



**Operational & Financial Viability of Indian Power Distribution Sector:**

**The bottlenecks, challenges & way forward**

**By**

**RAHUL BISWAS**

**(SAP ID 500024867)**

**Guided By**

**Bodhiswatta Saha**

**Asst. Director (HR), DVC**

**A DISSERTATION REPORT SUBMITTED IN PARTIAL FULFILLMENT  
OF THE REQUIREMENTS FOR**

**MBA in Power Management**

**OF**

**UNIVERSITY OF PETROLEUM & ENERGY STUDIES, INDIA**

**CENTRE FOR CONTINUING EDUCATION  
UNIVERSITY OF PETROLEUM & ENERGY STUDIES, DEHRADUN**

## Acknowledgement

This is to acknowledge with thanks the help, guidance & support that I have received during the dissertation.

I have no words to express a deep sense of gratitude to the management of Damodar Valley Corporation for giving me an opportunity to pursue my dissertation & in particular Mr. Bodhiswatta Saha, for his able guidance & support. The constructive suggestions that he provided me despite his busy schedule was a key value addition to the analysis of the research.

Lastly I would like to thank the entire faculty of the Centre for Continuing Education, University of Petroleum & Energy Studies for their consistent value addition to my MBA coursework.

Signature:  2/11/15

Name of the Student: RAHUL BISWAS

Residential Address: Block-3, Flat-37, CIT Buildings (old)  
Beleghata, Kolkata-700010, West Bengal.

Mobile Number: 9681610984

Email: [biswasrahul@hotmail.com](mailto:biswasrahul@hotmail.com)

Date: 01/11/2015

Place: Kolkata



**दामोदर घाटीनिगम**  
**DAMODAR VALLEY CORPORATION**

Declaration by the Guide

This is to certify that Mr. **Rahul Biswas**, a student of MBA in Power Management, Roll Number 500024867 of UPES has successfully completed this dissertation report on “**Operational & Financial viability of Indian Power Distribution Sector: the bottlenecks, challenges & way forward**” under my supervision.

Further, I certify that the work is based on the investigation made, data collected & analyzed by him & it has not been submitted in any other University or institution for award of any degree. In my opinion, it is fully adequate in scope & utility, as a dissertation towards partial fulfillment for the award of degree of MBA.

Signature:

  
12/8/15

**BODHISWATTA SAHA**  
**Assistant Director (HR)**  
**Raghunathpur Thermal Power Station**  
**Damodar Valley Corporation**  
**U/N Ministry of Power**

Name: Bodhiswatta Saha  
Designation: Asst. Director(HR)  
Mobile: +919830470591  
Email: bodhiswatta\_saha@dvcindia.org

Date: 12/08/2015  
Place: West Bengal

## Table of Content

Acknowledgement	ii
Declaration	iii
Table of Content	iv
Abbreviation & List of Tables, Figures	vi
Abstract/ Executive Summary	ix
Chapter 1: Introduction	1
1.1 Overview	1
1.2 Background	2
1.3 Purpose of the study	4
1.4 Research hypothesis	5
Chapter 2: Literature Review	6
2.1 Review Area Broad	6
2.2 Review Area Narrows	9
2.3 Critical Factors for the Study	10
Chapter 3: Research Design, Methodology & Plan	11
3.1 Research Design	11
3.2 Data Analysis Procedure	14
3.3 Data Sources	17
Chapter 4: Findings & Analysis	19
4.1 Analysis using Case Study Approach	19
4.2 Analysis using AHP Method	30
4.3 Result of the Study	42
Chapter 5: Interpretation of Results	44
5.1 Interpretation of the Results for AHP	44

5.2	Interpretation of the Results for Case Study	44
5.3	Comparison of the Result with the Research Assumption	46
	Chapter 6: Conclusions & Scope for Future Work	47
6.1	Key Trends	49
6.2	Scope for Future	53
6.3	Conclusion	56
	Bibliography	57

## **Abbreviation**

ABT	availability-based tariff
ACS	Average cost of supply
AHP	analytic hierarchy process
ARR	Average revenue realized
AMR	automated meter reading
APDRP	Accelerated Power Development and Reform Program
AT&C	aggregate technical and commercial
BPL	Below poverty line
CAGR	Compounded annual growth rate
CEA	Central Electricity Authority
CERC	Central Electricity Regulatory Commission
DF	distribution franchise
discom	distribution company
EA	Electricity Act
FERC	Federal Energy Regulatory Commission
HT/LT	High tension/low tension
R-APDRP	Restructured Accelerated Power Development and Reform Program
RGVY	Rajiv Gandhi Grameen Vidyutikaran Yojana
SCADA	supervisory control and data acquisition
SEB	state electricity board
SERC	state electricity regulatory commission
SLDC	state load dispatch center
TSO	transmission system operator
UMPP	ultra-mega power plant

## List of Tables

Table 3.1	Performance parameters used for AHP	page 18
Table 4.1	Parameters used for AHP with respective weightage	page 31
Table 4.2	Bottlenecks of Indian Power Distribution Sector	page 43
Table 6.1	Target setting matrix for Power Distribution Sector	page 55

## List of Figures

Fig 3.1	Component of Benchmarking	page 12
Fig 4.1	Break down of annual electricity expenditure of New Zealanders'	page 25
Fig 4.2	Weightage of objectives with respect to goal in software	page 32
Fig 4.3	Relative importance matrix with respect to each objective	page 33
Fig 4.4	Pair-wise comparison of AT&C with respect to alternatives	page 34
Fig 4.5	Pair-wise comparison of Gap after subsidy with respect to alternatives	page 34
Fig 4.6	Pair-wise comparison of Gap after subsidy with respect to alternatives	page 35
Fig 4.7	Pair-wise comparison of Subsidy received/subsidy booked with respect to alternatives	page 35
Fig 4.8	Pair-wise comparison of Debtors day with respect to alternatives	page 36
Fig 4.9	Pair-wise comparison of Creditors day with respect to alternatives	page 36
Fig 4.10	Pair-wise comparison of Energy Deficit with respect to alternatives	page 37
Fig 4.11	Pair-wise comparison of Power purchase cost per unit with respect to alternatives	page 37

Fig 4.12	Pair-wise comparison of collection efficiency with respect to alternatives	page 38
Fig.4.13	Pair-wise comparison of (Accumulated losses+ Subsidy receivable)/turnover with respect to alternatives.	page 38
Fig 4.14	Pair-wise comparison of Future Gap (2017)/Current ACS with respect to alternatives.	page 39
Fig 4.15	Pair-wise comparison of Net profit with respect to alternatives	page 39
Fig 4.16	Pair-wise comparison of Status of reforms & restructuring with respect to alternatives	page 40
Fig. 4.17	Synthesis of the goal: Performance Index for monitoring DISCOMs.	page 41
Fig. 4.18	Performance sensitivity for the nodes	page 42

## **Abstract**

The research work is in the distribution domain of the Indian power sector. Distribution & retail supply is the most important cog in the entire power supply value chain which interfaces with consumers & provide revenue for the sector. Indian electricity distribution caters among the largest consumer bases in the world. In spite of several reforms such as EA 2003, the Model State Electricity Distribution Management Responsibility Bill 2013, the estimated cumulative loss amount of the Distribution Utilities at the end of XII plan period (2017) stand at whopping Rs. 2,90,000 cr.

In this paper, I have tried to find out the bottlenecks of the distribution domain, analyze the operational & financial performances of various state utilities of the country & draw some remedial measures for future improvement.

For this purpose, I have taken the data of several state utilities from their websites, from the publications of several international papers & agencies & also tried to take some inferences from some successful International models. My research work is based on Case Study approach & AHP modeling for benchmarking the state utilities on various parameters.

## **Introduction**

### **1.1 Overview:**

The government of India has emphasized that an efficient, resilient & financially robust power sector is essential for growth & poverty reduction (Ministry of Power, GOI). Since Independence in 1947, India has added a significant power generation capacity from 1362 MW in 1947 to 210 GW in 2012. However various investment surveys point to poor availability & quality of power as critical constraints to national competitiveness & productivity. Further, almost 19,000 of our villages are still without power & those having it, must cope with unreliable supply, resulting unsatisfied demand & consumer welfare.

Generation, Transmission & Distribution are the three segments of the Power sector. Indian electricity distribution caters nearly 200 million consumers with a connected load of around 400 GW, which places the country among the largest electricity consumer bases in the world. The consumers are served by around 73 distribution utilities – 13 electricity department, 17 private distribution companies, 41 corporatized distribution companies & 2 State Electricity Boards. Though all three elements are important part of the chain, revenue originates at the distribution domain as it is linked directly with the consumer. Hence a below par performance at the distribution domain hurts the entire value chain. A financially & commercially viable power sector that are able to attract fresh investment is utmost important for economic acceleration of the country. However, the financial health of the SEBs has become a matter of grave concern as their losses have reached to an alarmingly high level. Though the government has taken several measures to address the issue, initially their prime focus was on generation & transmission segment & distribution improvement lagged clearly. Then Planning Commission had appointed a committee headed by former CAG Shri V.K Shunglu in 2010 to look into the financial problems of SEBs & to identify corrective steps. The Model State Electricity Distribution Management Responsibility Bill, 2013, has given stress on recasting the constitution of State owned discoms to usher in accountability & professional management of the electricity distribution of states. Government of India has introduced several schemes such as National Electricity Fund & Restructured-APDRP to incentivize investment in improving operational efficiency of

distribution infrastructure & Financial Restructuring of the State owned discoms for achieving the financial turnaround by restructuring their debt. It is too early to comment on these reformist measures however resulting benefits are yet to be seen.

Persistent operational & financial shortcomings had resulted government bailout in 2001 & even after several measures the sector required another bailout in 2012. Ominously, the recent increase in private investment & market borrowings means power sector difficulties may spill over to banking or other Institutions & affect the broader financial sector. This report thus analyzes sources of weakness in distribution, performances of several state utilities, the challenges & what more can be done in order to improve in medium & long term.

## **1.2 Background**

Energy pricing in India is a subject of Political affairs rather than a market affairs. Several State governments here try to exert their discretion to provide a direct subsidy to a certain class of consumers who are economically vulnerable. This practice of distorted pricing therefore creates immense pressure on the finance of the State distribution utilities resulting revenue losses.

Almost 30% of the total population in India lives in below poverty level. Under these circumstances for sustainable & inclusive development, affordable electricity for households is essential. Per capita electricity consumption in India is approximately 1010 units per year, which is way below the world average, where China averaging 4000 units per year. In order to realize the social objectives several State governments show keen interest in providing subsidized power for agriculture & domestic purpose. For selected categories of consumers, tariff is fixed lower than cost of service. Majority of discoms have struggled to maintain the financial solvency due to the absence of the cost reflecting tariff. As distribution segment caters the end users which generates the revenue, any financial imbalance here can create the shock wave through the entire chain.

Government of India had enacted Electricity Act, 2003, which has been considered a milestone in the power sector reform. EA, 2003 tried to bring accountability & transparency in the power distribution sector by unbundling SEBs, creating regulatory bodies at State & Central level for

setting guidelines for tariff rationalization & forming Appellate Tribunal, a quasi-judicial body to lodge complain against regulatory commissions. Before the Act, the cumulative loss amount of SEBs was approximated around Rs. 25,000 cr. However, 10 yrs after the Act, the cumulative loss amount stands at approximately Rs. 92,845 cr as per PFC on 2013<sup>1</sup>. Though generation segment has been de-licensed for private investment to improve the efficiency & competitiveness, the distribution still remains a licensed activity, which results a monopoly of the discoms. Due to the poor financial performance, many discoms unable to pay the power producers for power purchase, which adversely affects the investor sentiment in the power generation sector. With limited open access & few private distribution utilities in the market, private generators find it difficult to get alternative buyers. As a result, the capacity addition that is expected through the private investment also suffers. Also several mandates of the EA, 2003 such as timely tariff petition to SERC, separate budgetary allocation for subsidy amount etc are not followed properly. Many discoms book subsidies to cover the lower than cost of tariffs charged to agriculture or domestic consumers to accommodate the political objectives of the energy access. These subsidies are booked as a part of revenue loss on recommendation by the respective SERC. As per EA, 2003 this subsidy amount should be considered in the State budget allocation & paid upfront by the State government. However there is a slight deviation found in the amount of subsidy booked by the discoms & the amount received. As per PFC, in 2013, 98% of the subsidy booked amount had been released by the State governments.

The Reserve Bank of India has underlined in a recent publication in 2014 the risks faced by the Banks on their exposure to the power sector due to rising losses & debt level in SEBs. Cumulative debt of discoms to Banks & other financial Institutions stand at Rs. 200 thousand crores as on 2013. These may have a serious spill-over effect to the entire economy as Banks non-performing assets have raised to 4.45% from 4.1%. Therefore it is useful to review the status of the power distribution sector of the States & subsequently put forward a set of workable measures & a roadmap to contain the financial losses of the discoms & avoid the recurrence of the present crisis.

---

1. Report on the performance of the State power utilities By PFC 2011-12 to 12-13.

### **1.3 Purpose of the Study**

One of the very purposes of the study is benchmarking power utilities in the context of the infrastructure management, which has become essential component of utility management. With this study, I have examined the efficiency of the power sector value chain with respect to various drivers of cost & revenue, their correlation with each other & their correlation with respect to financial performance of the utilities. This performance index summarizes the credit quality of the State electricity utilities & allows more understanding of the sensitivity of these drivers & their effects on state finance.

If utility losses can be decomposed further we can find that losses may be segregated into three buckets: losses due to distribution energy losses above international norms of 10%, losses due to under-collection of bills, & losses due to below cost recovery pricing. In 2011, 14 States had tariffs that did not meet cost recovery level. The difference between input energy & energy sold is the distribution loss. Distribution losses, comprising both technical & non-technical factors, are in downward trajectory from 32% in 2003 to 21% in 2011. In spite of that fact, nine states have reported losses in upward trend such as Uttar Pradesh & Orissa. The share of energy realized to energy billed is the collection efficiency. Ideally the collection efficiency remain stable & majority of the States report more than 90% collection efficiency but States should be earned revenue from 100% of the energy billed.

In summary, with this report, I have tried to summarize the various drivers behind losses, to form a framework for monitoring the progress of the sector, to provide some solution for implementation & thus to move towards efficient & effective service delivery.

### **1.4 Research Hypotheses**

Indian power distribution sector is troubled with huge amount of debt. Performances in both operational & financial terms are in dismay. Though EA, 2003 has pronounced several measures but in reality nothing substantial has been achieved.

All in all I assume that the following suggestion by the committee headed by Mr. Deepak Parekh still holds true for this sector:

“Indian power sector is leaking bucket; the holes deliberately crafted & the leaks carefully collected as economic rents by various stakeholders that control the system.”

The bucket in the above remark is the power distribution sector which consumes no matter how much is generated without adequately compensating the producers of the electricity.

In this study, I have considered 11 numbers of States out of 29, for the purpose of analysis & benchmarking of their electricity distribution sector. Some of the States such as West Bengal, Gujarat, Karnataka have performed decently in various aspects & some of them such as Jharkhand, Uttar Pradesh are the worst performers over the time. I have tried to analyze in what aspects some States are fared over others. Even in the better performers, I have tried to analyze how much better one State is with respect to other & in what front. In short one State can be benefitted from the experience & performance of the other State & the performance of the total distribution sector can get improved further.

## **Chapter 2: Literature Review**

### **2.1 Review Area Broad**

#### *The Origins of the Reforms*

The Government of India has prioritized the power sector since 1947. As per Indian constitution, both central & state legislature should establish policy framework for electricity. With the enactment of Electricity Supply Act at 1948, CEA was established as an advisory body on planning, policy making & progress assessment. SEBs were also created for generation, transmission & distribution at state level. In 1991 faced with foreign exchange crisis, India embraced a broad based policy reforms & moved away from the inward-oriented licensing system of the past. This transitive period of the Indian economy established power sector as critical component for national growth. India continued to struggle with severe power deficit during 1990 & formation of functional regulatory commission was at sluggish pace. In 1998, government of India mandated the formation of state & central regulatory commission through the enactment of Electricity Regulatory Commission Act. Despite these reforms, the commercial performance of the state utilities continued to deteriorate, resulted a financial bailout in 2001 by the central government & formulation of the landmark Electricity Act, 2003.

