been increasing rapidly, especially in the last five years. The reason for the huge deficits in Tamil Nadu is due to the lack of power availability. Tamil Nadu is the most dependent on outside sources. One reason attributed to this low investment in generation by the state has been the huge losses experienced by the Electricity Board. Tamil Nadu is the state which has not reduced its T&D losses from last ten years even though it had relatively low losses. The main problem faced by Tamil Nadu in transmission is with respect to congestion in the Southern grid, the amount that can be transferred to the Southern Region is not high. This is a major problem for a state like Tamil Nadu which is dependent on outside sources of power. Low pricing of electricity consumption for agriculture and domestic categories, which results in the gap between cost and tariff is much higher as compared to other states. Tariff has not been revised for seven years from 2002-03 to 2008-09 which resulted in creation of huge regulatory asset. The TNEB has been borrowing heavily to meet its revenue expenditure<sup>28</sup>

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<sup>28</sup> <http://www.athenainfonomics.in/assets/TN%20Power%20Scenario.pdf>

#### 5.4.2. Reforms:

On 1 st July 1957, Tamil Nadu Electricity Board came into being and has remained the energy provider and distributor all these years. During the period the Government have extended the electrical network to all the villages and towns throughout the state. After 53years of journey on 1<sup>st</sup> of November 2010 it has restructured itself into TNEB Ltd; Tamil Nadu Generation and Distribution Corporation (TANGEDCO) Ltd; and Tamil Nadu Transmission Corporation (TANTRANSCO) Ltd. After seven year in 2009-10 tariff was revised. Since the tariff filing process has begun, it can be expected that the tariffs would be fixed in a more transparent manner going into the future. With the setting up of Tamil Nadu power finance corporation the capital needs of the power sector are taken care of by resources raised through it to some extent.

#### 5.4.3. Current Status:

**Table 46 Installed Capacity (as on 31/01/13)**

State	Central	Private	Total
6348 MW	3483 MW	8549 MW	18382 MW

Actual power supply position in 2012-13

Peak deficit(-)/surplus(+)	Energy deficit(-)/surplus(+)
-13.2%	-17.5%

Anticipated power supply position in the country during 13-14

Peak deficit(-)/surplus(+)	Energy deficit(-)/surplus(+)
-34.1%	-26.5%

In year 2013-14 both peak and energy deficit is expected to increase, increase in peak deficit is more than twice. TNERC has not moved to MYT framework. Recently FEEDBACK has done Category-wise cost of service study for TANGEDCO.

#### 5.4.4. Data collection and Analysis:

**Table 47 Average power Tariff (paise/kwh)<sup>29</sup>**

Category	2007-08	2008-09	2009-10	2010-11	2011-12
Domestic	153.07	165.17	172.52	177.55	180.87
Commercial	606.3	616.23	606.45	662.31	695.31
Agricultural	0.04	0.04	0.03	0.04	0.04
Industrial	455.01	457.9	473.52	502.55	529.75

**Table 48 % Growth rate of tariff of different categories over the years**

Category	2007-12
Domestic	4.285085
Commercial	3.561069
Agricultural	2.083333
Industrial	3.897363

**Table 49 Average cost of supply (Paise/kwh)<sup>30</sup>**

2007-08	2008-09	2009-10	2010-11	2011-12
397.88	478.89	493	511	499

**Table 50 Gap (paise/kwh)**

Category	2007-08	2008-09	2009-10	2010-11	2011-12
Domestic	-244.81	-313.72	-320.48	-333.45	-318.13
Commercial	208.42	137.34	113.45	151.31	196.31
Agricultural	-397.84	-478.85	-492.97	-510.96	-498.96
Industrial	57.13	-20.99	-19.48	-8.45	30.75

