

CHAPTER 5

ANALYSIS AND FINDINGS

The previous chapter discusses the various research methods used for obtaining results. In this chapter an attempt has been made to analyse the results that were obtained by using the said research methods.

It covers reliability analysis to understand how well constructed the questionnaire was. Analysis was also done of the factors obtained through the literature review, comparison with the international experience of UK, and stakeholder perspectives. Finally, based on this analysis an alternative suggestive framework was created to achieve the study objectives.

5.1 ANALYSIS OF ISSUES IDENTIFIED BASED ON LITERATURE SURVEY

The literature review carried out focused on the distribution framework and the challenges it poses to OA. It also incorporated the learnings for India from other countries like Brazil, Argentina and Chile, with regard to the framework for third party access. There have been a number of policies and regulations that have been introduced by the Central Commission and respective state commissions. The open access charges have seen a haphazard and rise and fall across states.

The newest draft regulations of Inter-state Open access of 2016 also show the greater commission's target to encourage longer period contracts in OA. These findings seem to hold ground with the transitioning scenario of the country with regard to power sector. Hence these issues were identified and introduced as factors to carry out further analysis.

5.2 ANALYSIS BASED ON COMPARISON OF OA FRAMEWORK IN INDIA AND UK

UK is out performing its G7 peers. In 1980s, UK had state owned inefficiently run companies. Electricity Council controlled Central Electricity Generating Board. 12 Regional Supply Boards faced a huge challenge of high cost charged from consumers.

The Office of Gas and Electricity Market i.e. Ofgem regulates policy framework of the power sector in UK impacting electricity tariff to be paid by consumers. The total electricity consumption in UK is 3020 billion KWh (CIA 2014) and per capita electricity consumption is 5472 KWh. To protect the consumer interest and efficient functioning of electricity market and network, the Electricity Act was introduced in 1989. Some objectives of distribution in energy sector in the United Kingdom are; (IEA, 2012)

- 1989 Act, privatized the system, but left regional companies intact.
- New structure had 3 Gencos (one state-owned), power trading in central pool with capacity market. Over 1 MW consumers could directly contract.
- National Grid+3 others (under control of supply companies) maintaining robust distribution network and its efficient operation.
- 12 Regional supply companies (plus distribution) – consumers could not switch. Competition within the country's networks and Independent Distribution Network Operators.
- Modifying the cost per unit – Regulator controls prices.
- Introduction of a losses incentive mechanism to encourage distribution network areas.
- In 2000 Gencos 8 – forced to divest and buy supply business (>100 KW could switch)
 - Supply companies forced to separate from distribution companies.
 - National Grid (plc) set up. Liberal trading market emerged.

Table below compares the Indian Open Access system to the UK Third Party Access system:

Table 5.1: Comparison of OA in India and UK

United Kingdom	India
Network Structure	
<p>DNOs (Distribution Network Operators) and IDNOs (Independent Distribution Network Operators) each is responsible for a regional distribution services area.</p>	<p>State Distribution Companies, State Generation and Distribution Companies, and Private Discoms (Distribution Companies) are responsible for distribution and supply to consumers</p>
<p>DNOs are natural monopolies. Regulator protects the consumer from the monopolistic abuse.</p> <p>OFGEM permits utilities to operate local networks and encourages the new consumers to switch resulting in competitive price and quality supply.</p>	<p>Distribution is largely controlled by state companies. The government bailed out the State Electricity Boards 15 years back when they defaulted on making payments to Central generators.</p> <p>Each state has a regulator in place to determine tariff and grant distribution licences.</p> <p>CERC determines interstate generation as well as transmission tariff. Distribution tariffs are determined by state regulatory commissions.</p> <p>Choice to consumer is available theoretically through OA and multi distribution license. It has not translated into practice.</p>
Pricing of Tariff	
<p>Energy Market determines tariff. The segmentation comprises of commercial, industrial and household charges.</p> <p>A long run marginal pricing is used in Great Britain. The charges are non-discriminatory, transparent fair.</p> <p>The Low Carbon Networks allowed up to £500m of funding supporting</p>	<p>Historically, Indian industrial and commercial consumers have been paying a higher tariff for the electricity they consume. This is in order to ensure that domestic and agricultural consumers receive power at a more affordable rate. This additional amount, known as <i>cross-subsidy</i> has continued under the Electricity Act, since regulators are allowed to set differential tariff based on the</p>

<p>projects sponsored by the distribution network operators (DNOs).</p> <p>Nuclear power decommissioning is a challenge, increased renewable energy installation are going to make power expensive initially till technology stabilises.</p> <p>Long run market pricing is done (as opposed to average cost of supply in India) which enhances investment opportunities in the sector.</p>	<p>consumer category. 18% of consumption goes to agriculture sector where power is either free or highly subsidized.</p> <p>When an industrial or commercial consumer decides to purchase power from an independent generator and not from the distribution licensee in that area, that distribution licensee fears loss of cross subsidy amount. India may consider shift over to marginal cost of tariff as practice in UK.</p> <p>Cross subsidy surcharge is imposed on the consumer to ensure that the distribution licensee does not pass on this additional amount to the domestic and agricultural consumers, which can result in a steep rise in the cost of power to poor people. The Electricity Act, however, recognizes that the ultimate goal is to reduce eliminate cross-subsidy as concept, so that all consumers pay the same amount for electricity.</p> <p>Cross subsidy surcharge has been the single biggest roadblock to an OA regime, the development of a market where a consumer can choose to purchase power from a generator of its choice. Most states have been charging a high level of cross subsidy which means that it does not make financial sense for a private operator. Prohibitive cross subsidy surcharges in most states have meant that the option to purchase power from others has remained only onpaper.</p>
<p>Periodicity of Revision of Tariff</p>	
<p>Supply price regulations impose restrictions on the consumer due to a monopoly environment. But it also helps with the simulation of</p>	<p>The Electricity Act, 1910 was not at all prescriptive, as no methodology was specified.</p> <p>The EA (Supply), 1948 prescribed a</p>