#### *Electricity Act, 2003*

By enacting EA, 2003, the GOI intended to bring enhanced competition, accountability & commercial viability to the sector. Some of the key features of EA, 2003 are as follows:

- Introduction of competition
  - Unbundling state electricity boards.
  - De-license generation.
  - Move to open access.
  - Introduce Power trading.
- Enhanced accountability & transparency
  - Establish SERC.
  - Establish a national appellate tribunal.
  - Corporatize utilities.

- Cost recovery & commercial viability
  - Improve operational efficiency.
  - Move to cost recovery.
  - Ensure competitive procurement.
- Improved customer service & affordability of supply
  - Reduce losses.
  - Establish service standard.
- Access to Electricity & Rural Electrification
  - Ensure universal access.
  - Affordability & availability.

### ***Salient steps taken so far***

To incentivize investment & improve operational efficiency of the distribution infrastructure several steps has been taken so far such as formation of National Electricity Fund, Re-structured APDRP, Model State Electricity Distribution Management Responsibility Bill, 2013, Financial Restructuring of State owned discoms etc.

### ***National Tariff Policy***

The main objective of the National Tariff Policy is to realize the service at actual cost. Some key features of the policy are mentioned below:

- Tariff design should link cost to service.
- Implementation of MYT framework.
- Framework for revenue & cost requirement.

### ***National Electricity Policy***

The policy aims at achieving the following:

- Access to electricity- Available for all households in next five years.

- Availability of Power - Demand to be fully met by 2012. Energy and peaking shortages to be overcome and adequate spinning reserve to be available.
- Supply of Reliable and Quality Power of specified standards in an efficient manner and at reasonable rates.
- Per capita availability of electricity to be increased to over 1000 units by 2012.
- Minimum lifeline consumption of 1 unit/household/day as a merit good by year 2012.
- Financial Turnaround and Commercial Viability of Electricity Sector.
- Protection of consumers' interests.

### *National Electricity Fund<sup>1</sup>*

NEF is a government approved scheme linked with reform measures to promote capital investment in distribution sector by providing interest subsidy on loans taken by public & private utilities for various capital works under distribution projects. The works covered under the RGGVY & RAPDRP projects are not eligible to ensure non-duplication & non-overlapping of subsidy towards investment. Estimated requirement of funds for the XIth plan period was Rs. 1,059,515 crores & for T&D section it was Rs. 449, 577 crores. However actual expenditure in the distribution is much below than the estimated amount due to several reasons.

### *Re-structured APDRP<sup>1</sup>*

The primary objective of this scheme is to reduce the AT&C losses of the state power utilities to 15%. It has been segregated into two parts.

Part A: For establishment of IT application for energy accounting & IT-based consumer service centre, expected investment amount is Rs. 10,000 crores.

Part B: Regular distribution strengthening project for which expected investment amount is Rs. 40,000 crores.

Initially funds for the projects under both parts of the policy would be provided as a loan. The entire amount of the loan for part A project would be converted into grant once the project will be completed. For projects under part B category, 50% of the loan amount would be converted into grant on achieving 15% AT&C losses on sustainable basis.

## ***Model State Electricity Distribution Management Bill, 2013<sup>1</sup>***

Several key features of the bill are mentioned below:

- In each financial year, the State government would submit an electricity distribution management statement before State legislature. Several key aspects of statement should be long term planning, customer protection, regulatory compliance, corporate governance & financial restructuring of State Distribution Licensee (SDL), to bring operational & financial viability of SDL.
- The statement shall comprise of KPIs by providing stress to payment of dues by government departments, distribution loss cut trajectory, provision of subsidy, energy accounting, improvement in collection efficiency & recovery of past receivables. The statement shall contain plans or strategies adopted by government to realize KPIs.
- The long term planning shall contain roadmap to reduce AT&C losses on time bound basis, SDL to estimate demand & AT&C loss,
- The bill requires the State government to evaluate twice a year the compliance of the guidelines, direction or regulations of the EA, 2003 by the SDL.
- The State government & SDL shall issue a MOU for specific target of KPI parameters in each financial year.

## **2.2 Review Area Narrow**

### ***Financial Restructuring of Discoms***

Under this scheme, the discoms & the State government are required to take measures for financial turn-around by restructuring the debt, which will have the support of transitional finance mechanism (TFM) by the Central government. The scheme was started in 2012 but faced hurdles as most of the eight states comprising 80% of the aggregate losses not able to meet necessary criterion including formulating detailed plan of the SERCs to liquidate regulatory assets & reduce cross-subsidy within six months from the date of approval.

---

1. "Electricity Distribution Crisis" at Energy Research Institute, TERI in 2015, page-6.

### **2.3 Factors critical to success of study**

By benchmarking & comparing among the State utilities, one can monitor the performance distribution sector & review the effect of the implemented measures. Following are the factors I have considered critical for the study:

- Issues of regulation such as timely issuance of tariff order are important. Here I have used it in another way such as creation of regulatory asset by considering the factor  $(\text{accumulated losses} + \text{subsidy}) / \text{Current AC}$ . This parameter also reflects the efficiency of the regulatory commission which is not under the control of State distribution utilities.
- Automatic pass through of fuel cost should be reflected in the financial data. This has been considered in the parameter the future gap in 2017 along with other forward-looking measures taken by the States.
- In this methodology of the ranking performance, financial performance is considered important with a priority towards AT&C loss reduction.
- Here the goal of unbundling is considered to enable the utilities to run on commercial principles & achieve independence in operation. Hence unbundling is treated as basic reform measures & huge negative marking is used for those not implemented the measure.
- Some of the factors such as Subsidy received / Subsidy booked though considered as a financial parameter but may depend upon the external sources & not in complete control of the utilities.

## Chapter 3: Research Design, Methodology & Plan

### 3.1) Research Design

#### *Benchmarking*<sup>1</sup>

Benchmarking is a performance monitoring method by which it is possible to assess the potential of improving efficiency within the Organization, to compare operating efficiencies of the Organization with respect to their national & International counterpart & to measure comparative improvements of the performance of an entity over time. A well designed benchmarking method assists entities to develop catch up plan to deploy the best practices & performance as followed by the lead entities of the sector. Benchmarking of distribution entities is a complicated exercise as it involves multiple inputs & outputs. Here in this study, I have considered several parameters such as AT&C losses, GAP after subsidy, subsidy booked/subsidy received, Debtors day, Creditors day etc for comparing the utilities based on the available public data.

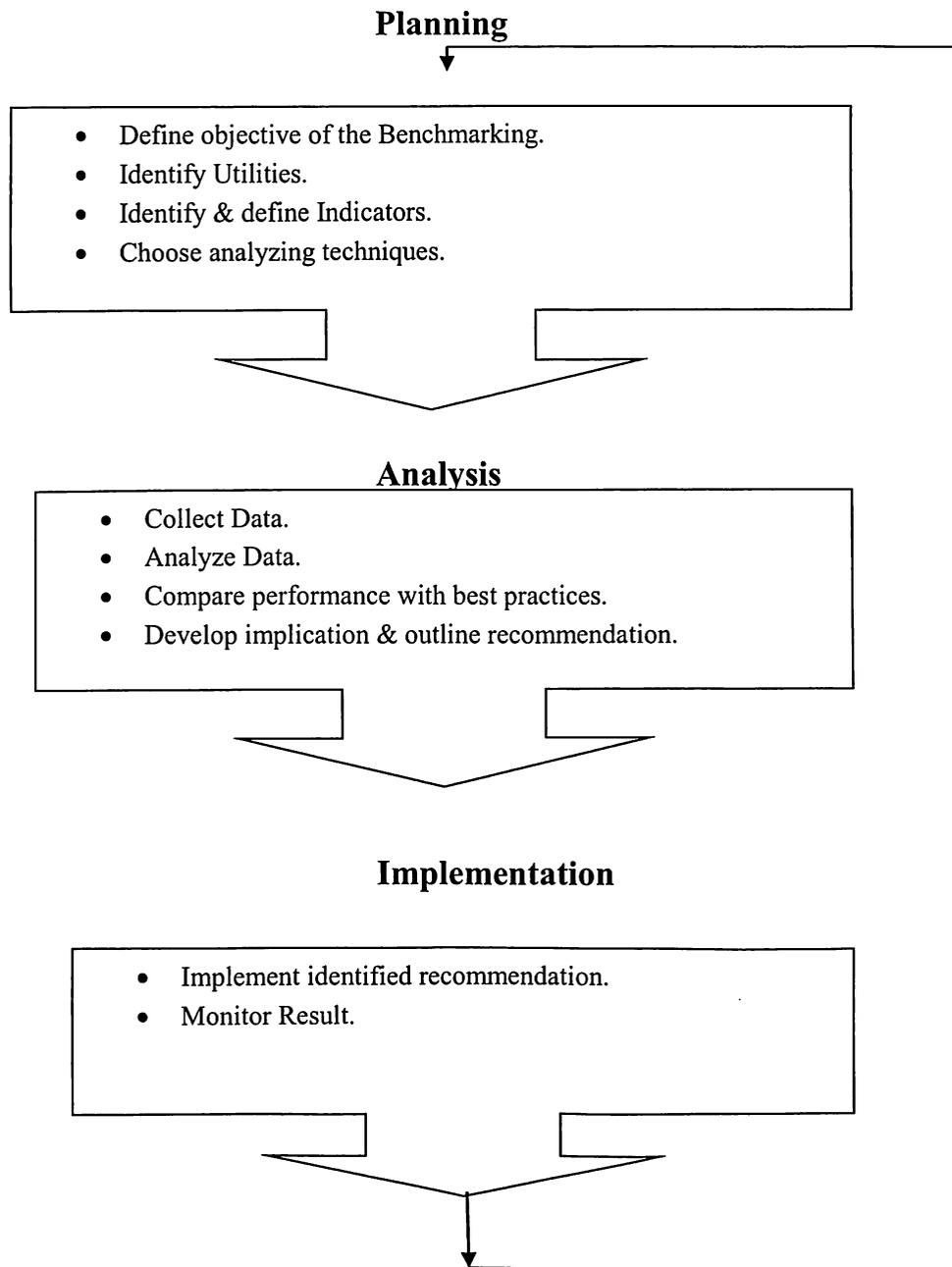
The entire Research procedure invariably constitutes into 3 parts:

- Planning.
- Analysis.
- Implementation.

The framework generally uses feedback mechanism so that the utilities can identify their area of weakness & implement the policies to remove the lacunae.

---

1. "Benchmarking of Electricity Distribution Utilities" By Thakur Tripta, page-2.



**Fig 3.1: Component of Benchmarking**

### ***Relevance of Benchmarking for Power Distribution Utilities***

With the enactment of Electricity Act, 2003, Distribution is separated from generation & private participation has been encouraged highly. The main motto is to improve the quality of supply in a cost effective manner i.e. providing a defined output for a minimal input. Such analysis would offer valuable lessons from the new structure that are being adapted & would help to understand the issues that will be faced by the regulators & consumers in future. In the open market regime, efficiency measurement by using this tool would be a particular area of interest for the regulators. As the market is moving towards competitive market, freed from the government control, regulators would require sophisticated benchmarking tools & methodologies to regulate monopolies & introduce performance based regulations while determining tariffs. Thus benchmarking can be a useful tool for the efficiency measurement of the distribution utilities.

### ***Summary***

Here in this study, I have used two methods for analyzing the State utilities performance based upon selected parameters:

- Analytical Hierarchy Process (AHP).
- Case Study.

AHP is a sophisticated benchmarking tool, which is used here for efficiency measurement of State utilities. In the case study approach, I have tried to analyze reform measure adopted by various developed countries & to draw some conclusion from those experiences.

## **3.2 Data Analysis Procedure**

### ***i) Analytical Hierarchy Process***

The Analytical Hierarchy Process (AHP) is a structured technique for organizing & analyzing complex decisions. Based on mathematics & psychology, it was developed by Thomas L. Saaty in the 1970s & has been extensively studied & refined since then.

It has particular application in group decision making & is used around the world in a wide variety of decision situations, such as in the field of government, business, industry, healthcare & education.

Rather than prescribing a correct decision, the AHP helps decision makers find the one that best suits their goal & understanding of the problem. It provides a comprehensive & rational framework for structuring a decision problem, for representing & quantifying its elements, for relating those elements to overall goal & for evaluating alternative solutions.

Users of the AHP first decompose their decision problem into a hierarchy of more easily comprehended sub-problems, each of which can be analyzed independently. The elements of the hierarchy can relate to any aspect of the decision problem- tangible or intangible, carefully measured or roughly estimated, well or poorly understood- anything at all that applies to the decision at hand.

Once the hierarchy is built, the decision makers systematically evaluate its various elements by comparing them with one another, two at a time with respect to their impact on an element above them in the hierarchy. In making comparisons, decision makers can use concrete data about the elements, but they typically use their judgments about the elements' relative meaning & importance. It is the essence of the AHP that human judgment, & not just the underlying information can be used in performing the evaluations.

The AHP converts these evaluations to numerical values that can be processed & compared over the entire range of the problem. A numerical weight or priority can be derived for the each element in the hierarchy, allowing diverse & often incommensurable elements to be compared to one another in a rational or consistent way. These capabilities distinguish the AHP from other decision making techniques.

In the final step of the process, numerical priorities are calculated for each of the decision alternatives. These numbers represent the alternatives' relative ability to achieve the decision goal, so they allow a straightforward consideration of the various courses of action.

### *ii) Application of AHP method in the Study*

Here in this report a performance index has been created using the AHP method. A number of quantitative & qualitative factors have been considered to measure the performance of the various states. Out of the various parameters, I have considered the following for comparison & measurement of the performance:

- Aggregate technical & commercial (AT&C) losses in %.
- Gap after subsidy (AC-AR)/AC.
- Subsidy received / Subsidy booked in %.
- Subsidy/AC in %.
- Receivables in days.
- Payables in days.
- Energy Deficit in %.
- Power purchase cost per unit in Rs/Unit.
- Future Gap (2017)/ACS.
- (Accumulated losses + Subsidy receivables)/ Current turnover.
- Status of Reforms & Restructuring:
  - a. SERC:
    - i) Constituted.
    - ii) Operational.
    - iii) Open Access Regulation.
  - b. Unbundling or Corporatization:
    - i) Unbundling or Corporatization implementation.
    - ii) Privatization of Distribution.
- Collection efficiency in %.
- Net Profit.

Though there are several variables such as Debt-Equity ratio, Interest coverage ratio, Fixed assets to total debt ratio, sustainability etc but I have chosen the above factors as I have found them representative of other aspects. I have assigned each of the above parameters certain weightage & the total score is constituted as 100. Then for each of the above factor certain criterion has been set based on which every State has been assigned relevant score. Finally pairwise comparison has been done to derive the importance of every factor with respect to the goal & sensitivity analysis has been done to conclude the best performing state & compare the others with the best performer. It is essential that state governments & power distribution utilities adhere to certain minimum requirements which are mandatory as per law or otherwise. So the methodology adopted here has proposed negative marking for non compliance. In the absence of negative marks such parameters would have led to assigning of some weightage to the minimum eligibility criterion at expense of parameters which can distinguish merits of rated utilities. The parameters that have negative marks include status of reforms & restructuring, payables (up to minus 3%). The negative marking provides the necessary depth & flexibility to the rating methodology. Finally the methodology presented here is illustrative & can be replicated with larger set of variables for larger set of samples.

### ***iii) Case Study***

Basically, a case study is an in depth study of a particular situation rather than a statistical survey. It excels at bringing a complex issue or object understandable & can add strength to what is already known through previous research. It emphasizes a detailed contextual analysis of a limited number of events or conditions & their relationships. Researchers have used the case study method for many years across a variety of disciplines.

Critics of the case study method believe that the study of a small number of cases offer no grounds for establishing reliability or generality of the findings. Others feel that it may biases the findings. However researchers continue to use the method with success in a carefully planned & crafted way.

Here in this study, I have analyzed a strategic model used for the improvement of the distribution performance in a Latin American country. Also as per the pending Electricity Amendment Bill, 2014, separation of carriage & content will be the mandate & thus try to force the company

better service by providing retail consumers the option to choose the supplier who will pay the regulated set fee to the company owning the wires for the right to use the network. I have tried to use the lessons in the open access in distribution from the international experience by examining the effects in New Zealand, the United States & Europe.

### **3.3 Data Sources**

The formulation of this report has faced several constraints due to the availability of the data. Primary data available was inadequate for completion of the report. So the data is taken from various secondary sources & the precision of the report heavily depend upon the accuracy of the secondary data available.