**Table 51 Tariff realization as % average cost of supply**

Category	2007-08	2008-09	2009-10	2010-11	2011-12
Domestic	38.47	34.49	34.99	34.75	36.25
Commercial	152.38	128.68	123.01	129.61	139.34
Agricultural	0.01	0.01	0.01	0.01	0.01
Industrial	114.36	95.62	96.05	98.35	106.16

<sup>29</sup> Annual report 2011-12 on the working of the state power utilities and electricity department, Ministry of power

<sup>30</sup> Annual report 2011-12 on the working of the state power utilities and electricity department, Ministry of power

**Table 52 Energy consumption Category wise (MU)<sup>31</sup>**

<b>Category</b>	<b>2007-08</b>	<b>2008-09</b>	<b>2009-10</b>
Domestic	13007.71	13501.92	13939.94
Commercial	6288.34	6379.18	7076.758
Agricultural	10716.75	10527.72	11948.52
Industrial	21112.2	21266	23065.84
Total	51125	51674.82	56031.06

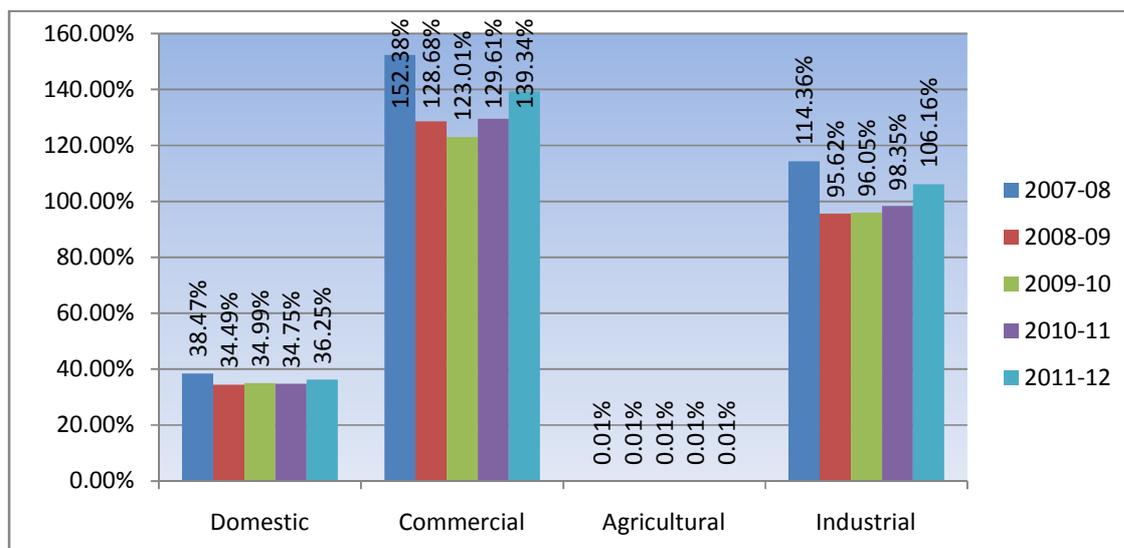
**Table 53 Revenue (in Crs)**

<b>Category</b>	<b>2007-08</b>	<b>2008-09</b>	<b>2009-10</b>
Domestic	1991.09	2230.112	2404.918
Commercial	3812.621	3931.042	4291.7
Agricultural	0.42867	0.421109	0.358456
Industrial	9606.262	9737.701	10922.14
Total	15410.4	15899.28	17619.11

From whatever data available we can say that agriculture category is getting electricity free of cost in spite of cost of supply being as high as 490 paise/kwh and 499 Paise/kwh. From domestic category only 35% or 36% is realized as against commercial from which 139% is realized. Only for industrial category realization is within +-20% which is good indicator. One major finding is that in year 2011-12 realizations have increased for the entire category except agriculture which shows the effect of reform which took place on late 2010. It means reform is turning out to be good for Tami Nadu and should have been taken place long back which could have avoided creation of gap.