<p>competitive market features as well as give the firms an incentive of achieving efficiency while also giving the consumers the benefit.</p> <p>With introduction of competition, there was reduction in price caps and regulations. With privatization, tariff too was modified.</p> <p>Followed by this came the concept of regulation for franchise customers covered franchise, taking under 100kW in 1994.</p> <p>In 1999 domestic customers started benefiting as prepaid meters became competitive between various suppliers.</p> <p>Hence there have been periodic modifications.</p>	<p>methodology of tariff. State Boards would change tariff. To avoid the loss, could get grants from Government.</p> <p>K.P. Rao Committee introduced two part tariff setting methodology and the concept of deemed generation was introduced.</p> <p>After 1991, tariff of state owned generation companies would be determined by the Government.</p> <p>Transmission tariff did not exist in law. As unbundled transmission was not there till 1989 before establishment of POWER GRID.</p> <p>Five types of norms were existing till 1998 before Electricity Regulating Commission (ERC) came in to being.</p> <p>Examples are the retail tariff of licensees, the retail tariff of SEBs, the bulk tariff of central stations and the bulk tariff for IPPs.</p> <p>The process of tariff determination required consultation with stakeholders when EA, 2003 came into force.</p>
<p>Unbundling of Utilities</p>	
<p>ICPs and IDNOs can undertake contestable activities like the design, procurement and construction of the sole use connection assets.</p>	<p>In 1991 Power Sector reforms were initiated with the objective of stimulating competition for obtaining private participation in different sector namely generation, transmission and distribution. DDG (Decentralized Distributed Generation) is parallel of IDNOs, and they need no licence in rural/local body areas.</p>

<p>DNOs can undertake non-contestable activities which include determining the point of connection to the distribution system, design approval and undertaking upstream reinforcement to the distribution system.</p> <p>The European Union led changes has resulted in liberalised treatment of the UK electricity competitive market.</p> <p>Directive 96/92/EC promoted the independence of transco operator to access the pre existing wholesale market in Great Britain (England, Wales and Scotland).</p> <p>Directive 2003/54/EC prescribed unbundling, third party access, independent regulators, enhanced protection of vulnerable consumers.</p> <p>Third Energy Package led to development of Internal Markets in 2011.</p>	<p>SEB's were unbundled into separate companies for Generation, transmission and distribution. Central and state level independent commissions were set. Some reforms are:-</p> <ul style="list-style-type: none"> ○ SERC constituted in 22 states ○ Tariff orders in 14 states SERC ○ Unbundling was done in 14 SEBS ○ Privatization of distribution in 2 states
Trading	
<p>There exists a system of trading among generators, traders and customers. Trading occurs bilaterally or on exchanges. Market has a forwards and futures too. Interconnectors promote export import of power between Britain and France, Ireland and Netherlands.</p>	<p>Second phase of reforms was aimed at separating the distribution sector from the generation and transmission sector. However privatization in the loss making distribution sector was tough. Only Delhi and Orissa successfully privatized their electricity Discoms. As of now, the Act of 2003 has recognized trading as a licensed activity. However the wholesale market is still not very developed in India. It is gradually opening up.</p>
Retail Market	
<p>The consumers' interests in the retail market are ensured through the development of a competitive market for electricity. Removal of barriers to competition and smart metering are</p>	<p>In India retail market is yet to take shape.</p>

essential practices in the retail market.	
Independence of System Operator	
<p>Electricity is transmitted at higher voltage to avoid transmission losses. England has 400 KV while Wales has 275 KV. Voltage of the order 400kV, 275kV and 132kV exists in Scotland. Northern Ireland operates on 275 KV.</p> <p>National Grid exists in England and Wales, North connects South Scotland with multiple interconnectors. South Scotland further connects England and Wales to National Grid. National Grid Company (NGC) is a monopoly that regulates the high voltage transmission network.</p> <p>NGC, Scottish Power and Electricity de France jointly own, operate transmission between England and France.</p> <p>Electricity Act, 1989 mandates NGC to maintain, coordinated transmission network facilitating competitive generation as well as supply.</p>	<p>State Load Despatch Centre is an apex body which does energy accounting within the State Grid. It is responsible for optimum scheduling and dispatch of electricity within the states in accordance with the contracts that are signed in line with Grid Standards and State Grid Codes. All licensees and state entities has to comply with the directions issued by the corresponding SLDCs.</p> <p>SLDCs have to comply with the directions of the RLDC.SLDCs operates a Government Company or entity.</p> <p>Unlike NGC, SLDC has to report to the RLDC for transmission purposes. Although NGC is a monopoly it is also the authority when it comes to transmission. Due to this independence they have powers to reduce transmission losses via energy markets through loss factor application.</p>
OA Policy	
<p>UK initially vertically integrated, fully opened up supply competition by 1999.</p> <ul style="list-style-type: none"> • In 1990, 1MW consumers (about 45% of the non- 	<p>Under EA, 2003, the OA Policy ensures that bulk users of electricity typically with demand above 1MW would be able to choose from a large number of competing generation</p>