In table 3.1 I have detailed the performance parameters used for AHP analysis. Apart from those parameters detailed in the table, I have considered another two parameters, one is Net profit & the other is Status of reform & restructuring. The utilities those are profitable for three consecutive years taking account of the subsidy, have given highest priority. Through the parameter Status of reform & restructuring, I have tried to measure the implementation of the various reforms proposed through various policies & acts such as unbundling & corporatization, privatization of distribution etc in the utilities.

Parameters	Name of States										
	West Bengal	Gujarat	Delhi	Tamil Nadu	Haryana	Karnataka	UP	Rajasthan	Uttarakhand	Jharkhand	MP
AT&C losses in %	18	23	22	18	31	19	33	30	25	38	22
Gap after Subsidy	-0.01	-0.01	-0.05	.34	.11	0.01	.26	0	0.2	.24	.19
Subsidy/AT&C in %	0	6.3	0	5.86	24.1	4.85	9	54.45	0	8.49	13.82
Subsidy received/ Subsidy booked in %	100	100	0	100	100	90	100	7	100	100	100
Debtors day in days	85	43	239	95	69	179	323	43	183	205	131
Creditors day in days	55	0	11	39	61	162	551	30	315	120	363
Energy deficit in %	2.8	4.5	0.8	6.2	4.2	7.7	21.6	2.4	6.5	19	7.8
Power purchase cost/unit in Rs	2.77	2.92	3.99	3.91	3.46	2.71	2.82	3.92	2.49	2.56	2.29
Collection efficiency in %	94	99	95	94	95	98	83	95	88	86	77
Future Gap(2017)/Current ACS	-0.17	-0.18	.03	1.38	0.39	.1	.2	.3	.05	.13	.7
(Accumulated losses+subsidy receivable)/Turnover	-.03	.01	.03	-1.44	-.46	.03	-1.34	-.5	-.78	-.95	-2.29

Table 3.1: Performance parameters used for AHP<sup>2</sup> & <sup>3</sup>

2. AF-Marcados EMI Analysis
3. "Beyond Crisis"- A World Bank Report, page-102.

## Chapter 4: Findings & Analysis

### 4.1 Analysis using Case Study Approach

#### *a. Enersis of Chile: a strategic model<sup>1</sup>*

At the beginning of the 1990s, high total losses coupled with poor service quality & low access rates were the trade mark for the most Latin American countries. Average tariff level was below the cost of supply & both government subsidy & cross-subsidization were usual practice. As the external subsidy was used to keep the inefficient utilities afloat with worsened service, people started to lose their willingness over time to pay higher tariffs. Thus income source for the power sector started to decline, deepening the crisis.

From 1985 to 2000 Latin America was the region in the developing world that made the most significant advances in the comprehensive reform of the power sector. In 1982, Chile became the first Latin American country to introduce wide-spread reforms in the power sector, made the state owned enterprises privatized to improve efficiency & the result is impressive. Today some of the Chilean utilities perform better than their counterpart at the developed countries.

Enersis, the largest group in the country which is also involved in generation, is responsible for the distribution in the country's capital at Santiago. Enersis was formed from the dismantling of the Chilena de electricidad in 1981. In that year three new companies were formed & these companies were privatized in 1987. One of those companies Chilectra, the main electricity distribution company at Santiago changed its name to Enersis in 1988. Soon after the privatization, Enersis began to move aggressively into diversification program. After privatization their profitability increased sharply. Parameters indicating operational performances of the company are excellent. When they took over the distribution, T&D loss was 22 percent. Today total losses are less than 5 percent.

Enersis successfully participated in the privatization process of distribution companies in Argentina, Brazil, Peru & Colombia & became the owner & operator of some of the largest companies in those countries.

---

1. 1999\_Enersis: Global Strategy in the Electric Power Sector, page 10-19.

Immediately after the takeover of each company, Enersis had implemented its in-house approach to improve operational efficiency & to overcome the challenges imposed by the specific environment. Total losses were reduced in all cases.

In the complex socio-economic & political condition, the approach used by Enersis for loss reduction is based upon a strategic model & related action plans & programs. Based on the concept of customer segmentation & geographic sectorization, the strategic model focuses on elimination of irregularities in electricity supply to all existing users, actions on customer's connection needed to improve quality of supply & to capture clandestine users to become customer of the utility.

### ***Field of action of the strategic model***

The strategic model applied by Enersis to impose market discipline comprises actions in:

- Regulation.
- Commercial Management.
- Technical management.
- Community engagement.
- Training & management of external contractors.
- IT & punitive action.

### ***Regulation***

In this field main actions include working together with the political authorities & regulators to achieve:

- A tariff structure that would allow financial sustainability.
- Tariff rate reflecting cost of efficient supply meeting service quality standards, assuring a equilibrium between customer & service provider.
- Generation of sufficient funds to subsidize low-income consumers by means set by the government: charging additional to a section of the consumer, government grants or combination of those.
- Use of technologies for low-cost & environmentally sustainable supply.

## ***Commercial Management***

Main actions comprise:

- Integral management of metering, billing, collection, inspection of meters, disconnection-reconnection due to unpaid bills.
- Implementation of policies for customer service & programs for payment of old debts & commercial regularization.
- Increasing the number of point of contacts for customer service to move the company closer to the consumer.
- Marketing program for creating awareness about the electricity being a priced commodity.
- Communication program to inform consumers about their rights & obligation.

## ***Technical Management***

Main actions include:

- Construction of distribution network less vulnerable to tampering & irregular connections.
- Field assessment for unmetered consumers, tampered meters, irregular connections.
- Proper sealing of consumption meters.
- Monitoring operational condition of installed seal & public lighting service.

## ***Training & Management of external contractors***

It includes:

- Assuring ethical behavior of the contracted worker.
- Continuous training & working tools including safety equipment.
- Certification of contractors based on quality, environment, occupational health & safety.
- Implementation of procedures for monitoring execution of contracts for outsourced services including auditing of representative samples.
- Documentation of workers with unethical behavior.

### ***Community engagement***

It is an important area where following actions need to be taken:

- Set direct contact with communities, their leaders & the authorities in order to create awareness about the electricity being a commercial good.
- Design & execute campaign to create a culture of payment of electricity bill on regular basis, preservation of electrical infrastructure & behavior to avoid electrocution.
- Develop programs for training & orientation of children from low-income family.

### ***Information technology***

Investments in IT comprise:

- Incorporation of MIS to support commercial & technical functions.
- Progressive application of automated meter reading devices for reading & monitoring consumption of large & medium consumers.
- Systematic field actions on irregular service condition detected through the commercial MIS.
- Permanent regularization & incorporation of users to the consumer database.

### ***Punitive action***

It refers to:

- Working together with justice department to prevent electricity theft.
- Ensuring police action when required.
- Recovery of old debt in selected cases through judicial action.
- Systematic presentation before justice of the cases involving large consumers.

Energy prices are unregulated in Chile for customers with connected capacity greater than 2 MW, for temporary consumers & for consumers requiring special quality of supply. Consumers with unregulated prices may negotiate directly with the service providers & other consumers are subjected to maximum price set by the tariff.

In power distribution, companies are allowed to set tariff reflective of the cost of the supply including allowed losses & a return on investment. The operational cost include: general & administrative cost of distribution, selling, maintenance & operating cost of distribution assets, cost of energy & capacity losses, & expected return on investment of 10% per year including the cost of renewing all the facilities & physical assets used to provide the distribution services, including interest costs, intangible assets & working capital. The various costs are based on average of those incurred by the distribution companies & more efficient companies may earn more than 10% return.

***b) Separation of carriage & content in distribution***

The introduction of retail competition in distribution is expected to induce more competition through the separation of carriage & content. Till date in India, the price discovery & private participation is mainly confined in generation as most of the distribution companies are state-owned entities. So the government of India have proposed the Electricity Amendment Bill,2014, pending before the Parliament for approval through which they want to segregate the wire & the supply. The owner of the network who receives the payment for the carriage will be responsible for the losses incurred & discrepancies between the metered quantity of power injected into the system versus the metered quantity of power delivered. The benefits of segregation are including:

- Increasing the focus on wire system strengthening & development.
- Increasing accountability, transparency & commercial prudence & thereby reducing & controlling AT&C losses.
- Identifying & containing the wheeling cost of power by focusing on reducing technical losses.
- Helping to develop an energy market.
- Improving customer service.
- Introducing competition in retail supply & offering consumers a choice of supply by commoditizing electricity.
- Achieving long term commercial viability of the power sector by improving efficiency.

### *Experience from New Zealand*

Separation of carriage & content has been successfully implemented here & retail competition is thriving. Most New Zealand consumers have a choice of 20 retail brands selling power. The Electricity Industry Participation Code that is used to govern the electricity market with effect from November, 2010, promotes retail competition by specifying efficient switching process & by allowing any party to be an electricity retailer by maintaining minimum specifying standard. Retailers & few large consumers buy electricity directly from spot market.

Here are some of the crucial supports provided by the institution for smooth implementation of retail competition:

- **Consumer Switching Fund:** To strengthen competition 3.5 year consumer switching fund was established. The first initiative for that was the awareness campaign to promote the benefits of comparing & switching retailers. The funds aim to improve the flow of the information through the system to increase the consumer's readiness for switching & thus to create more pressure among the suppliers to create innovative pricing mechanism. During the first 90 days of the campaign, around 4,00,000 people visited the website & around 1,25,000 switching took place.
- **Metering:** It is a critical part of the retail market competition. The act specifies the meter performance, maintenance & meter supplier's responsibility for accrediting metering test houses. There are 20 test houses all over the country currently approved by the authority. The advanced metering system is a significant steps taken by the retailers, which helps the consumers to analyze expenditure & control cost by running appliance during low cost period of the day. This also helps the distributors & retailers to maintain their portfolio more cost effectively.
- **Market Administration:** The authority performs the market administration by itself such as appointing auditors for the test houses, metering installations, providing back up procedures in the event of failure of market system. Two private contractors handle the registry & reconciliation.

---

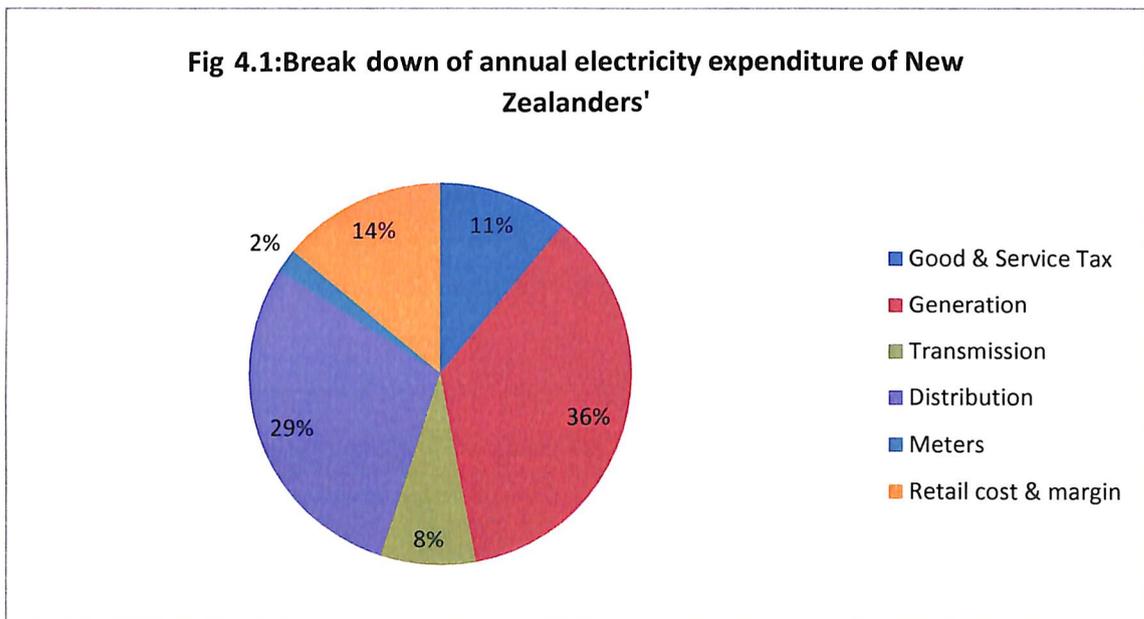
2. "More Power to India" a World Bank Report by Pargel Sheoli & Banerjee Ghosh Sudeshna page 200.

**Registry:** It is a national database containing information about 2million point of connections where electricity is supplied. This is managed by a competitively selected private contractor.

**Reconciliation:** The competitively contracted reconciliation manager receives & processes about 50 million metering data point on a monthly basis, reconciles them against a registrar of contracts & passes the data to industry participants.

- **Distribution:** Twenty nine distributors are engaged in the distribution through overhead line or underground cable. There are also a large number of embedded generators connected directly to the distribution network rather than to the national grid.

Despite the separation of carriage & content, it seems that the monopoly nature of wire business still have the advantage over the content, which faces stiff competition. Here is the break-up of the annual expenditure of the New Zealanders for electricity:



From the data, it is clear in spite of the separation distribution accounts for 29% of the total electricity expenditure for the New Zealanders' where as content or retail cost accounts for 14%.

### *Experience from the United States<sup>3</sup>*

Around 20 numbers of states have implemented varying degree of retail competition, in which consumers have the right to purchase power from the non-utility provider. The incumbent utility may continue to serve the consumers who select to buy from it but for consumers who choose to buy from the alternate service provider, the incumbent utility acts as a wire & service provider but not the seller of the electricity.

The cost of the distribution remains regulated reflecting the cost of service basis, the cost of electricity generation is decided on the wholesale market or through bilateral contracts. A much larger pool of consumers are now exposed to the wholesale power rates.

Here the whole power market does not appear to be workably competitive. Hence by providing the access to the alternate retail service provider doesn't address the fundamental problem of whole sale market from which those suppliers have to purchase electricity. As a result though fuel cost was falling but price was rising in 2011. So the beneficiary of the restructuring here are not the consumers but those largely depreciated generating units.

### *Experience from European Union*

Competitive retail & generation markets were introduced in this region in the 1990s & early 2000s. This changes & restructuring though would not able to bring the desired outcome as the large central-station power plants remain the main supplier for vast majority of the consumer. But with the time scenario is changing.

To promote the retail competition which puts customer firmly at centre is the main motto of the Eurelectric- the union of the electricity industry at pan-european level. Trustworthy & well-functioning markets are the foundations of Europe smart energy system which is based upon the new type of customers who are more demanding, aware, active & engaged. The principle of this market is that customers, buying electricity & electricity services should be like any other purchase: they should be able to make an informed choice based on a variety of offers & be confident that any potential problem will be solved later on.

---

3. "More Power to India" a World Bank Report by Pargel Sheoli & Banerjee Ghosh Sudeshna page 212.

According to Eurelectric (2013), several trends are reshaping the global power sector. Some of them are growth of renewable energy, a more decentralized system, foundation of the smart grid & retail competition & new services. As a result of the increasing retail competition, greater product differentiation may be possible now & consumers are expecting more from their retail supplier.

Centralized utility model is under threat from varieties of emerging technologies & affect the revenue expectations of utilities' investor. Fixed line distribution network system is also getting vulnerable with the time as viable & economic renewable-energy storage technology is not far off. This will permit the production close to where it will be consumed thus reducing the need for carriage. In a scenario where energy storage coupled with distributed generation produces risk to the viability of the grid & consumers are willing to leave the system if cost-competitive alternatives are available, tariff restructuring for lost revenue of the utility is a temporary fix to the threat of customer leaving.

To assess the level of retail competition in Europe following factors have been analyzed<sup>4</sup>:

- **Market Concentration:** The level of concentration is an important indicator of market concentration. For a competitive market necessary characteristic is high number of supplier & low market concentration. Here the market share for four largest suppliers is around 75% with persistent high level of market concentration. This means the retail competition is still not well developed in many countries.
- **Entry & exit activity:** Over the last few years in some countries under EU such as Germany, Hungary, Greece etc significant entry or exit activity of the active nation-wide supplier for the household electricity market have been noticed. Whereas for some other countries there are no significant entries.
- **Mark-up:** It is the difference between the retail energy component & wholesale energy cost. This is a proxy for the gross margin from which suppliers need to pay among others costs, operating costs & taxes. The higher the competing suppliers' in a market lower the retail margin should be (mark-up indicator). In the presence of competitive & liquid

---

4. ACER market monitoring report\_2014: Page No-50.

whole-sale market the retail price should have a closer relation with the wholesale price. It has been found that in the countries such as Great Britain, Ireland, and the Netherland etc switching rates are high & suppliers need to spend additional money on sales, marketing & customer service to retain consumers. But the cost to serve the consumers is relatively lower. In some countries with regulated price, mark-ups have been assessed negative, which signifies retail prices energy component set to be lower than whole-sale energy cost. This seems to be the case in Romania & Latvia, which creates a potentially dysfunctional market in these countries. Here tariffs are not cost reflective, resulting an unattractive market for competing energy suppliers. A high mark-up value should create price competition which has been observed in the markets of Great Britain, Ireland, and Netherland etc & largest savings are available in these countries.