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<sup>31</sup> [www.indiastat.com/power](http://www.indiastat.com/power)



**Figure 10 tariff realization as % average cost of supply**

TNEB has not approached Commission for tariff revision since FY 2003 therefore Tamil Nadu Electricity Regulatory Commission (TNERC) has issued second tariff order in 2010 after the first tariff order in 2003. In spite of manifold increase in the input costs there was no tariff revision for the past seven years and there has been revenue deficit since 2003-04. Since no Tariff Orders have been issued by TNERC post 2003, there are no true-up orders available. Despite of all these problems Tamil Nadu was resistant for reform to take place.

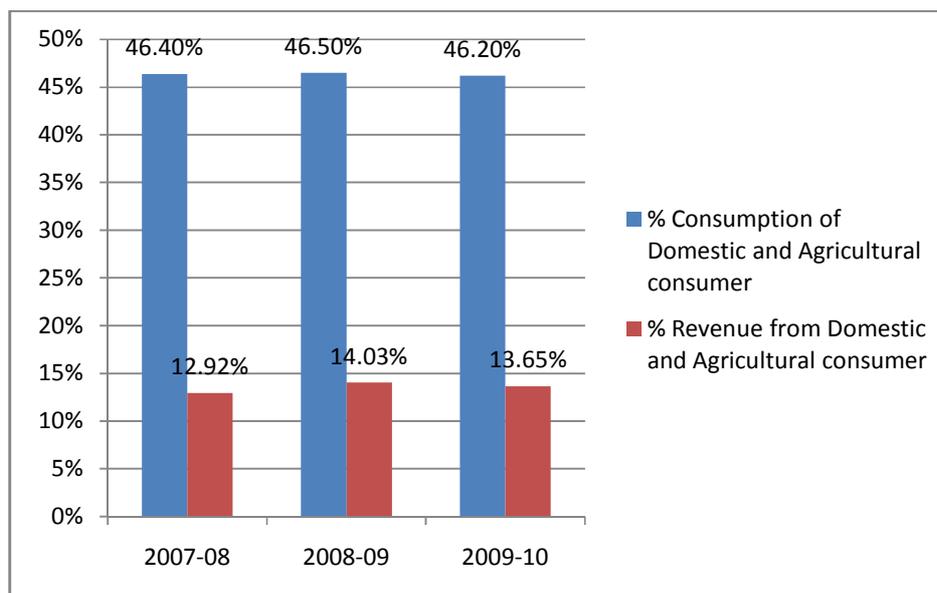
**Table 54 % consumption of domestic and agricultural consumer**

2007-08	2008-09	2009-10
46.40	46.50	46.20

**Table 55 % revenue from domestic and agriculture category**

2007-08	2008-09	2009-10
12.92	14.03	13.65

**Figure 11 consumption and revenue of domestic and agricultural category**



**Table 56 Profit and loss statement (after subsidy) (Rs crs)<sup>32</sup>**

Particulars	2005-06	2006-07	2007-08	2008-09	2009-10	Total
Revenue	14349	16105	17508	17644	18846	84452
Expenditure	15317	17931	21202	25429	28424	108302
Profit/Loss	-968	-1826	-3694	-7785	-9578	-23850

The increase in the financial losses of Tamil Nadu can be attributed to following factors:

- 1) Non revision of tariff for the past seven years. The accumulated revenue deficit upto 2012-13 is **Rs. 17445.46 Cr** and is also called **Regulatory asset**. It is also noticed that the State Commission has also not provided for any carrying cost on the **regulatory asset** and the programme for recovery of the amount to be taken as expenses in future tariff.
- 2) There is no major capacity addition by TNEB since last 10 years. Major reasons for losses are shortage of power, exponential growth of demand and power purchase from the market at high price. TNEB is buying around 20 million units on day-ahead basis to meet the growing demand at spot market prices.
- 3) Free electricity for the agricultural consumers. Government subsidy required to support agricultural consumption was Rs 5828 crore in FY 2009-10 against which the Government had released only Rs 267 crore.