<p>domestic market) could exercise choice of supplier.</p> <ul style="list-style-type: none"> • By 1994, limit was reduce to 100 kW. • Finally, 1999 saw competition opened up for every consumer (below 100 kW). 	<p>companies instead of being forced to buy electricity from their existing monopolistic utility. This policy helped large consumers by ensuring regular supply of electricity at competitive rates.</p>
<p>Wheeling Charges</p>	
<p>Wheeling is a special case of general network pricing, depending on the market requirements. The charge on wheeling is the charge for the transferring electricity through transmission and distribution lines from one utility's service area to another utility. It can be for an interstate transmission as well.</p>	<p>In India wheeling charges are same as Transmission charges, power flows of inter- state and inter-regional is regulated by CERC.</p>
<p>Account of Losses</p>	
<p>Electrical losses are or the order of 1.5% of greenhouse emissions and cause financial impact.</p> <p>Regulator devised a mechanism that would take into consideration losses as well as incentives, as part of their electricity retail tariff.</p> <p>OFGEM from 2015 have brought forth a new control prescription of parameters through obligations of license, expenditure allowed for business plans, annual statement reporting with discretionary reward.</p>	<p>The revenue loss at retail distribution occurs due to various causes like non/under-billing by distribution companies, non/under-payment by wrong classification by mistake as cross subsidized consumers, i.e. agriculturists etc.</p> <p>Aggregated Transmission and Comm-ercial losses are as high as 31% and thus SEBs have introduced more novel regulations and technologies to improve tariff billing and collection practices, promoting higher collection efficiency. Smart grids have off late been receiving increasing attention from the various stakeholders.</p> <p>AT&C losses are viewed as high risk investments which can undermine viability. Thus its reduction is of utmost importance.</p> <p>Under RAPDRP (Restructured Accelerated Power Development &Reform Programme), focus has shifted to increased use of technological solutions. The aim is to reduce AT&C losses 3% every year.</p>

5.2.1 Discussion on Open Access Mechanism in India and UK

It is evident from overall, that now we have added 12 variables to 16 gaps notice till synopsis analysis are research gaps. Existing literature does not have a clear cut benchmarking study of India with United Kingdom on implementation of OA in distribution sector. Brazilian experience of separation of high paying customers has also been studied and is relevant. Variables Research gaps identified after benchmark study are-

- Under Pricing of Tariff.
- Wholesale market model.
- Voltage wise losses.
- Success and failure in Latin America.
- Unbundling of utilities,
- Path of Chilean privatization
- Entry of IPPs
- Smart grid framework.
- Separation of network in UK.
- Network monopoly could create entry barriers.
- Establishment of regulators.
- Network/wheeling charges.
- Periodicity revision of cost reflective tariff.
- Low domestic/agricultural tariff.
- Political determination of electricity price.
- Privatization of utilities more than one licenses in one service area.
- Regulatory certainty.
- Choice of supplier.
- Independence of network operator.
- Capacity building of regulators.
- Tariff without cross subsidy.
- Carriage and content cost be separately determined.
- High industrial/ commercial tariff.
- High cross subsidy Retail surcharge.
- Low rural electrification.

- Market mechanism.
- Fixation of OA charges
- Long term firm power contract.

5.3 ANALYSIS OF RESULTS OF RESPONSES THROUGH QUESTIONNAIRE AND IDENTIFICATION FACTORS AFFECTING OA MECHANISM IN INDIA

5.3.1 Analysis of Responses through Questionnaire

As stated Chapter 4, Likert Scale based questionnaire was constructed based on the parameters identified. The questionnaire designed can be seen in **Appendix I**.

The responses received were then analyzed in this section.

Reliability

A small segment of 30 persons were interviewed to ascertain whether variable drives from Literature Review are valid.

We carried out a reliability analysis of the scale using Cronbach's Alpha. Validity refers to measurement what it purports to measure. Individual questions are not analyzed. Total score of respondent is added and then interpreted. Neutrals disappear.

The results achieved by statistical test are as below:

Table 5.2: Reliability Statistics

Cronbach's Alpha	N of Items
0.842	30

- Cronbach's Alpha (Statistical Tool): 0.842 (Above 0.7)
This implies a high rate of internal consistency of the questions related to OA implementation

- For the questions 10, 14 and 29, Cronbach's Alpha, if those items are deleted is more. This implies that eliminating these questions would lead to a higher internal consistency.

Table 5.3: Cronbach's Alpha if Item Deleted

Questions	Cronbach's Alpha if Item Deleted
q10	0.846
q14	0.845
q29	0.850

Q 10. Adequate measures have been initiated in the proposed amendments to the Electricity Act, 2003 for encouraging OA:

- Strongly agree
- Agree
- Indifferent
- Disagree
- Strongly disagree
-

Q 14. State Electricity Regulatory Commission (SERC) provided adequate regulatory support for OA through notification of regulations:

- Strongly agree
- Agree
- Indifferent
- Disagree
- Strongly disagree

Q 29. Although distribution companies are reluctant to allow OA citing operational constraints, OA can actually ensure reliable supply of power:

- Strongly agree
- Agree
- Indifferent
- Disagree
- Strongly disagree

The three questions are related to implementation of OA and the possible lack of interest of discoms to implementation. Hence these essentially were very important questions to investigate what are the reasons for its failure and so on.

However, since the reliability is high the questions are show high validity and thus we will not eliminate questions based on the above findings.

Adequacy

KMO Index checks if we can factorize the original variables efficiently. But it is based on the idea of partial correlation. Variables are more or less correlated, but the correlation between two variables can be influenced by the others. So, we use the partial correlation in order to measure the relation between two variables by removing the effect of the remaining variables. KMO Index compares the values of correlations between variables and those of the partial correlations. If the KMO Index is high (≈ 1), PCA can act efficiently; if KMO is low (≈ 0), PCA is not relevant. Historically, the labels in Table 4 (given in Appendix) are given to values of KMO (Kaiser 1974).

Table 5.3.1.2: KMO and Bartlett's Test

KMO Measure of Sampling Adequacy		0.756
Bartlett's Test of Sphericity	Approx. Chi-Square	347.756
	Df	78
	Significance	0.000

KMO Index for our data is 0.756 (>0.6). This is a middling result and very much acceptable for a reliable PCA.