- ***The relationship between retail & wholesale electricity prices:*** The degree of alignment of these two prices can be a proxy for the efficiency of retail suppliers. In several countries where it was expected a solid relationship between retail & wholesale price, mark-ups have increased constantly over the period. Norway constitutes a best benchmark, which has a dynamic retail market & relatively low mark-up. The retail electricity price here is linked to the day-ahead wholesale price & any changes in the whole sale prices are quickly passed to the consumers. This makes the price formation process more transparent.
- ***Product Differentiation:*** In a retail market level of competition is not always related to the price component. With the maturity in the market, instead of price competition suppliers depend on product diversification strategies to attract & retain customers. In the majority of the European countries, suppliers provide fixed price offers, which insulate the consumers against any future price increase. The availability of forward wholesale products allows the suppliers to hedge their supply cost & supports the offering of fixed retail prices. Some consumers also prefer variable price offers, as these present a slightly lower initial price than the fixed price offers. Other product diversification strategies are linked to dual-fuel product or important of green issues.
- ***Switching activity:*** Household consumers are generally offered standard contractual terms & conditions by the suppliers & they are unable to negotiate on an individual basis like an industrial consumer. Switching rates are the indication of consumers'

participation in the market & several nodal agencies previously expressed their concern over low switching rate. In 2013 Norway, Ireland, Great Britain & the Netherlands have above 10% switching rate, which is more than majority of the countries in the electricity market. Although switching rates are lower in majority of the countries but trend are upward.

### ***Concluding Observation<sup>5</sup>***

Two important observations are:

- 1) From the experience of New Zealand, it is clear that strong institutional support is required to make the retail competition successful. In that country public sector takes an active interest to make it seamless for the consumers to switch in & out of hiring various retail suppliers. The same is not case for the United States, where retail competition remains less successful & retail switching rates are far lower as public sector doesn't support in the similar way. In European countries success rates are modest in retail competition & here too public sector & Institutional capacity does support the consumers.
- 2) The relevance of carriage & content model<sup>6</sup> in the long run needs to be questioned. With the technological advancement, distributed generation & energy storage may get affordable in the coming days & the future of the centralized electricity model with grid system & large number of low-tension consumers may not be so bright.

### ***Indian perspective***

The scenario in India is slightly different from the above discussed countries. India has a shortage of power & this means if customers get options to a new technological paradigm they may desert the utility or use it as a back-up option. Utilities that cannot offer quality service to the existing customer & have large pool of potential customers un-served are vulnerable to any technological changes that let consumers get reliable power at their location.

---

5. "More Power to India"- World Bank report: Page No- 210.

6. The Economist 2013a- "How to lose half a trillion Euros." October 2012.

Due to constrained Institutional capacity available to provide required customer support, the still developing regulatory capacity at state level & development on distributed generation front it may be useful to start pilot projects for retail competition in India rather than full scale application.

#### **4.2 Analysis using AHP Method**

The methodology, that is used here, is developed keeping view the poor financial health of the state distribution utilities & it may be useful to serve as a basis for Government assistance to the state power sector.

The states under consideration in this study are:

- West Bengal.
- Gujarat.
- Delhi.
- Rajasthan.
- Tamil Nadu.
- Haryana.
- Karnataka.
- Uttar Pradesh.
- Uttarakhand.
- Madhya Pradesh.
- Jharkhand.

Out of these states, Tamil Nadu, Uttar Pradesh, Rajasthan, Jharkhand & Haryana state boards have incurred huge losses & as on March, 2014 their combined debts are around Rs. 2.5 lacs crore.

The summary of the parameters used for analysis are detailed here:

Sl. No.	Parameters	Weightage
1	Aggregate Technical & Commercial Losses in %	0.263,-.105
2	Gap after subsidy	0.112
3	Subsidy/AC in %	0.097
4	Subsidy booked/ Subsidy received in %	0.037
5	Debtors day in days	0.083,-.002
6	Creditors day in days	0.125,-.037
7	Energy Deficit in %	0.035,-.004
8	Power purchase cost per unit in Rs/unit	0.093
9	Collection efficiency in %	0.039
10	(Accumulated loss + Subsidy Receivable)/ Turnover	0.035
11	Future Gap (2017)/ Current ACS	0.034
12	Net Profit	0.028,-.005
13	Status of reform & restructuring  a) SERC: i) Constitution. ii) Operational. iii) Open Access Regulation.  b) Unbundling or Corporatization i) Implementation. ii) Privatization of distribution.	0.014,-.007

**Table 4.1: Parameters used for AHP with respective weightage**

Here Aggregate Technical & Losses (%) for SEBs means ratio of difference between net energy input (Mkwh) & Energy realized (Mkwh) with net energy input (Mkwh). Debtors day in days means ratio of debtors for sale of power multiplied by 365 with revenue from

sale of power. Creditors day in days means ratio of creditors for purchase of power multiplied by 365 with cost of purchase of power.

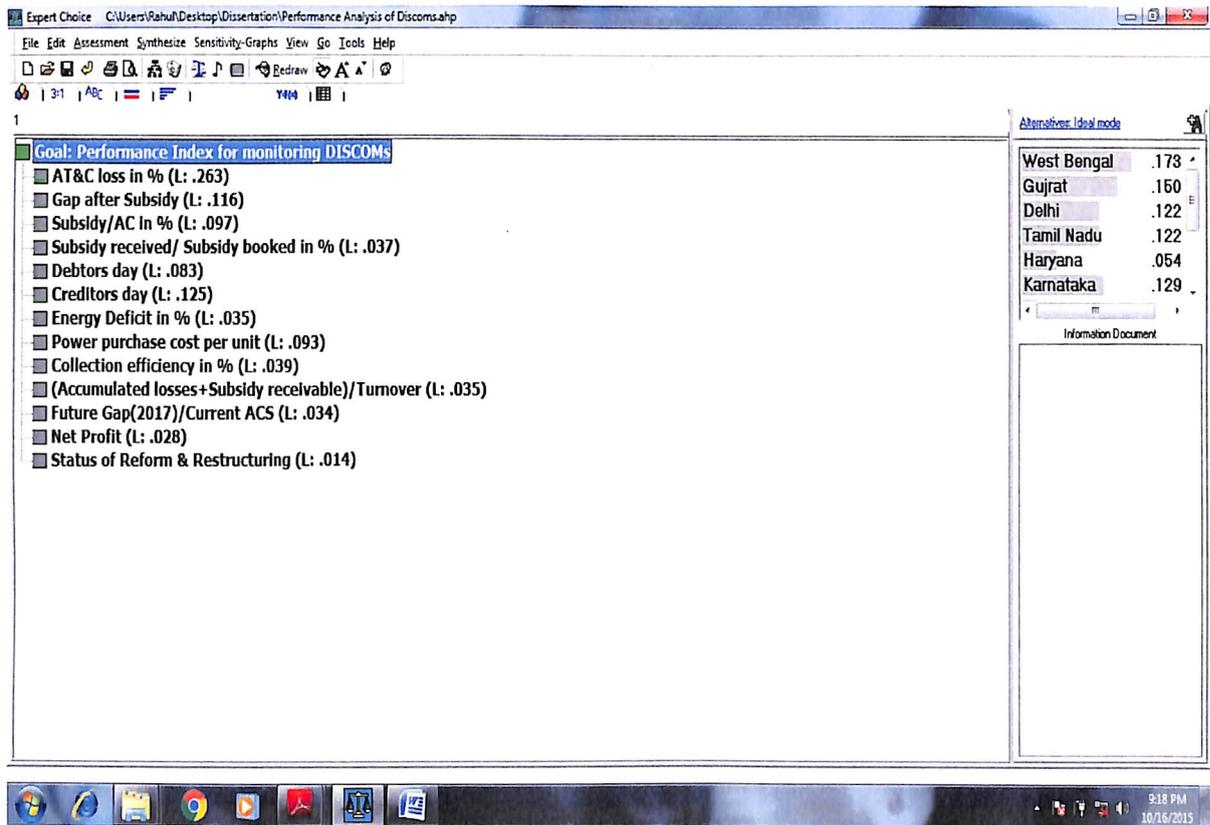


Fig 4.2: Weightage of objectives with respect to goal in software.

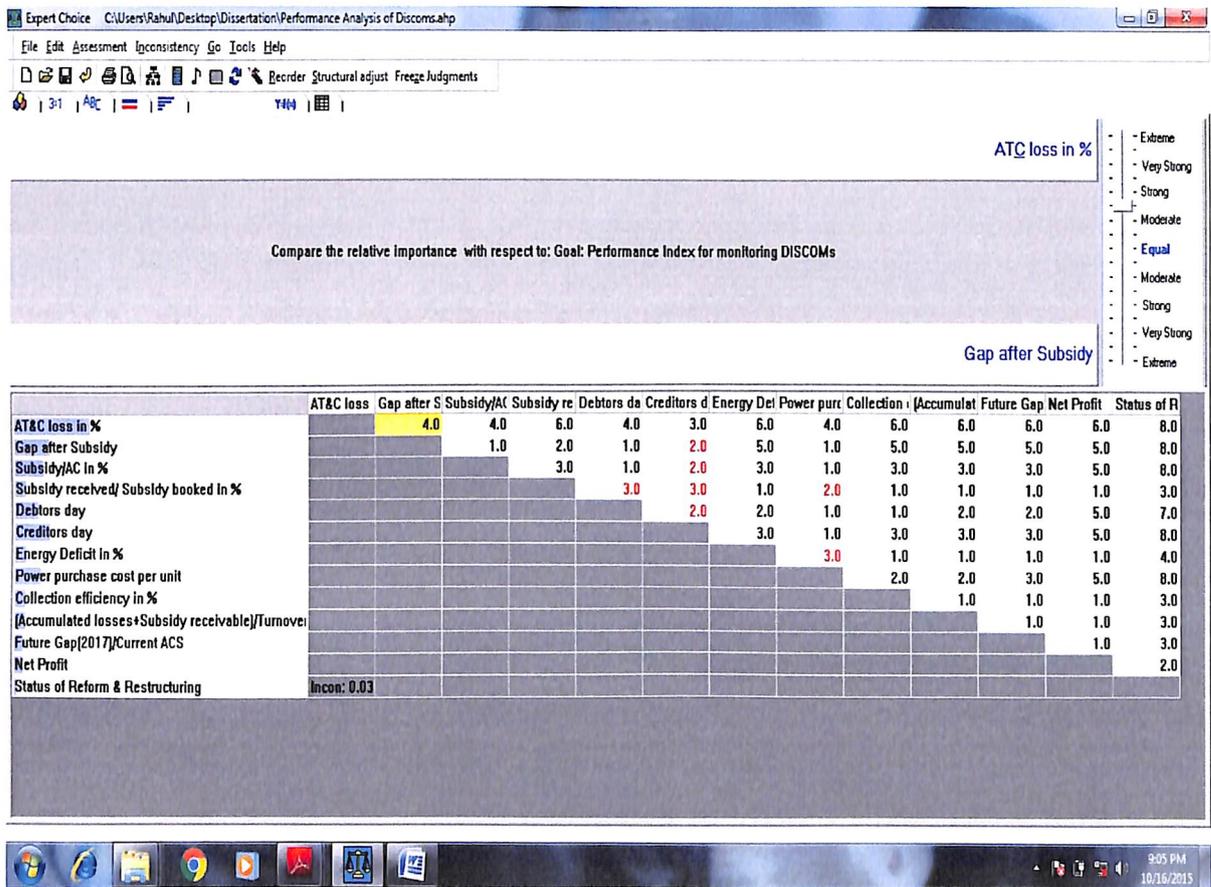


Fig 4.3: Relative importance matrix with respect to each objective.

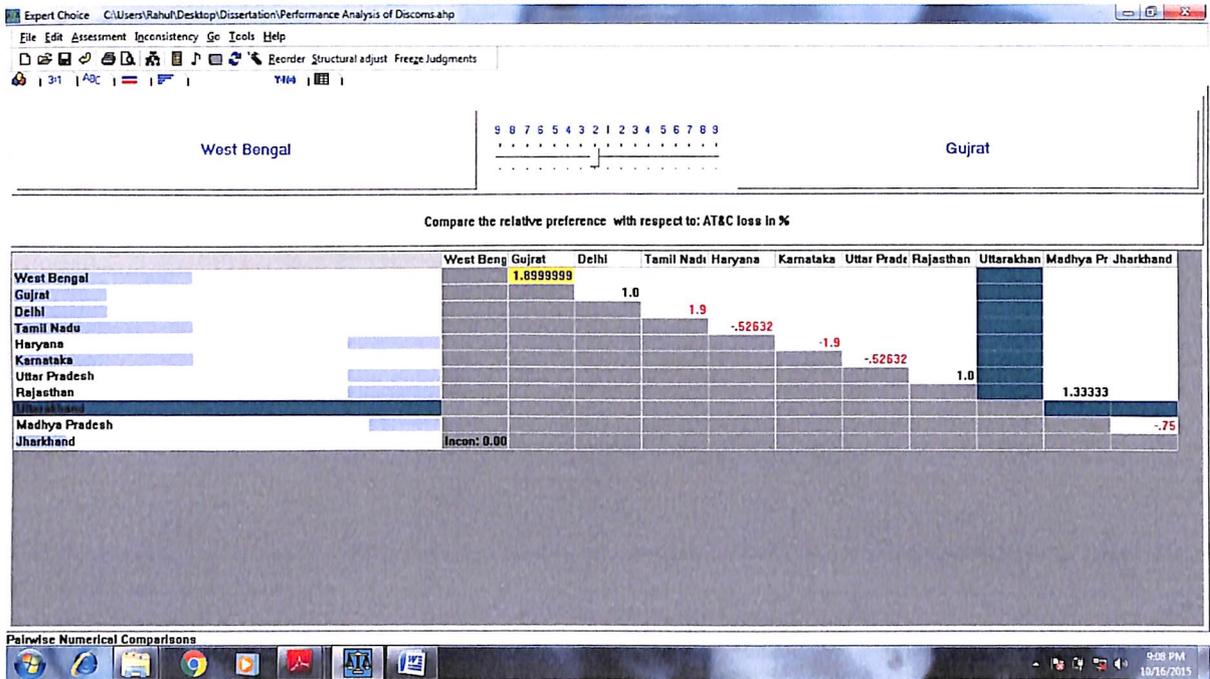


Fig 4.4: Pair-wise comparison of AT&C with respect to alternatives.

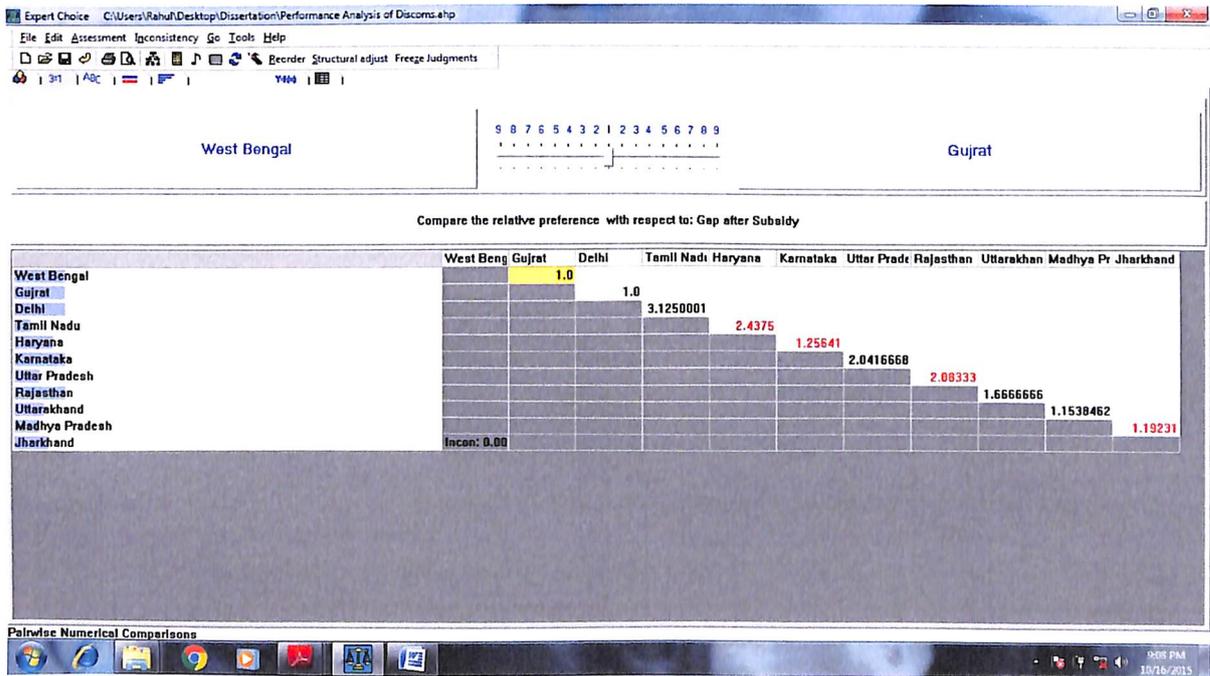


Fig 4.5: Pair-wise comparison of Gap after subsidy with respect to alternatives..