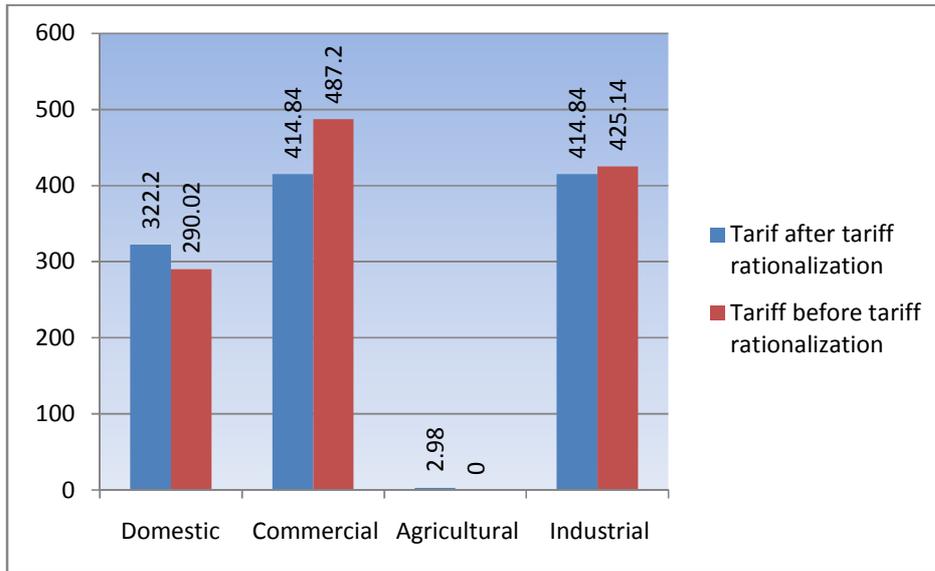
<sup>32</sup> Shunglu committee report

## 5.5. Sensitivity analysis:

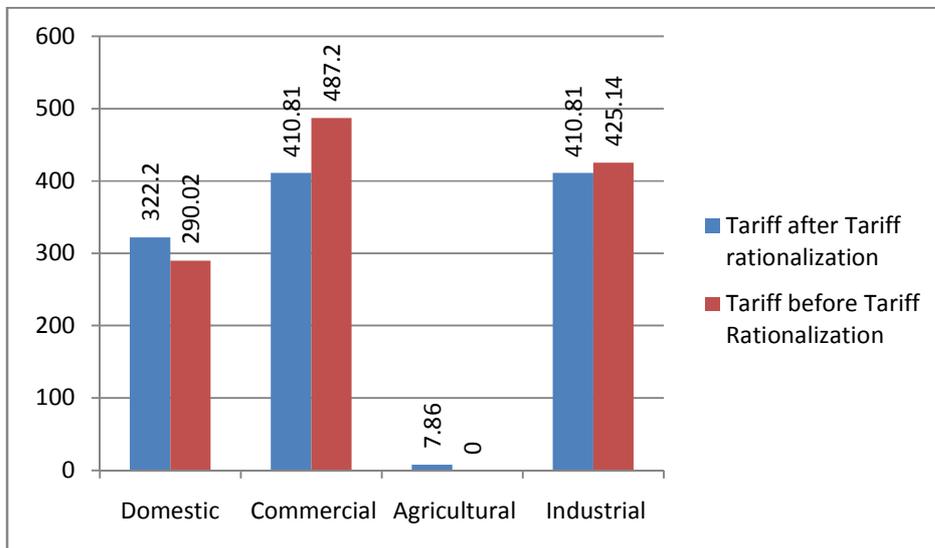
This particular case is of Punjab for year 2009-10 where average cost of supply for the year was 402.76 Paise/kwh. Here we can see different combinations of tariff reflecting cost of supply, keeping the total revenue and consumption of each category as constant. Tariff of different category of consumers in same year is shown by row before rationalization in the below given table. Comparing this tariff with the cost of supply we found that domestic, commercial, agricultural, and industrial were paying 72.01%, 120.97%, 0.00%, 105.56% respectively. To rationalize the tariff or to bring these tariff near to the cost we have reduced the tariffs of commercial and industrial to 103% of the cost of supply and simultaneously we have also increased the tariff of domestic to 80% of cost of supply. After fixing the values of these three category I noticed the variation in tariff of agricultural consumer which shows that Agricultural category which was earlier getting free of cost will now have to pay only 2.98 paise/kwh (keeping both total revenue and category wise consumption same). This tariff is some how near to tariff rationalization, reflecting the cost and reduction in cross subsidy. With similar approach and by varying only the commercial and industrial tariff to 102% and 101% of the cost of supply we have noticed the change in agricultural consumer in rest two cases below.