5.3.2 Factors Affecting Open Access Scheme in India

Factors are hypothetical constructs loadings refers to simple co-relation between factors and hypothetical constructs. The basic assumption used, to carry out Factor Analysis is that the items must be linearly related to each other and be at least moderately correlated to each other. Otherwise the number of factors would be almost the same as the number of items which would render the Factor Analysis redundant.

Theory of Factor Analysis:

The statistical model of Factor Analysis can be written algebraically as follows.

If we take s variables X_1, X_2, \dots, X_s defined on an example of n subjects, then variable i can be written as a linear blend of r factors F_1, F_2, \dots, F_r where, as clarified above $r < s$.

Thus, $X_i = a_{i1}F_1 + a_{i2}F_2 + \dots + a_{ir}F_r + e_i$,

Where all the a_{ij} are the factor loadings (or scores) for variable i and e_i is the portion of variable X_i that cannot be clarified by the factors.

Key steps of Factor Analysis are as follows:-

Calculate initial factor loadings

- Principal Component Method: However, the factors got will not really be the principal components but the loadings for the k th factor.

We used Principal Component Method. Factor loadings are shown in Appendix. Ideally loading should be 1. Communality depicts the role of a common variable among factors.

Factor Rotation

After calculating the initial factor loadings, the factors are rotated. It is to find factors that are easier to interpret. The rotation is done to try to make variables within a subgroup score as high (positively or negatively) as possible on one particular factor. At the same time, ensuring that the loadings for these variables on the remaining factors are as low as possible. In other words, the objective of the rotation is to try to ensure that all variables have high loadings only on one factor. There are a number of different methods of rotation of each type. We used Common Orthogonal varimax rotation method for better interpretation of factor loading (high or low), High loadings being close to 1 and low loadings being close to 0. 0.5 loadings refers to Indeterminacy.

Calculation of factor score

When calculating the final factor scores (the values of the r factors, F_1 , F_2 , F_r , for each observation), a decision needs to be made as to how many factors to include. This is usually done using one of the following methods

- Choose m such that the factors account for a particular percentage (e.g.75%) of the total variability in the original variables.
- Choose m to be equal to the number of Eigen values over 1 (if using the correlation matrix).
- Use the Scree plot of the Eigen values. This will indicate whether there is an obvious cut-off between large and small Eigen values. In some statistical packages (e.g. SPSS) this choice is actually made at the outset. The second method, choosing Eigen values over 1, is probably the most common one. The final factor scores are usually calculated using a regression-based approach.

Correlation Matrix and Determinant

The correlation matrix is used to check the pattern of relationships between the statements. We must make sure that the significance values of the statements are below 0.05 and the correlation coefficients should not be too high. A case of otherwise may indicate a problem of multi collinearity. Also, the problem of singularity should be avoided by checking whether the determinant is greater than 0.00001. This shows that all the questions are somewhat correlated. For example: Question 1 and question 4 have a correlation of 0.057, while question 1 and question 25 have a correlation of 0.481. Thus generation companies selling a part of their power on a mandatory basis in the wholesale market is little correlated with independence of SLDCs, while has a much higher correlation with the question stating whether retail sale of power of electricity can help in separation of technical and commercial losses which help in focused reduction of distribution companies' losses.

In this case most of the variables have a significance level below 0.05 while the inverse is not positive definite. Hence there is no problem of singularity.

It uses the following formula:

$$\chi^2 = -(n - 1 - \frac{2p+5}{6}) * \ln |R|$$

Under H0, it follows a χ^2 distribution with a $[p \times (p-1) / 2]$ degree of freedom.

In our results:

Thus we can reject null hypothesis at 5% level of significance (as the significance is <0.05)

From this, we can conclude that we can perform PCA efficiently on our dataset. This implies that performing the Principal Component Analysis on the questions set will be giving better factor scores. Therefore, there is substantial co-relation amongst variables. Co-relation matrix is therefore an Identified Matrix.

Hypothesis–Factor Matrix is not an Identified Matrix significance being 0.000, we reject the hypothesis.

Factor Analysis of the question set would be efficient only if KMO can be stated to be above 0.7.

Scree Plot

A Scree Plot displays the Eigen values associated with a component in descending order versus the number of the components. We can use Scree Plots in principal components analysis and factor analysis to visually assess which components explain most of the variability in the data.

However, the plot shows that the curve levels off after the third component. If we go according to the Scree Plot, then we must keep 3 components. But we also checked the percentage of variance being explained by the first three

components after rotation. If it is more than 75%, then we must follow what the Scree plot states, or else we must go according to the condition that these components with an Eigen value greater than 1 are chosen. In our case, the first three components explained approximately 50% of the variance. Thus, we choose the fourth component as well, as Scree Plot is not too reliable.

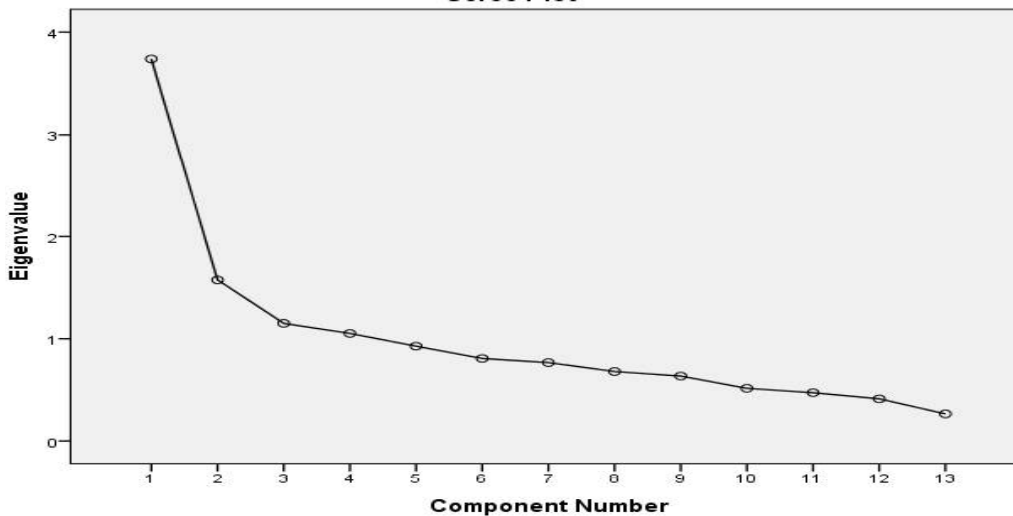


Fig. 5.1: Scree Plot

By the application of factor analysis, 30 identified variables were reduced to 4 factors, which can be termed as the key factors affecting open access in the distribution sector. The Cronbach's Alpha if item is deleted is given below for all the factors.