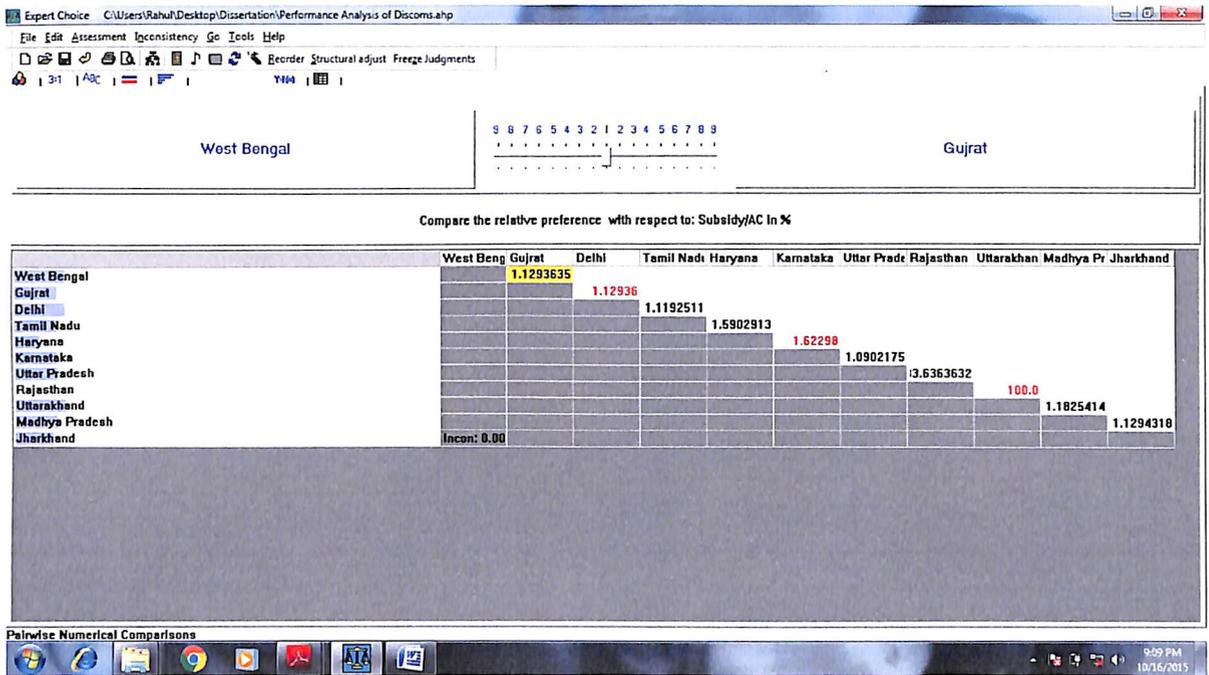


Fig 4.6: Pair-wise comparison of Gap after subsidy with respect to alternatives..

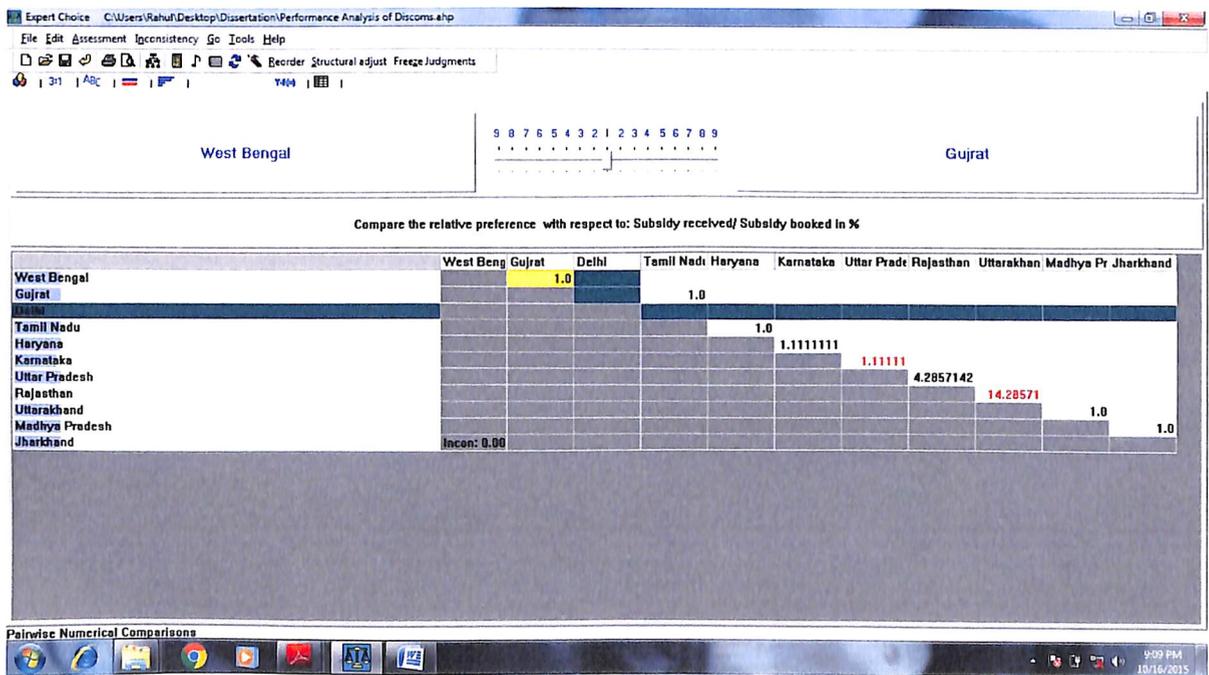


Fig 4.7: Pair-wise comparison of Subsidy received/subsidy booked with respect to alternatives.

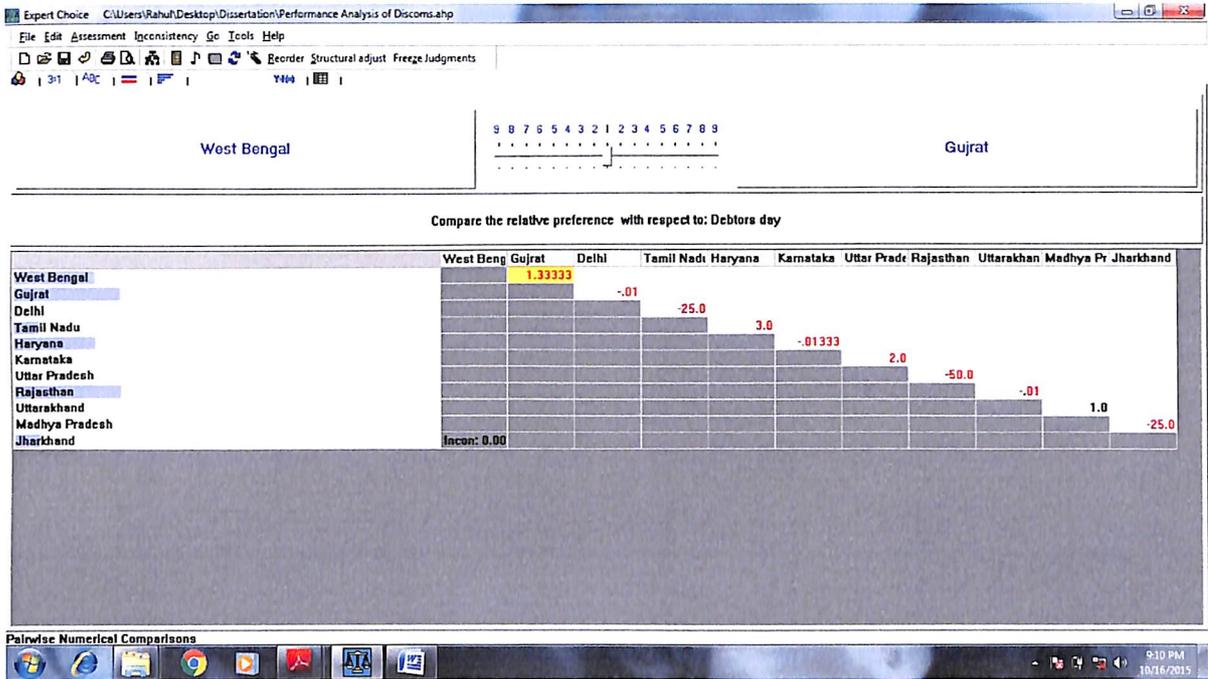


Fig 4.8: Pair-wise comparison of Debtors day with respect to alternatives.

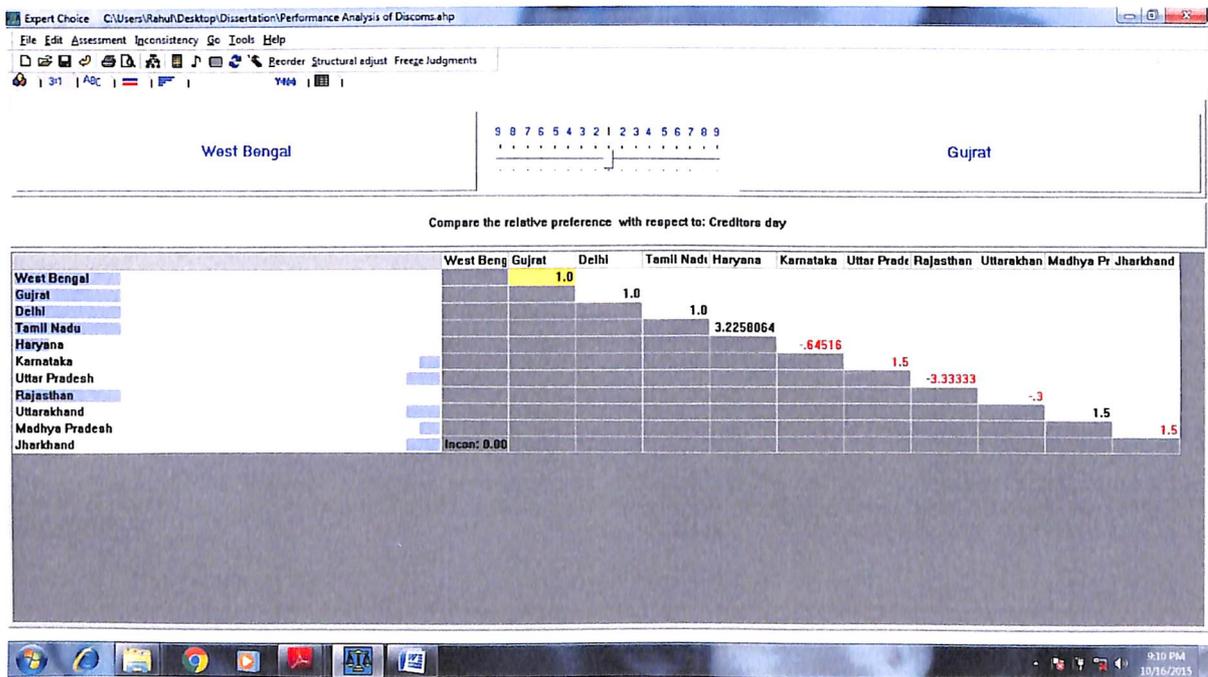


Fig 4.9: Pair-wise comparison of Creditors day with respect to alternatives.

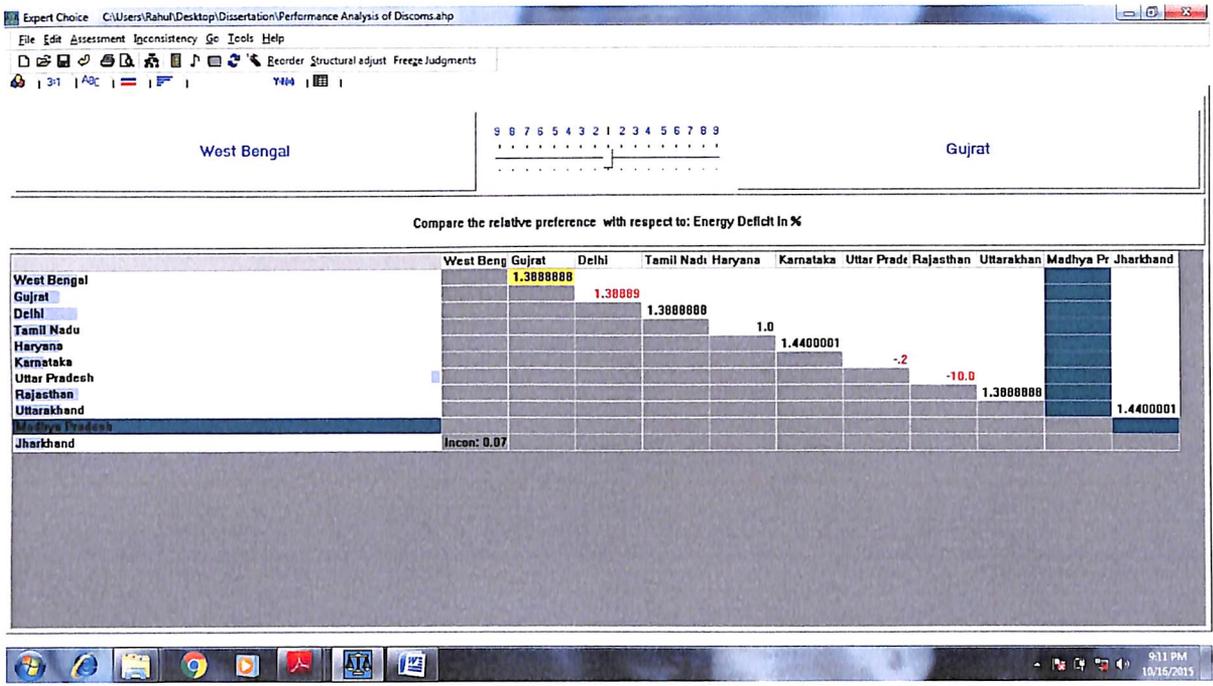


Fig 4.10: Pair-wise comparison of Energy Deficit with respect to alternatives

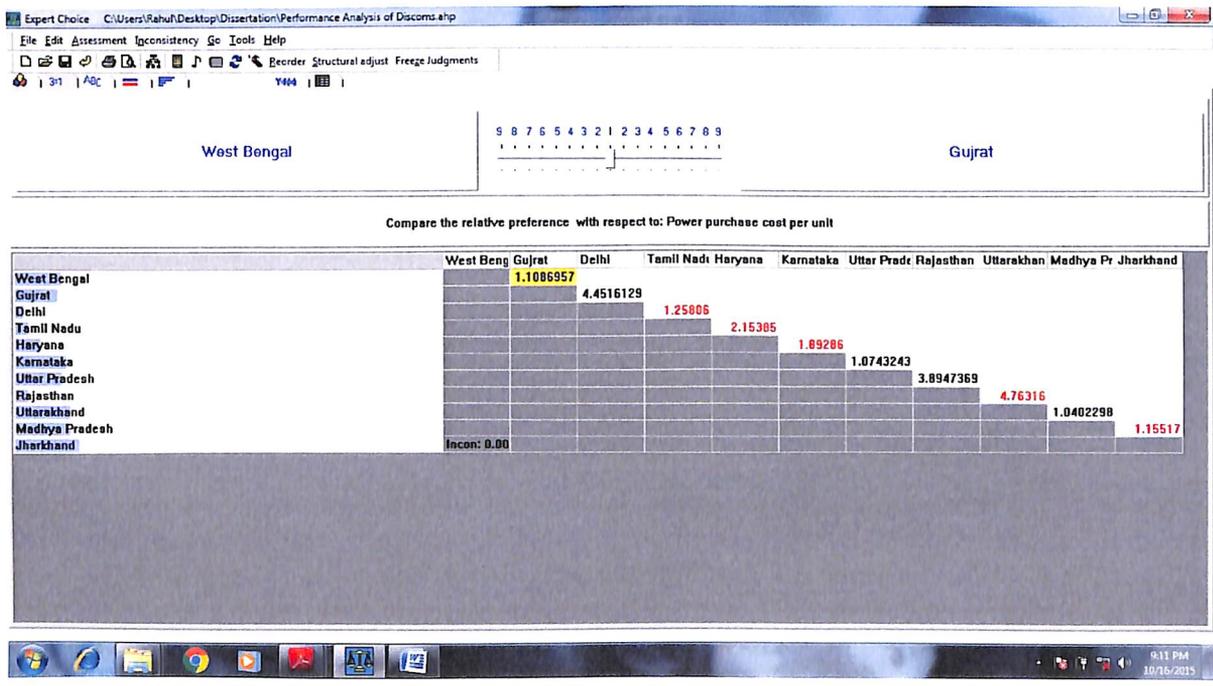


Fig 4.11: Pair-wise comparison of Power purchase cost per unit with respect to alternatives.