### Tariff (paise/kwh)

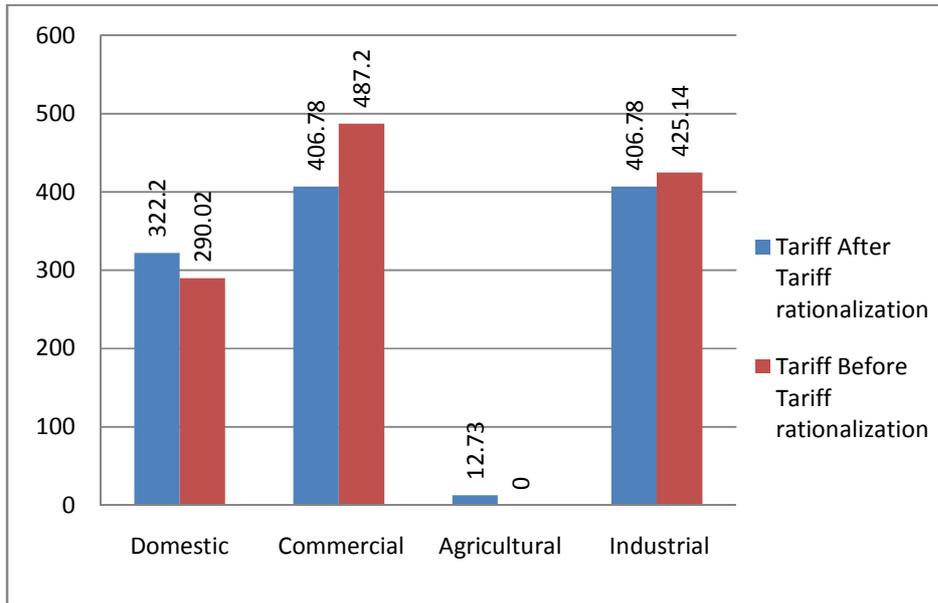
Particulars	Domestic	Commercial	Agricultural	Industrial
After Rationalization	322.2	414.84	2.98	414.84
Before Rationalization	290.02	487.2	0	425.14



Particulars	Domestic	Commercial	Agricultural	Industrial
After Rationalization	322.2	410.81	7.86	410.81
Before Rationalization	290.02	487.2	0	425.14



Particulars	Domestic	Commercial	Agricultural	Industrial
After Rationalization	322.2	406.78	12.73	406.78
Before Rationalization	290.02	487.2	0	425.14