Table 5.4: Cronbach's Alpha

	F18	0.836	Lack of specific timeline for elimination of cross subsidies detrimental to OA items
	F5	0.837	Distribution companies don't encourage OA because of anticipated losses from cross subsidies
	F22	0.838	Lack of specific timeline for elimination of cross-subsidies is forcing the OA consumers to continue to source power through distribution licensees
	F28	0.840	Rationalization of Cross Subsidy Surcharge to choose the type of generator i.e. OA, Captive Power Producer or

Tariff & Cross Subsidy Reforms			continue with dist. Licensee
	F26	0.838	Introduction of competition in retail sale of electricity would bring the electricity prices down and OA consumers find it economical to tie up with a supplier
	F17	0.837	Further tightening of cross subsidy bandwidth from the present +/- 20% will actually further help OA
	F16	0.838	In continuation to the earlier direction for treatment of consumers with a load of 1 MW as OA consumers, further directions should be given by the Government to the Regulators for introduction of OA to the consumers below 1 MW load, gradually in phases
	F7	0.839	Partial OA is the immediate step to be taken in those states where the distribution companies are running exceptionally high losses, thereby incentivizing them to not only supply certain amount of the power to OA consumers under market determined prices but also selling power through the contracts with the distribution company under a regulated tariff
Competition in Retail Power Market	F25	0.836	Introduction of competition in retail sale of electricity facilitate separation of technical and commercial losses leads to focused efforts on reduction of losses
	F16	0.838	In continuation to the earlier direction for treatment of consumers with a load of 1 MW as OA consumers, further directions should be given by the Government to the Regulators for introduction of OA to the consumers below 1 MW load, gradually in phases
	F13	0.834	Provisions contained in Section 11 of the Electricity Act, 2003 are indiscriminately used by various State Governments

			against providing the OA to consumers
	F28	0.840	Rationalization of cross subsidy surcharges through amendments to the Electricity Act and Tariff Policy needs to be carried out to facilitate the consumers to choose from “OA”, “Captive Generation” or “to continue with distribution licensee”
	F1	0.828	All generating companies should mandatorily sell a part of their generation through the wholesale market for deepening the OA to consumers in the country
Promotion of Wholesale Market	F1	0.828	All generating companies should mandatorily sell a part of their generation through the wholesale market for deepening the OA to consumers in the country
	F7	0.839	Partial OA is the immediate step to be taken in those states where the distribution companies are running exceptionally high losses, thereby incentivizing them to not only supply certain amount of the power to OA consumers under market determined prices but also selling power through the contracts with the distribution company under a regulated tariff
	F17	0.837	Further tightening of cross subsidy bandwidth from the present +/- 20% will actually further help OA
	F18	0.836	Lack of specific time line in for elimination of cross subsidies has proved detrimental for success of OA
Institutional Reforms	F4	0.840	SLDCs must be made independent in decisions pertaining to monitoring and reducing transmission losses
	F9	0.829	The cross subsidy surcharges as specified by the appropriate commission are

			adequate to mitigate the losses projected to be incurred by the distribution companies on account of migration of high value consumers to the fold of OA
	F17	0.837	Further tightening of cross subsidy bandwidth from the present +/- 20% will actually further help OA

5.4 ANALYSIS OF RESULTS OF OPINION SURVEY

After selection of 4 components discussion with experienced industry experts were held. First Round was unstructured while 2nd Round used structured questionnaires. The findings are detailed below:

I. Tariff and Cross Subsidy Reforms

Ist Round Result

- Section 62 (3), EA 2003 enabled cross subsidy based on load factor, voltage, power factor, total consumption nature of supply and the purpose of supply.
- Subsidized electricity encourages high consumption wastage. APTEL too envisioned a cross subsidy target of +/- 20% of the average cost of supply, yet to be achieved.
- Cross subsidy raises the cost of Commercial/Products/Industrial, rendering them uncompetitive.
- Bulk consumers get the incentive to set up captive plants, depriving State Utilities of revenue of X-subsidy. MSEDCL incurred loss 1860 Crores, June 2015.
- The cross subsidy surcharge is as high as 52% in some states like West Bengal preventing OA Bulk consumers to cheaper alternative source.

Second Round structured Question & Result

- As and when retail competition becomes a reality, migrate to a distribution network operators will run losses due to erosion of significant cross subsidies.
- An efficient tariff regime can emerge if cost reflective tariff, along with the concept of cost of services are implemented. Many states are yet to carry out studies on the front of cost of services.
- To avoid cross subsidy charges, wealthy users take to captive generation, which is a highly expensive alternative to OA. The imposition of the cross subsidy is based on the assumption that large consumers are wealthy. But this is always not true. There are wealthy residential users too get cross-subsidized in turn.
- If cross subsidies cannot be completely eliminated in a socialist country like India, we should implement a somewhat more efficient form eg. DBT.
- To implement retail competition, initiatives are needed from the side of distribution companies. Reducing their AT&C losses. One potential solution that India has recognized is that of smart metering. As of now India has approximately 200 million number of meters, while USA has 150 million. Of these should be smart meters, which are 31% in , while in India it is less than 1%. (Yamanaka, 2014)
- Scope lies also in differentiating consumers on the basis of ‘unwarranted commercial consumption’ or ‘huge capacity to pay’ or ‘have the potential to conserve energy’. (FOR)

II. Competition in Retail Power

Ist Round Result

- New Zealand has well-organized operation of the electricity industry for benefit of consumers.