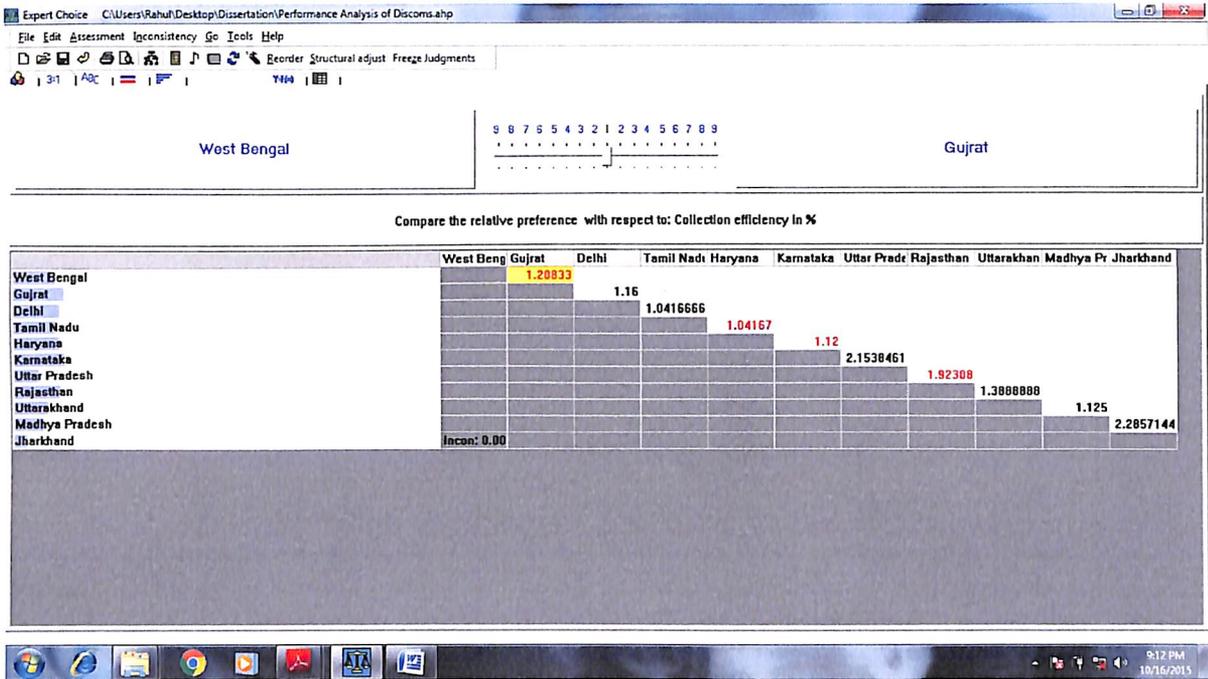


Fig 4.12: Pair-wise comparison of collection efficiency with respect to alternatives.

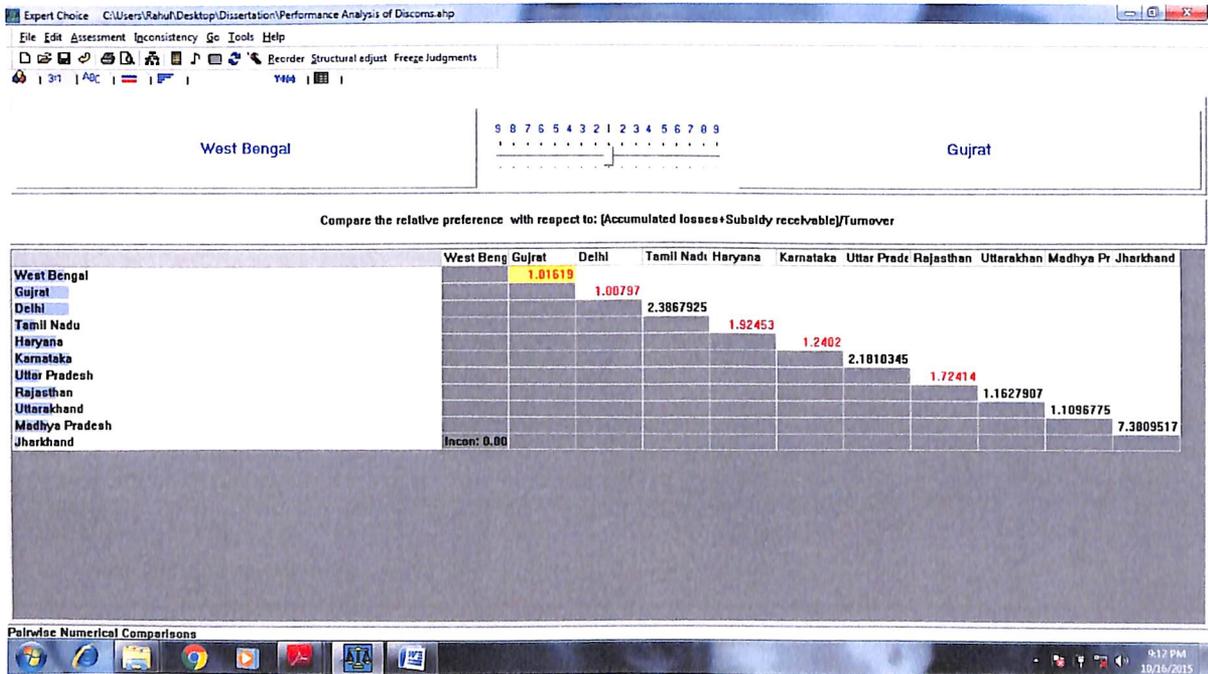


Fig.4.13: Pair-wise comparison of (Accumulated losses+ Subsidy receivable)/turnover with respect to alternatives.

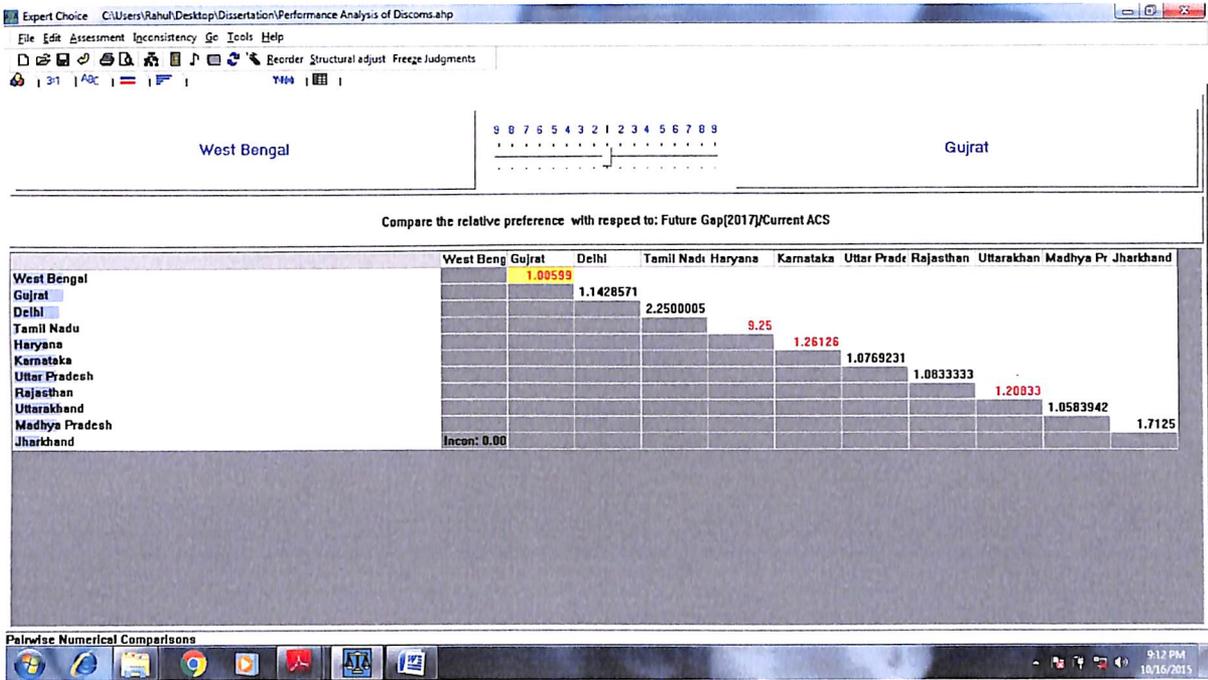


Fig 4.14: Pair-wise comparison of Future Gap (2017)/Current ACS with respect to alternatives.

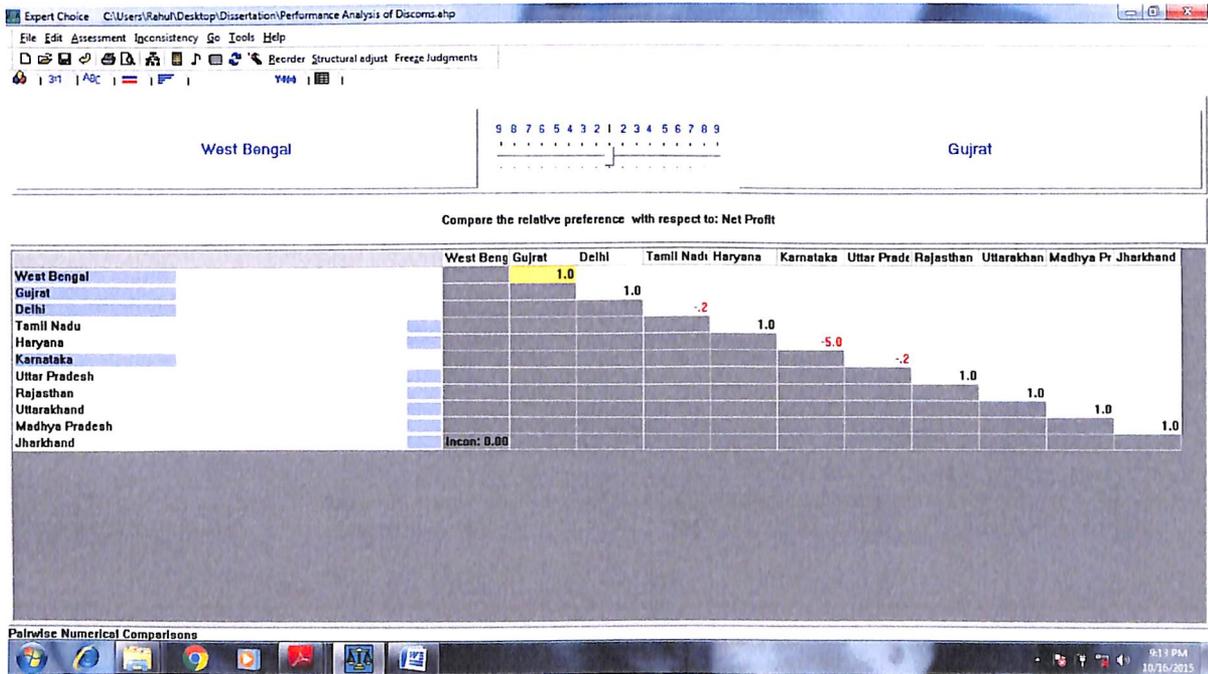


Fig 4.15: Pair-wise comparison of Net profit with respect to alternatives.

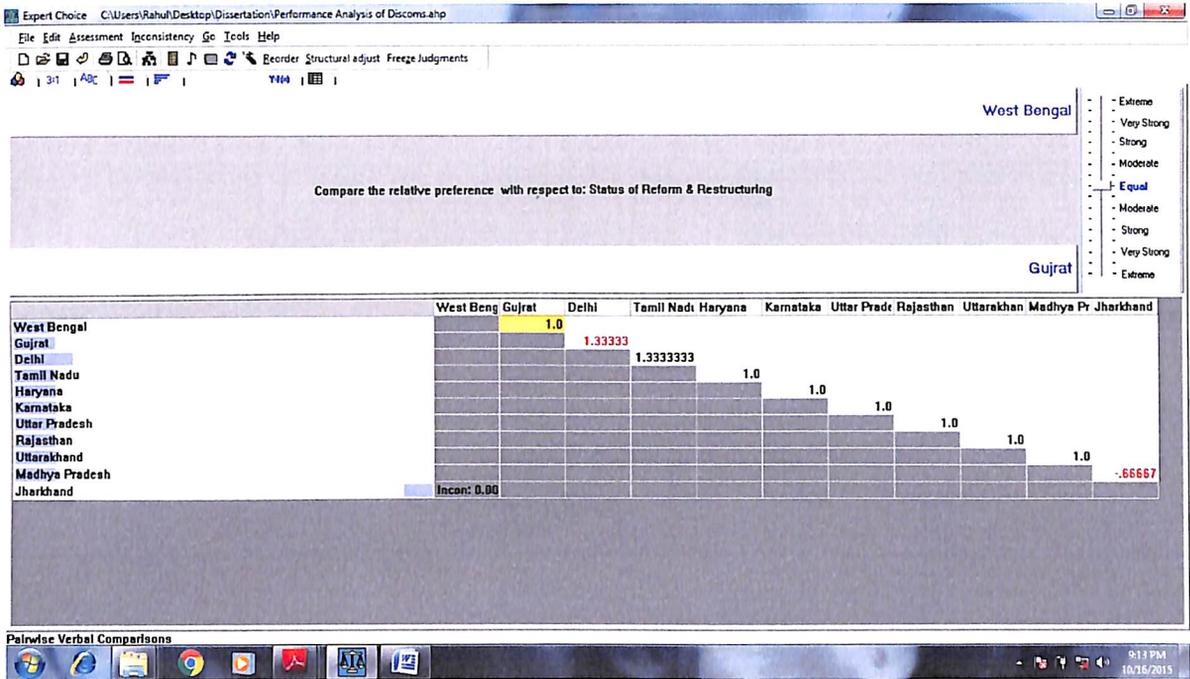


Fig 4.16: Pair-wise comparison of Status of reforms & restructuring with respect to alternatives.