## Chapter 6

### 6.1. Conclusion:

State	Category	2007-08	2008-09	2009-10	2010-11	2011-12
Gujarat	Domestic	77.94	81.73	84.82	87.52	87.23
	Commercial	124.54	121.47	127.51	132.75	133.91
	Agricultural	30.51	42.54	40.10	41.47	41.19
	Industrial	116.92	115.83	119.55	123.98	124.42
A.P	Domestic	68.64	65.46	59.97	64.10	60.51
	Commercial	160.71	148.04	132.62	135.29	127.87
	Agricultural	4.39	3.95	3.74	6.80	10.96
	Industrial	146.18	146.09	135.31	141.69	125.53
T.N	Domestic	38.47	34.49	34.99	34.75	36.25
	Commercial	152.38	128.68	123.01	129.61	139.34
	Agricultural	0.01	0.01	0.01	0.01	0.01
	Industrial	114.36	95.62	96.05	98.35	106.16
Punjab	Domestic	72.93	72.06	72.01	74.67	81.13
	Commercial	123.91	123.38	120.97	117.36	111.63
	Agricultural	0.52	0.00	0.00	15.30	68.83
	Industrial	105.83	106.03	105.56	100.81	97.80

**Table 57 Tariff realization as % of cost of supply for entire state under consideration**

Reform process was started long back in year 1991 with the aim to take care of the deteriorating health of the SEBs. This was followed by restructuring of SEBs which started in year 1995, when Orissa SEB was unbundled into separate generation, transmission and distribution. Then came Electricity act 2003 which mandated minimal reform i.e Transmission should be unbundled from SEB as is done by Punjab and Tamil Nadu. Apart from this the act also says commission while specifying the terms and conditions for the determination of tariff shall be guided by that the tariff progressively reflects the cost of supply of electricity and also, reduces cross-subsidies in the manner specified by the Appropriate Commission. This is also known as cost reflective tariff or tariff rationalization. National Tariff policy which came up in 2006 mentioned that the SERC would notify roadmap within six months with a target that latest by the end of year 2010-2011 tariffs are within  $\pm 20\%$  of the average cost of supply for achieving the

objective that the tariff progressively reflects the cost of supply of electricity. Higher tariff and lower tariff which is not at all reflection of cost affects the socio-economic development of the country. Cross subsidy leads to inefficient and unproductive use of scarce electricity and sends a wrong signal to consumers who pay less. It also undermines the operation of the utility in the long run as because the cross-subsidizing category leave the utility's system and switch to self generation. For the development of the competitive power market Tariff Rationalization is very important.

In order to see whether reforms have any effect on the tariff rationalization we have taken two states from early reforms and two from the late reforms. Two early reforms state here are Gujarat and Andhra and two late reformers are Punjab and Tamil Nadu. During the study several observations came up to conclude. We cannot say that the impact is on the whole state but is on the few categories. Moreover the reform cannot alone do everything, apart from this there is a need of Government support and willpower to actually mean it. We know Gujarat and Andhra Pradesh are the states which has undergone early reform whereas Tamil Nadu and Punjab are the one with late reform still we cannot say that early reform has performed better than late reform states.

Agriculture category is still being subsidized by industrial and commercial category in all the states; but the quantum is varying from state to state and year to year. This can be due to erratic power supply to agriculture consumer and also the timing during which they get the supply i.e odd hours. In domestic category there is mixed impact among states, states like Gujarat and Punjab are moving towards cost reflective tariff and rest Andhra Pradesh and Tamil Nadu are still to achieve. Tariff rationalization with Andhra Pradesh being at slightly better position than Tamil Nadu. The reason behind Tamil Nadu being at such a position can be attributed to Tariff revision not been taken place for seven years from 2002-03 to 2008-09. As far as Commercial and industrial are concerned, in Gujarat the realization % is increasing because average cost of supply is decreasing and tariff is constant whereas in Andhra Pradesh the realization is decreasing over the year which is good sign. The industrial tariff in Andhra Pradesh is lowest among all the four states, it is because they follow cost of serve model. The Commission has used the CoS model since the first Tariff Order for FY2000-01 for both tariff fixation and allocation of cross-subsidy. In Punjab the realization for Commercial and industrial is decreasing and this is no where related to reform but the tariff have surely increased for entire

category from 2010-11 onwards, the year of reform. In Tamil Nadu the curve is U-shaped from 2007-08 to 2011-12, initially it decreased then again started to increase. It is also because of tariff revision exercise in year 2009-10 which felt the need for tariff hike to recover a portion of regulatory asset of amount more than Rs 15,000/ crore.