- Has an Electricity Market Information website covers market monitoring data such as seller market share, monthly swapping reports and wholesale last pricing.
- United Kingdom, the retail sector was recognized through the electricity pool of England and Wales. The consumers were separated into 'franchise' and 'non franchise' in the selling side of the market. The market was stretched to individuals with load consumption of 100kW and above annual demand. The system was highly successful as more and more customers chose for a corporation as opposed to a public electric supplier.
- Countless deal of mergers and acquisitions electricity market with growing competition.
- Policies charge involved licenses to supply power to consumers countrywide.
- Consumers were now allowed to choose their own supplier.
- Price controls remained for those, who could not take benefit of the retailing.

2nd Round structured Question and Result

- Learning from the experiences, we can encourage competitive pricing and consumer choice to consumers.
- To facilitate competition. It is necessary to remove barriers to entry, expansion and exit from the industry.
- Industry experts are of the opinion that it is technically feasible to modify the criteria.
- OA to less than 1 MW contract demand.
- Process will be extremely complex and wrought with inefficiencies.
- Individual SLDCs must be strengthened as well with proper augmentation of transmission and distribution sector. However prior to any such

modifications, it is a necessity to improve transmission infrastructure as the current situation in the power market has seen a great deal of transmission congestion.

III. Promotion of Wholesale Market

Ist Round Result

- A number of requirements like the unbundling of the vertical integration has taken place.
- United Kingdom developed a wholesale market in 1990. India on the other hand is struggling to manage its greater than 1 MW load consumers due to various problems like transmission congestion, failing financial conditions of distribution companies and lack of incentives for private investment.
- Bilateral transactions have been started which involves bids to buy and offers to sell electricity; the prices are quite non-competitive while the collective transactions that are handled by the power exchanges have very low prices due to the distress sales happening there.
- Need to balance both these transactions to ensure that prices are neither too high nor too low. Thus, in order to increase efficiency agents must be allocated only that much risk which he can handle.
- Wide fluctuations.
- Purchase of power must be made mandatory from the pool. Moreover, there must be a gradual step taken towards the independence and flexibility of market operators and the power exchanges.
- Stress more on the various aspects of power trading.

2nd Round Result

- Section 11 of the EA has been a dampener.
- Wholesale competition is that of scheduling preference given to long term contracts, followed by medium term contracts and finally short term contracts. Considering the fact that the power exchange market is mainly driven by short term OA contracts, the available transfer capability for OA consumers is very small and hence results in innumerable cases of bids not being cleared and failed attempts at power procurement through power trading. Hence, like in other countries scheduling preference should be gradually made on the basis of more short contracts. This in the long run will also lead to lesser transmission congestion, better transmission infrastructure and hence more liberal retail competition.

Table 5.5: Nodal Agencies

Inter State Nodal	Intra State Nodal	Transmission OA Availability
LTOA-CTU-	LTA-STU	12-25 years
MTOA-CTU-	MTOA-STU	3 months to 3 years
STOA-RLDC-	STOA-SLDC	Up to 3 months

IV. Institutional Reforms.

First Round Result

- OA Charges vary from state to state.
- The charges can be reduced to one single charge to as much of an extent as.
- Losses should also be considered at the technical level only at the relevant voltage levels to avoid excessive voltage-wise loss.

- Gradual reduction of cross subsidy surcharge with it being applicable only to a few categories of consumers.
- Rajasthan's solar policy exempts solar projects under OA from CSS spurring it to have one of the highest installed solar capacity.

Second Round Result

- State Direct Benefit Transfer (DBT) and central government policies (RE-Targeted Agricultural Subsidy) will benefit discom.
- State Instrumentality -to keep arm's length approves high Aggregate Technical and Commercial losses can be advanced TADA/Tech/IT/SCADA for smart grid.
- Billing and collection (DF) inefficiency.
- Calibrated liquidation of Regulatory Assets can help distribution utilities to recover the financial losses incurred through in time truing exercise.
- Failure of OA in the distribution sector have been attributed to reasons like:
 - A. Lack of awareness regarding the benefits of OA.
 - B. Resistance from distribution utilities for fear of losing key industrial consumers.
 - C. Indifference from state governments and lack of strong support through EA, 2003
 - D. Improper functioning of SLDCs, requirement of cumbersome procedures for obtaining 'No Objection Certificates.
 - E. Lack of efficient transmission and distribution networks
 - Technical feasibility of OA being opened up to consumers with a contract demand less than 1MW is feasible only if Ring-fencing of SLDCs is done.
 - Requirement of heavy augmentation in the distribution network with a more efficient transmission network.
 - Importing technical expertise in regulators from experienced agencies.

- If OA is allowed for load less than 1 MW, it will become more complex to handle as Infrastructure is already a issue.
- Independence of SLDC is key to making OA a success in the market:
All the experts agreed that the independence of SLDC may indeed be a necessary step in making OA a success:
- SLDCs being an instrument of a State must be made independent having Authority in decision making,
- SERCs can simply take an overview of the decisions taken by the SLDCs
- Time bound application process with transparency for application of OA if implemented by SLDCs, would result in stronger OA mechanism.
- Restructuring the state SLDCs, such that the individual members are accountable
- Annual Revenue Requirement should be decided judiciously by discom following Merit Order dispatch that does not over burden the industrial consumers with a high cross subsidy surcharge.
- Concept of separation of carriage and content of power may not be feasible in all locations and areas.