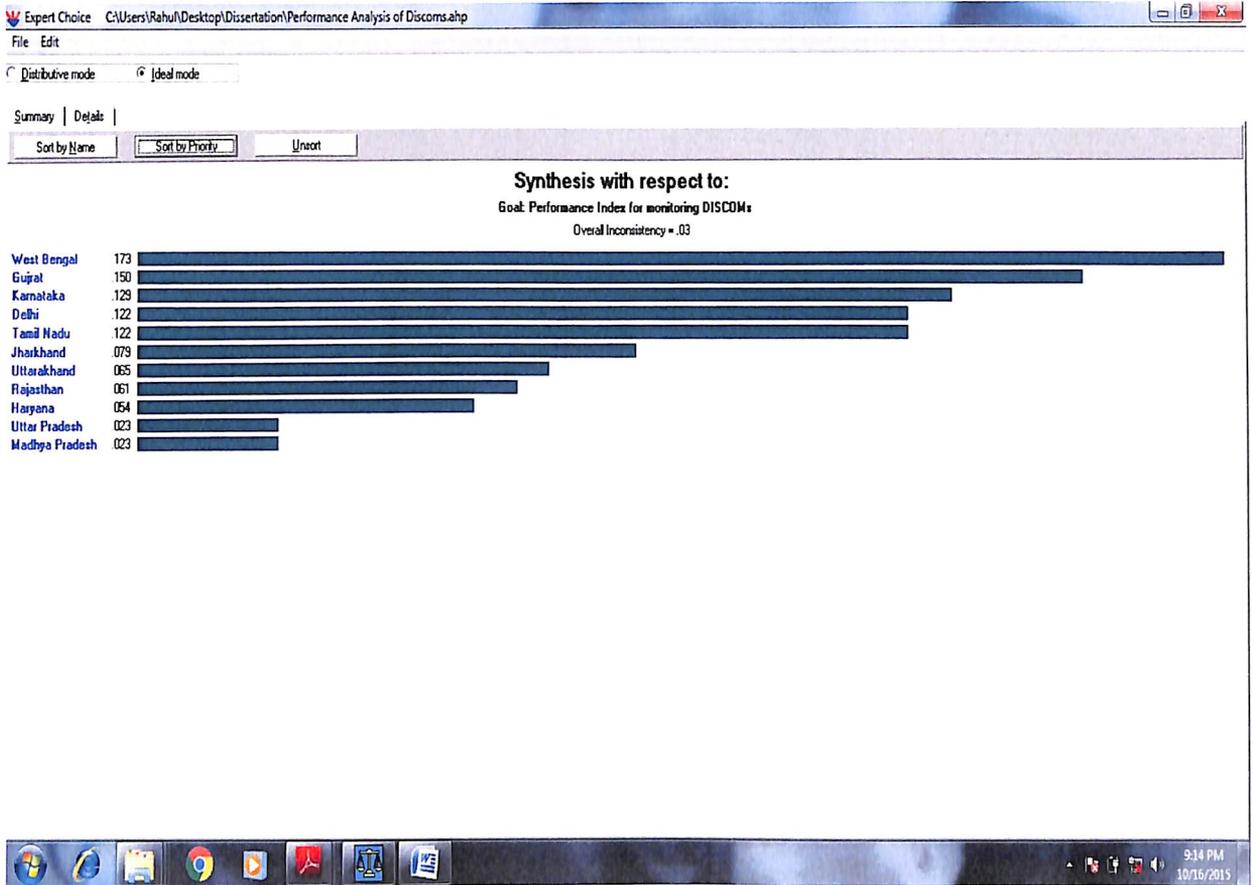


Fig. 4.17: Synthesis of the goal: Performance Index for monitoring DISCOMs.

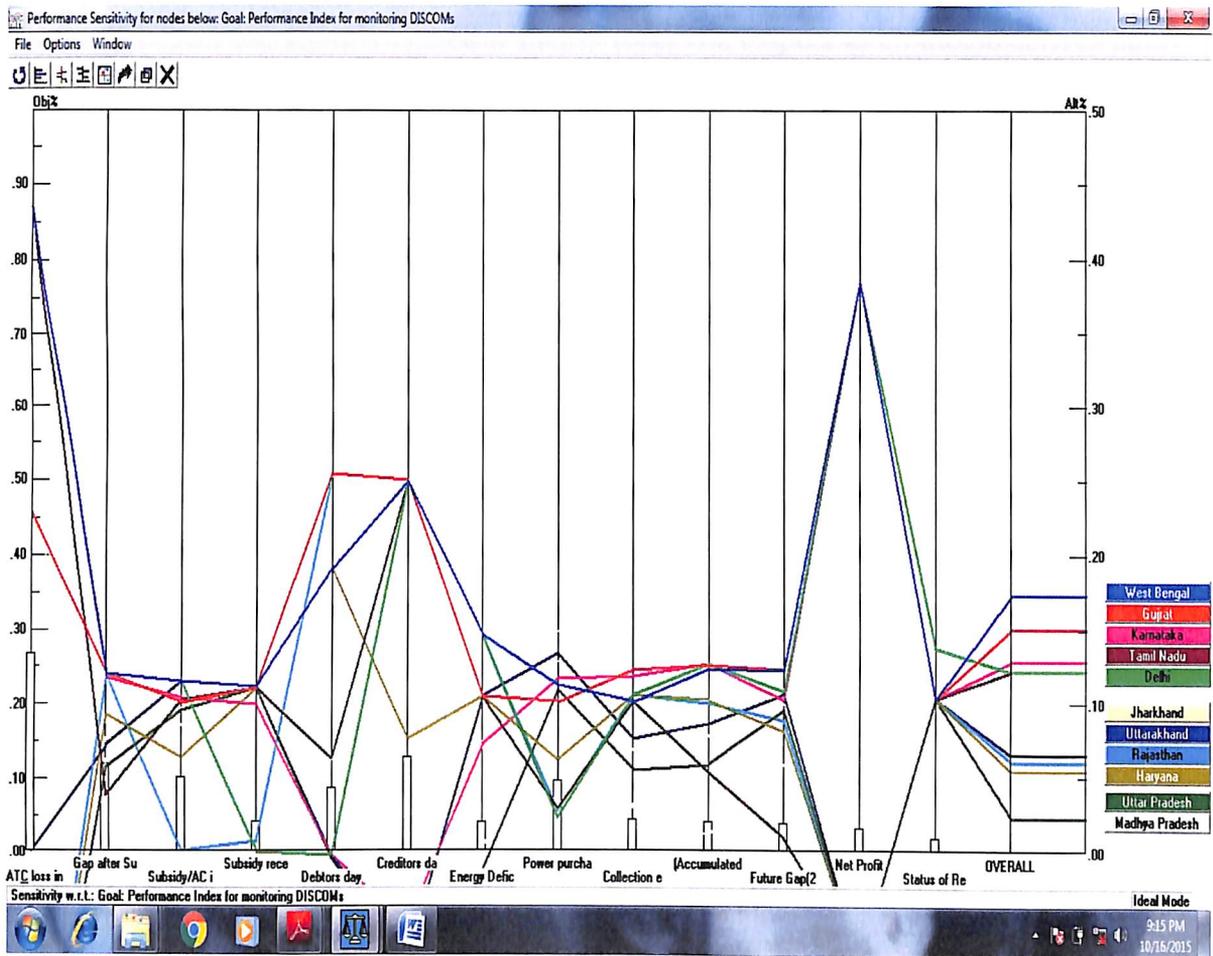


Fig. 4.18: Performance sensitivity for the nodes.

### 4.3 Result of the Study

After synthesizing with respect to goal, I have found that West Bengal is at the top of the list with 0.173 points. Gujarat & Karnataka are at the second & third position of the list with 0.150 & 0.129 points. Even though West Bengal appears to be in the top spot of the list, in several parameters the state performs poorly such as collection efficiency, debtor days etc but the tariff is cost reflective with moderate AT&C losses. Uttar Pradesh & Madhya Pradesh are at the bottom of the list with 0.023 points. Both the states perform poorly on AT&C losses, creditor days, debtor days, collection efficiency, and energy deficit etc.

Here I have also performed performance sensitivity analysis. Sensitivity analysis with respect to goal node will show the sensitivity of the alternatives with respect to all the objectives below the goal. The performance sensitivity displayed here shows how the alternatives were prioritized relative to other alternatives with respect to each objective as well as overall.

Here it is clearly found that AT&C loss has the highest priority among the objects, then gap after subsidy & so on. West Bengal has performed well not only in terms of AT&C loss but also in terms of overall objectives.

In summary, AHP method based on the above parameters can be used to provide a quick assessment of various power utilities at a point of time.

### ***Indian power distribution sector bottlenecks from the study***

From the above study, I have highlighted some of the bottlenecks of the Indian power distribution sector.

• Revenue covers only 70-75% of the average cost of supply.
• Over-stretched system.
• Significant AT&C losses, largely due to unmetered supply & theft.
• Rising gap between cost of supply & revenue realized.
• Distribution Transformer lines are overloaded & HT-LT line ratio is high.
• Under investment.
• Outdated rules, regulations, management structure & accounting practice.
• Unmetered service such as in agriculture.

Table 4.2: Bottlenecks of Indian Power Distribution Sector

## **Chapter 5: Interpretation of the Result**

### **5.1 Interpretation of the result for AHP**

Two conclusions emerge from the analysis. Firstly, power purchase costs have played a key role in the deteriorating finances of the state utilities. Those utilities, that rely on their own generation & contracted purchase, have performed better.

Another important factor is AT&C losses. Poor capacity planning by allowing extra connections without adequate investment on network has increased AT&C losses. The HT/LT ratio plays an important role for the reduction of AT&C losses & consequently power purchase costs, which in turn affect financial gap.

The states which have increased the tariff regularly have also improved efficiency such as West Bengal & Gujarat etc. The nominal increase in tariff is adequate to offset the rising cost profile. Whereas the states those have neglected to increase tariff, have been hit hardest.

### **5.2 Interpretation of the result for Case Study approach**

Indian power distribution sector is witnessing lot of positive changes of late such as increasing consumer demand, increased urbanization, rural electrification & increased private sector participation. By comparing the outcome from the International experience, it may be concluded that in following areas, Indian power sector need further improvement.

#### ***IT based information system<sup>1</sup>***

Most distribution utilities in India struggle to maintain & utilize a comprehensive information system be it for the asset, commercial, consumers or financials. Lack of accurate information hinders decision making in arresting theft, making investment & estimating losses.

Though Ministry of Power, Government of India, have launched R-APDRP for the XI five year plan, the establishment of automated & reliable system for sustained collection of automated baseline data & adoption of information technology for energy accounting is necessary before sanctioning any regular distribution strengthening project.

---

1. "Emerging opportunities & challenges" By PWC at World Energy Council, page-35.

## ***Metering & Energy Audit***

Despite of the focus given to energy audit & metering all consumers, rural domestic & agriculture consumers are still not metered completely. So the figure of the distribution losses reported by the utilities may not be appropriate as there are significant numbers of unmetered connection, or connection with electromechanical meter or defective meter.

To identify energy & revenue loss, comprehensive energy accounting system is very much essential & consumer indexing is not completed to enable it.

## ***AT&C losses***

AT&C losses are very high in India, in some cases hovering around 35% & these losses are higher in both technical & commercial heads. Higher technical losses are due to old & dilapidated conductor, old & inefficient distribution transformers, longer lines serving distant & remote loads & higher commercial losses are due to power theft, poor collection efficiency, faulty metering & poor billing.

## ***Open Access***

India is a country with shortage of power as demand is always higher than supply. This shortage contributes to reduce India's economic growth & reduced level of consumer amenity. Also non-cost reflective tariff is reducing the international competitiveness of some Indian firm & forcing the Industrial consumers to opt for sub-optimal energy supply choices.

Open access seems to be the policy response for those problems. But from the International experience it seems that open access in distribution & separation of carriage & content may not be able to sort out the problem completely. It will be more fruitful, if the measures apply in steps before going to the full phase roll out.

## ***Slow progress in Private sector participation***

Outright privatization has faced several hindrance in India such as past liabilities, network rundown condition, staff liabilities etc. Initially privatization of distribution was done in Orissa in 1999 & was considered a failure due to inadequate support from the local government.

Then distribution franchisee model was developed which is Public Private Partnership (PPP). It offers a demarcated part of licensed area to an operator for a fixed tenure based on competitive bidding & effective input price for purchasing power. Franchisee would earn based on its performance in reducing losses & improving efficiency. This model came to prominence when Bhiwandi is handed over to Torrent Power after competitive bidding. Franchisee was able to reduce AT&C losses, transformer failure rates, increase reliability indices & increase customer satisfaction.

### ***Managing talent***

Recruitment in majority of the utilities is sporadic over the 10-15 years with some of them resorting to contractual agreement to fulfill the manpower requirement. As the jobs of the utilities are less attractive compare to IT, manufacturing or some other industries, Engineers & other technical personnel are less interested to join the utilities. Also most of the utilities have either defunct or under-performing training program. As a result of these problems, personnel are found to be undertrained or unskilled in most of the cases, which hit the efficient operation.

### **5.3 Comparison of the result with Assumptions**

From the result it has been found that some of the utilities such as West Bengal, Gujarat etc. are performing well & even without subsidy from the government they are making profits. Most of the states have implemented reforms measure & re-structuring.

Bulk of the total debt of power distribution sector in India is because of few states. Tariffs are not cost reflective for the majority of the state power utilities except in few cases of West Bengal, Gujarat, Karnataka, Delhi etc. & in some states the gap between actual cost of supply & tariff is not covered even after receiving subsidy from the government. In some states government even are not providing the necessary subsidy support & the state utilities become commercially unviable.

In summary, it may be concluded that despite of the reform measures with some improvements in the performances there are lot to be done to make Indian power distribution utilities competitive & commercially viable. So the research findings are in line with the assumption.

## 6. Conclusion & Scope for future work

### *Annual Revenue Requirement (ARR)<sup>1</sup>*

ARR is the sum total of the power purchase cost, cost of operation & maintenance, capital cost, cost for working capital, interest, depreciation, tax etc. with adjustment for preceding year's revenue gap. Tariff for the financial year is fixed depending upon the ARR & estimated sale of electricity. As per NTP, 2006, the SERCs should endeavor to set the tariff above 20% of the average cost of supply & in actual practice few states are implementing the measure. In most of the cases tariffs for domestic consumer are less than ACS except in few cases such as West Bengal, Gujarat etc. Some state governments such as Karnataka, Delhi, Punjab etc. provide budgetary support in the condition that the utilities provide tariff concession to the domestic & agriculture consumers. Also subsidy from the government is not available upfront as stipulated to the EA, 2003.

### *Regulatory Asset<sup>2</sup>*

Since tariff is estimated ex ante, actual revenue realized may not cover the ARR. The gap is to be adjusted while estimating the ARR in the ensuing year. This revenue deficit is earmarked as regulatory asset. As per NTP, 2006, realization of regulatory asset is a time-bound exercise & should not exceed more than three years period. But lack of timely cost reflective tariff revision has resulted in its yearly nationwide magnitude to the tune of more than Rs. 70,000 crores & its interest component costs around Rs. 9,500 crores as per estimate by World Bank in 2014.

Some of the states such as Uttar Pradesh, Rajasthan, Tamil Nadu etc. are incurring massive losses due to unchecked regulatory assets.

To avoid the mounting regulatory asset & meet the ARR, discipline in tariff setting is necessary. Following measures may address the mounting problem faced by the discoms.

- 
1. "Electricity Distribution Crisis" at Energy Research Institute, TERI in 2015, page-4.
  2. "Electricity Distribution Crisis" at Energy Research Institute, TERI in 2015, page-5.

## ***Remedial Measures***

### ***a. Discipline in tariff setting<sup>3</sup>***

To cater the mounting regulatory asset & to meet the ARR, the state regulators should explore ways to liquidate the existing regulatory assets in a time-bound manner. They should not allow carrying forward the same as it will increase the problem. Apart from that SERCs should comply with the NTP, 2006 to impose discipline in tariff-setting, to reduce the revenue deficit. SERCs should avoid the consideration of subsidies while issuing tariff order until that subsidy has been realized upfront. So cost reflective tariff is mandatory.

### ***b. Feeder separation<sup>4</sup>***

The consumers in India are of varying capacity. Till date, more than 30 percent of the total populations are in below poverty level. Rural households & Agriculture are the sectors where subsidy is required for integrated social development. To cater that requirement & to make sure of the proper utilization of the subsidy, feeder separation is necessary, specially for agriculture. To prevent over-usage of irrigation pumps & limit power demand, many State governments have stipulated certain hours per day power supply with a cap over the capacity of the pump. But as the power supply for rural households & irrigation are through the same feeder, many times it has been observed that drawing of electricity by the pumps is more than the stipulated hours. It is putting more load than the projected demand & quality of power supply is deteriorated. Some State governments have taken initiative for feeder separation but they have faced some problems. Due to irregular power supply, consumers are not sure about running the pumps resulting trust deficit. This problem can be sorted out by assuring uninterrupted supply for specific period per day & informing the consumers about that before-hand so that they can take care of the farming requirement. Gujarat is one State, which has implemented feeder separation successfully.

### ***c. Pre-paid meters<sup>3</sup>***

Apart from agricultural consumers, low-income households are getting benefitted from the subsidy.

3. "Electricity Distribution Crisis" at Energy Research Institute, TERI in 2015, page-8.