## 6.2. Recommendations:

The amount of cross subsidy received/ contributed by various consumer categories is dependent on the way the cost of supply is calculated. Category wise Cost of service is related to demand factors such as peak and off-peak demand and also demand at different voltage level. Therefore every commission should move from average cost of supply to category wise cost of supply as this gives true picture of the cost imposed by the particular category on system.

Finally, I would like to say that to move towards cost reflective tariff it is very much necessary to revise tariff periodically every year with the mechanism to pass through the increase in power purchase cost every quarterly/ half yearly to minimize the gap at the end of the year. There is also a need to improve efficiency of the system so that the cost gets reduced and becomes comparable to tariff. In order to ensure that government subsidy reach on time and in reasonable amount commissions should be given more authority as this directly affects the tariff setting and forces commissions to cross-subsidize agricultural and domestic category with industrial and commercial category.

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State	Category	Avg. cost of supply (paise/kwh)					Avg. Tariff (Paise/kwh)					Gap (Paise/kwh)				
		2007-08	2008-09	2009-10	2010-11	2011-12	2007-08	2008-09	2009-10	2010-11	2011-12	2007-08	2008-09	2009-10	2010-11	2011-12
Gujarat	Domestic	391.71	464.25	441.21	425.46	427.47	305.31	379.45	374.23	372.35	372.9	-86.4	-84.8	-66.98	-53.11	-54.57
	Commercial						487.82	563.91	562.58	564.8	572.42	96.11	99.66	121.37	139.34	144.95
	Agricultural						119.52	197.49	176.92	176.45	176.07	-272.19	-266.8	-264.3	-249	-251.4
	Industrial						458	537.72	527.47	527.47	531.84	66.29	73.47	86.26	102.01	104.37
A.P	Domestic	353	367	436	440	467	242.29	240.23	261.47	282.03	282.56	-110.71	-126.8	-174.5	-158	-184.44
	Commercial	365	389	450	455	482	586.59	575.88	596.77	615.58	616.33	221.59	186.88	146.77	160.58	134.33
	Agricultural	186	218	245	275	293	8.17	8.61	9.16	18.7	32.1	-177.83	-209.4	-235.8	-256.3	-260.9
	Industrial	250	256	294	287	333	365.45	373.98	397.81	406.65	418.02	115.45	117.98	103.81	119.65	85.02
T.N	Domestic	397.88	478.89	493	511	499	153.07	165.17	172.52	177.55	180.87	-244.81	-313.7	-320.5	-333.5	-318.13
	Commercial						606.3	616.23	606.45	662.31	695.31	208.42	137.34	113.45	151.31	196.31
	Agricultural						0.04	0.04	0.03	0.04	0.04	-397.84	-478.9	-493	-511	-498.96
	Industrial						455.01	457.9	473.52	502.55	529.75	57.13	-20.99	-19.48	-8.45	30.75
Punjab	Domestic	343.99	364.45	402.76	427.29	464.93	250.88	262.62	290.02	319.04	377.21	-93.11	-101.8	-112.7	-108.3	-87.72
	Commercial						426.25	449.65	487.2	501.46	519	82.26	85.2	84.44	74.17	54.07
	Agricultural						1.8	0	0	65.36	320	-342.19	-364.5	-402.8	-361.9	-144.93
	Industrial						364.05	386.42	425.14	430.77	454.72	20.06	21.97	22.38	3.48	-10.21

**Table 58 Complete data of avg. Cost, Avg. Tariff, and Gap of entire states**

Data Source: Annual report 2011-12 on the working of State Power Utilities and Electricity Department  
2010-11 Revised. Estimate  
2011-12 A.P  
Andhra Pradesh Average cost of supply data source: Tariff order for respective years