3rd Round Delphi Technique on All

India is well on its way to be a super provider of infrastructure. The power sector is far from being fully developed. The main reasons could be summarized as excessive intervention of State instruments inadequate infrastructure lack of incentivized private participation. With the setting up of a wholesale market along with a bilateral and collective trade, there is now a gradual opening up of the market.

OA is considered to be a boon in many ways as it power heralds sector reforms in the country. It initially saw a rush of great degree of transparency in pricing. Given the vastness of our country, the implementation of OA on a large scale, is a cumbersome task.

OA charges must be made more transparent with a consolidated singular charge that should not differ from state to state. At present, there is information asymmetry while processing OA transactions. Lack of transmission capacity is a matter of concern that must be addressed. Intra-state ABT metering must be made an all India reality.

With regard to separation of carriage and content, one feasible option could be to hand over the network of the distribution segment to the intra-state transmission licensee and require the existing distribution licensee to act as a supply licensee only. The competition in retail supply of electricity may be introduced through grant of supply license to competing suppliers. Keeping in mind all these factors, the objective-wise findings of the factor analysis and the final opinion survey we have set up an alternative suggestive framework as follows answering the research problem:

- Rationalization of tariff should lead to cost reflective tariff that also includes the concept of cost of service.
- There is no consistency in regulations followed by state regulators in determination of wheeling charges and cross subsidy surcharge. Due to unavailability of voltage-wise data on cost and distribution losses, state regulators have to allocate costs and losses between the wheeling and retail supply functions on the bases of assumptions. Moreover, in the absence of proper data, cost of supply cannot be properly determined which affects the estimation of cross subsidy surcharge. Thus, collection of such data is necessary.
- Modification of scheduling preference from long term contracts to short term contracts can help to reduce problems related to non-clearance and partial clearance of bids in power trading.
- Gradual opening up of the market to consumers who consume lesser than 1 MW can help to promote the retail market. Thus, even if not now in the near future, OA must be mandated for consumers consuming a load below 1 MW.

- Privatization of utilities through the PPP model and Distribution Franchisee Model can be a way to implement more efficient distribution system, as the relatively small size of the distribution areas involve less capex brings the entities closer to the consumers.
- Development of Smart Grid is essential for energy efficiency and demand side management.
- Advance Metering Infrastructure (AMR), can solve the problems of bills, theft of electricity, high distribution losses, illegal consumer connections and high costs of reading meters.
- A smart metering can help in cost benefit analysis.
- Isolation of defaulters of bill payments to improve collection efficiency.
- Incentives to distribution licensees bringing about greater percentage of reduction of AT&C losses.

5.5 SUMMARY OF ANALYSIS

- There is laxity in implementation of statutory provisions of in Electricity Act regarding direct sale of surplus power by captive power plants outside states, as CPPs need permission from state government as well as requires approval for usage of SEB's Transmission network. Enforcement needs to be strict.
- Generators should not be discouraged by Discoms/SERCs from entering the open access market. Their action to force IPPs and CPPs to sell their surplus power only to state utilities, as stated by the Electricity Act 2003, Section 11, has created innumerable inefficiencies in the power market.
- The independence of Load Dispatch Centers is a necessary pre condition for the health of the power market. SLDCs should be ring-fenced from all generation, transmission and distribution utilities of the State. Introduction of a system of certification of system operators by

an independent body is necessary as well, along with laying down of standard operating procedures which would be adopted by SLDCs.

- Current process of availing Open Access is extremely cumbersome with innumerable rounds of NOCs/formalities to be fulfilled. The process must be simplified in order to ensure that more number of consumers can avail open access.
- Congestion management in order to increase available transferable capacity is extremely important. India currently follows a highly time consuming format of area split congestion management. In order to remove market inefficiencies, a time based congestion management system must be followed having efficient scheduling.
- Capacity shortages can be reduced by the separation of carriage and content, such that the wires belong to one company while the supply of power can be done by another company. This can help to ensure fair competition. If dominant company owns the wiring, it can cause access issues.
- Framework development is portrayed in flow Diagram.

5.6 SUGGESTIVE FRAMEWORK

Elaborate analysis of secondary as well as primary data has brought forth critical factors affecting OA Mechanism in India. The Delphi Technique⁶ has been applied on these factors, and alternative suggestive framework for free and fair OA in India is being recommended. Four desired levels of Policy Reform and regulatory intervention at macro and micro level are portrayed in the framework diagram.