4. "Emerging opportunities & challenges" By PWC at World Energy Council, page-38.

State governments usually put a cap on the consumption level to which households are entitled for subsidy. So metering is essential to keep a check on the consumption level. However even after metering, discoms have faced difficulties to bill the consumption. It may be due to lack of human resource for door-to-door checking, monitoring of meters, and resistance from consumers etc. Pre-paid meter may solve the problem of the discoms. Under this scheme, a household can draw electricity up to the monthly threshold of the free or subsidized electricity. After that, the consumer may allow to draw power beyond the threshold limit if he is willing to buy credit for his monthly consumption. This will spare the utilities of door-to-door checking exercise & also allow consumers to monitor their monthly consumption. This may also reduce AT&C losses & contain subsidy volume. However for successful implementation of this scheme requires close coordination administration at different level. Initially it can be implemented in selected districts to get a feel about the pros & cons.

#### ***d. Controlling AT&C losses***

Various approaches that can be followed to reduce AT&C losses are mentioned below:

- Using High Voltage Distribution System (HVDS) & Aerial Bunched Cable (ABC) both the technical losses & the fault percentage in the LT line can be reduced drastically.
- Distribution transformer & feeder-wise metering.
- Reactive power compensation by capacitor.
- Separation of agriculture & distribution feeder.
- Removal of sub-standard CRGO steel for transformers.

#### ***e. Modernize & transparent accounting practice***

The accounting practice of discoms is often not transparent, which jeopardizes the tariff-setting activities of the SERCs. This raises concerns & often delays in issuing the tariff orders. Discoms should apply computerized accounting practices with the help of sophisticated software such as ERP etc. which will improve collection & archiving management of operational & financial data.

#### ***f. Promoting competition***

Till now State-owned utilities enjoy monopoly in power distribution & in the absence of competition, there have been serious lapses in their functioning & inefficient delivery by them. Privatization of the distribution sector was initiated sometimes back with few circles in Delhi, Orissa & West Bengal, but except Mumbai in no other States two operators are allowed to compete in one circle. Thus consumers really don't have the option to choose their supplier & unacceptable price hike by the private entities becomes a topic of debate in the political circle. By separating carriage & content, consumers will get the option & it will invoke more competition. Also private participation through franchising may be an option to bring improvement.

But from the International experience, we have seen that for successful implementation of the retail competition strong Institutional support is necessary with active interest from the public sector to make it seamless for the consumers to switch-in & switch-out for hiring their suppliers. Hence it is advisable to implement the idea in selected circles initially to understand the problems or challenges. After gathering sufficient experience, it can be rolled out to other circles in phases.

#### ***g. Creating public awareness***

Informed consumers are the key to deliver quality service in an economy. Public participation is central to implement any strategies or measures effectively. Since tariff has been a contentious issue, regulatory commissions should use electronic & print media & information technology to reach out to the public for creating awareness.

#### ***h. Power planning<sup>5</sup>***

Power purchase accounts for more than 60 percent of the distribution cost & it is essential for the utilities to perform a comprehensive exercise to project demand for short term, medium term & long term. To procure power on short term basis during energy deficit period is always costlier & utilities should minimize the short term purchase by planning properly.

---

5. "Beyond Crisis"-A World Bank Report, page-109.

### ***i. Demand assessment & network planning<sup>5</sup>***

To ensure utilities' power distribution capabilities are efficient & adequate to meet not only current demand but also future demand, existing network need to be strengthened by in depth demand assessment & network planning. Here in this study I have found technical losses are very high in some states such as Uttar Pradesh.

### ***j. Data quality<sup>5</sup>***

Energy data are still not reliable & timely. The majority of the state utilities are burdened by incomplete metering, defective meters & manual meter reading. These lead to inadequate billing & revenue collection. There is an urgent need to focus on energy auditing to contain AT&C losses.

### ***k. Skills<sup>5</sup>***

The implementation of R-APDRP, which is designed to reduce losses, increase efficiency & energy auditing by using information technology, will only be possible if the utilities have sufficient manpower with necessary skills & requisite training in information technology.

### ***l. Customer satisfaction & rights of consumers***

In India about 20 percent of the consumers provide 80 percent of the revenue. Hence improved & well functioning customer service is necessary. This can be achieved by using modern technology such as providing information about power cut to the customer's mobile etc.

Also supply obligation should be enforced. Utilities sometime cut their own consumers to profit from short term sale.

## **6.1 Key trends**

The four key trends that may shape the country's electricity distribution in the next decade are mentioned below:

### **a. Increased customer expectations<sup>6</sup>**

With more exposure to the improved service standard across sectors such as banking, healthcare, consumers in India are expecting better service from the utilities.

*i) Implementation of standard of supply:* Implementation of standard of performance & making utilities pay for deficient service standards will be a reality.

*ii) Customer as a stake holder:* Feedback from customer complaint, interactions, consumer grievance redressal forum, ombudsman etc. enables utilities to design service as per consumer expectations.

*iii) Multiple service delivery options:* With parallel licensee, open access & private participation the customer will have more options while choosing the power supplier.

### **b. Enhanced regulatory oversight<sup>6</sup>**

The existing trends in electricity costs & recovery in distribution sector are showing a rising gap between actual cost of supply & realization. Some state regulators in Jharkhand, Tamil Nadu, Rajasthan & Haryana etc. have revised tariff orders after a long gap. Going forward, there may be regular tariff revision but utilities should have mechanism to collect the revised tariff otherwise it will increase the problem for the utilities.

### **c. Segregation across business elements**

There was unbundling & restructuring of SEBs across the country in the last decade. In the coming days focus will be on segregating each element in the distribution business to bring the more skills, expertise & efficiencies not available in the utilities. Full scale retail competition may be far way, distinction & involvement of private sector in elements such as metering services, revenue cycle management, distribution franchisees, managing call centers, O&M outsourcing etc. will get more pronounced.

---

6. "Emerging opportunities & challenges" By PWC at World Energy Council, page-38.

#### **d. IT as a differentiator**

The investment made during R-APDRP will have a cascading effect on the IT infrastructure across the utilities as benefit will start to flow. The focus will be on building a distribution business compatible with smart grid & connecting the proposed smart grid to the end consumer through smart metering. Presently distribution metering infrastructure is a one-way communication device for pulling consumption data to the utility's database but going forward the meters will become a complete communication channel to undertake bilateral communication with the end consumers.

### **6.2 Scope for future work**

The viability & efficiency of the distribution subsector is critical to attract investment into generation, transmission & the electrical equipment sub-sector linked to it. So the integrated approach supported by all the stakeholders including government, regulators, utilities & consumers has significant impact on the overall socio-economic development of the country.

#### **a. Government support<sup>7</sup>**

Government interim support to distribution till the sector is self-sustainable is important without which all other measures will fail. Government needs to play the following role:

- i) Effective administrator & law enforcer- in terms of implementing effective legislation, setting up special courts & police stations & enabling environment to arrest in case of power theft, support utilities in registering genuine power theft cases & criminal conviction.
- ii) Provider of subsidies- clearly stated policies for providing subsidies to the specific consumers categories such as BPL consumers, agriculture consumers etc. in timely manner will help to reduce the financial crunch of the utilities.
- iii) Owner- In short term, government has to bail out the utilities from the existing losses by allowing operational autonomy, restructuring debt & infusing equity.

---

7. "Emerging opportunities & challenges" By PWC at World Energy Council, page-41.

## **b. Transforming utility operation<sup>7</sup>**

*i) Integrated action plan:* Utilities should have an integrated performance management plan that measures & monitors the progress of the key initiatives. The plan should be segregated into short, medium & long term targets. It may be start with the appropriate utilization of the fund available through R-APDRP, RGGVY etc.

State utilities should have an achievable vision for themselves set by an autonomous board & the board should be empowered to monitor the performance of the utility, initiate independent action plan, complaint to the government & regulatory provision but with-out any external intervention.

In addition to the performance management, utilities should also focus to the HR process such as recruitment, retention, and training etc. & adoption to the information technology systems.

*ii) Involvement of private players:* The existing resource & skill crunch in the utilities can be compensated by bringing in private players for managing business processes of various forms such as managing rural distribution infrastructure.

## **c. Balanced regulatory intervention<sup>7</sup>**

A regulator plays a key role in balancing sector's viability along with managing consumers' interest. Independence of regulators, periodic evaluation of the functioning of SERCs, cost reflective tariff & avoiding creation of regulatory asset are some of the key regulatory measures. Regular third party of the reported operational parameters & capital expenditure needs to be ensured by the regulators.

## **d. Consumer awareness**

To prevent the electricity theft, change in mindset is absolutely necessary. Utilities can design communication to create awareness among the people about the theft, tariff & quality of service & how theft can create huge losses not only for the utilities but for the entire society at a large. From the International experience, it has been observed how Enersis of Chile have successfully able to create the awareness among the public & help them to understand about the value of electricity.

## Planning to implement changes<sup>8</sup>

Timely implementation of the schemes is the key to yield desired result. This not only fixes a problem before it reaches to the crisis stage, but also helps the exchequer to avoid losses because of cost escalation due to delay thus putting pressure on the budget. Considering the importance of the challenges & the hurdles of implementation, a target setting matrix is formed for the measures discussed above. The given analysis is based upon perception.

Challenges	High	<ul style="list-style-type: none"> <li>• Liquidating RA</li> <li>• Pre-paid meters</li> </ul>		<ul style="list-style-type: none"> <li>➤ Separation of carriage &amp; content</li> <li>• Privatization of distribution</li> </ul>
	Low	<ul style="list-style-type: none"> <li>• Completion of feeder separation.</li> <li>• Consumer sensitization</li> <li>• Power planning</li> <li>➤ Computer-based account integration</li> </ul>	<ul style="list-style-type: none"> <li>➤ Regulatory reforms</li> <li>• Demand assessment &amp; network planning</li> </ul>	
		Short-term	Medium-term	Long-term

Desired time-line →

Table 6.1: Target setting matrix for power distribution sector.

- State;
- Central;

Each of those above measures requires active collaboration between State & Central governments.

8. "Electricity Distribution Crisis" at Energy Research Institute, TERI in 2015, page-11.

### **6.3 Conclusion**

One of the biggest challenges to power distribution sector in India is find out urgent solution to the financial dismay of the state utilities. This is not an over-night problem to the sector. However instead of considering it as an issue of national economic relevance, it has become a political contention largely due to the fact that electricity supply in India is treated as a public service. Unless & until this mindset will change with strong political intention to make electricity as a business commodity for serving consumer better by maintaining quality of service & accountability, the above said policy measures will not make any relevance.

The administrations are not unfamiliar to the proposed action points, yet little substantial has been achieved in reality. Though there are some cases where administration have tried to implement the reforms & have done it successfully. From the analysis, we have found one of the prime examples such as Gujarat. In the state of Gujarat reform measures have been implemented in large scale including rural feeder segregation, recasting the past debt of the SEBs, and unbundling of SEB into seven companies etc.

The Government of India have launched a pan-India scheme for rural & agriculture feeder separation on November, 2014, metering of distribution transformers, feeders or consumers. From the analysis it has also been observed that some of the states are improving their performances effectively from the earlier days, though there is a long way to go for achieving performances of International standard. It is quite clear that there is no single silver bullet to the problem. It is expected that instead of maintaining status quo both Central & State Governments will show intent to sort out the problem & with periodic performance evaluation, benchmarking & rectification Indian power distribution sector will become internationally competitive.

## Bibliography

- [1] Central Electricity Authority, Government of India. (2013). Growth of Electricity Sector in India from 1947-2013. New Delhi: Central Electricity Authority, Government of India.
- [2] “Crisis in India’s Electricity Distribution Sector: Time to reboot for a Viable Future”- By Das Shyamasis & Goswami Anandajit, The Energy & Research Institute, TERI, Policy Brief, January, 2015.
- [3] A World Bank Study “Beyond Crisis: The Financial Performance of Indian Power Sector”- By Khurana Mani & Banerjee Ghosh Sudeshna, 2013, p 45-115.
- [4] Bajaj, H. L., and D. Sharma. 2006. *Power Sector Reforms in India*. New Delhi: Government of India. <http://www.worldenergy.org/documents/p001438.doc>.
- [5] A World Bank Study “More Power to India: The Challenge of Electricity Distribution”- By Banerjee Ghosh Sudeshna & Pargal Sheoli, p 71-107.
- [6] Mayer, Kristy, Sudeshna G. Banerjee, and Chris Trimble. 2013. “Elite Capture: Domestic Tariff Subsidies in India.” Background paper for this report. World Bank, Washington, DC.
- [7] Sharma, D.P., P.S. Chandramohan Nairb, and R. Balasubramanian. 2005. “Performance of Indian Power Sector during a Decade under Restructuring: A Critique.” *Energy Policy* 33 (4): 563–76.
- [8] World Bank. 2013. *Lighting Rural India: Load Segregation Experience in Selected States*. Washington, DC.
- [9] Banerjee, Sudeshna G., Doug Barnes, Bipul Singh, Kristy Mayer, and Hussain Samad. 2013. “Power for All: Electricity Access Challenge in India.”
- [10] Planning Commission. 2011. *Financial Position of Distribution Utilities*. New Delhi: Government of India.
- [11] Deloitte. 2013. *Review of Reforms Implementation in the Indian Power Sector*. Report Prepared for the World Bank, Washington, DC.
- [12] “Emerging opportunities and challenges India Energy Congress – 2012” Report for World Energy Council By PWC, 2012, p 27-45.
- [13] “Integrated Rating System For State Power Utilities, 2012”- By Ministry of Power, GOI, p 4-11.

- [14] "The Performance of State Power Utilities for the years 2009-10 to 2011-12"- By Power Finance Corporation, p 6-110.
- [15] "Reducing Technical and Non-Technical Losses in the Power Sector"- Background Paper for the World Bank Group Energy Sector Strategy July 2009, p 5-34.
- [16] "The Future of the U.S. Electricity Sector"- By Dickenson Bill & Sharp Phil, 2013, p 5-50.
- [17] "Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2013" By ACER & CEER, October, 2014, p 21-175.
- [18] "Enersis: Global Strategy in the Electric Power Sector"- By Grosse Robert & Fuentes Carlos, 2001, p 4-16.
- [19] Central Electricity Authority. 2011. Review of Performance of Thermal Power Stations 2009–10. New Delhi: Central Electricity Authority, Ministry of Power.
- [20] Government of India. 2003. Electricity Act, 2003. Ministry of Power: [http://powermin.nic.in/acts\\_notification/electricity\\_act2003/preliminary.html](http://powermin.nic.in/acts_notification/electricity_act2003/preliminary.html).
- [22] Ministry of Power, Government of India. 2005. National Electricity Policy. Ministry of Power: [http://www.powermin.nic.in/whats\\_new/national\\_electricity\\_policy.htm](http://www.powermin.nic.in/whats_new/national_electricity_policy.htm).
- [23] Ministry of Power, Government of India. 2013. Model State Electricity Distribution Management Responsibility Bill, 2013. New Delhi: Ministry of Power, Government of India.
- [24] Prime Minister's Office, Government of India. 2014. Deendayal Upadhyaya Gram Jyoti Yojana. [www.pmindia.gov.in](http://www.pmindia.gov.in): [http://pmindia.gov.in/en/news\\_updates/15461-2](http://pmindia.gov.in/en/news_updates/15461-2).
- [25] Ministry of Power, Government of India. 2012. Scheme for Financial Restructuring of State Distribution Companies (Discoms). New Delhi: Ministry of Power, Government of India.
- [26] The World Bank. 2013. News. World Bank: <http://www.worldbank.org/en/news/press-release/2013/10/01/lightingrural-india-is-feeder-segregation-the-only-answer>.
- [27] Ministry of Power, Government of India. 2006. *Tariff Policy*.
- [28] [www.IndianPowerSector.com](http://www.IndianPowerSector.com). 2013. Haryana government gives nod to discoms debt rejig. [www.IndianPowerSector.com: http://indianpowersector.com/home/2013/03/haryana-government-gives-nod-to-discoms-debt-rejig/#more-19450](http://indianpowersector.com/home/2013/03/haryana-government-gives-nod-to-discoms-debt-rejig/#more-19450).

- [29] Kumar VR and Sethi M. 2014. Indian power utilities: A panacea for financial revival. *Global Journal of Finance and Management* 67.
- [30] Benchmarking of Electricity Distribution Utilities” By Thakur Tripta, page-2-18.
- [31] The Economist 2013a- “ How to lose half a trillion Euros.” October 2012