⁶Chia-Chien Hsu et al, Vol.12, Number 10, 2007

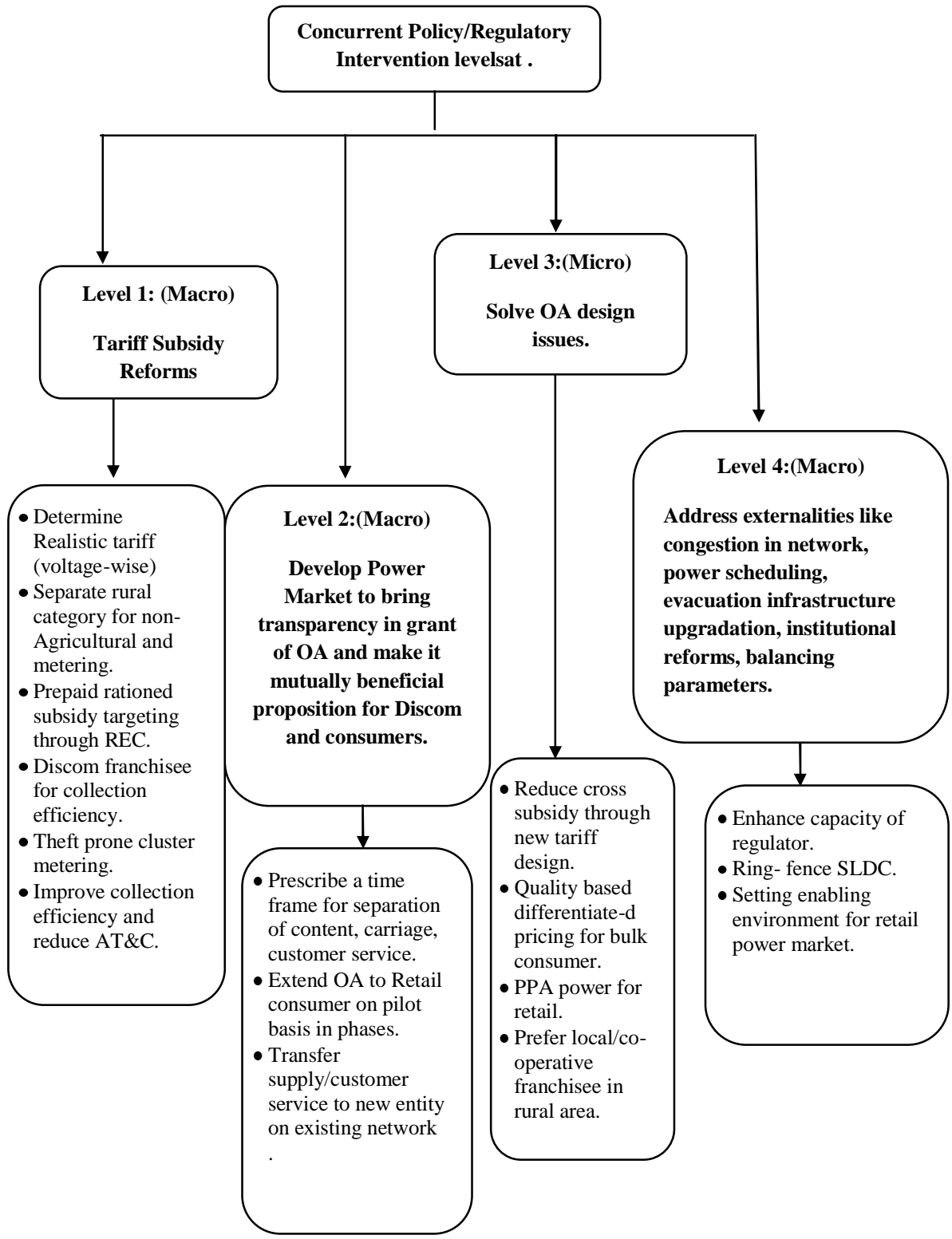


Fig. 5.2: Suggestive Framework

Level 1: Tariff Subsidy Reforms

There needs to be tariff subsidy reformation to ensure OA prices continue to be competitive

- Tariff must be realistically imposed in order to ensure pricing under open access is economical and equitable. Power purchase cost is the main component of tariff and can be segregated for different voltage levels while taking into consideration transmission and distribution losses, both technical and commercial corresponding to the different voltage levels. The other component like ROE, Interest on Debt, Interest on Working Capital, Depreciation and Operation and Maintenance Costs are apportioned across all voltages. Hence average cost of supply is the key ensure differentiation for consumers connected at different voltages. This would imply that consumers connected at the same voltage level would have the same cost of supply. Ideally the tariff must be within 15-20% of the average cost of supply as specified for HT and EHT level consumers who are connected to the ISTs as stated in the dictum of the National Tariff Policy.
- For the above to be implemented proper computation of the ARR is a requirement for ensuring that the Average Power Purchase Cost, the Average Cost of Supply and hence the CSS is calculated correctly.
- Distribution utilities have one consumer category for agricultural consumers. However the load consumption pattern for agricultural purposes and other household needs varies. Hence there is a need for categorical separation of rural consumers into non-agricultural and metered consumers, that is, those who have feeder connections for irrigation purposes. This can help to identify the consumers who can take advantage of the cross subsidy, while for other consumers a minimum monthly charge may be imposed, as is done.

- In order to prevent misuse of subsidised power consumption and ensure efficient collection of revenue, subsidy should be rationed to a certain quantity as decided and monitored by Rural Electricity Corporation. This would ensure that the quantum of subsidy offered by utilities falls, thereby reducing the burden of cross subsidy on industrial consumers.
- Like seen in the case of Bhiwandi Franchisee Model, collection efficiency of distribution utilities can be improved. The AT&C losses in Bhiwandi fell from 58% to 20% due to the Bhiwandi Electricity Distribution Franchisee. Privatization of utilities through the PPP model and Franchisee Model can be a way to implement more efficient distribution system, as the relatively small size of the distribution areas brings the entities closer to the consumers, leading to transparency and accountability, also it does not need high amounts of capital expenditure.
- The development of Smart Grids is essential to efficient management and sustainable energy. Also energy efficiency can be increased by stronger attempts at demand side management. The problems of financial health of distribution companies can be addressed through installation of AMR. This can solve the problems of high non paid bills, theft of electricity, high distribution losses, illegal consumer connections and high costs of reading meters.
- Incentives must be provided such that distribution licensees which have a greater percentage of reduction of AT&C losses are given first preference when consumers must use their networks through Open Access.

Level 2: Development of Power Market

There is a need for developing the power market and making OA mutually beneficial for Discoms and Consumers.

- The concept of multiple supply licensees had been proposed in the Electricity Act Amendment of 2014, by segregating carriage, which is

the distribution network from the content, which is the electricity supply business. While the introduction of separation of carriage and content in UK was highly successful, the same path has to be tread carefully in India. This is because in UK there was surplus generation capacity with no transmission constraints. India doesn't have the same features as UK which makes it a challenge to implement it.

- If open access consumers want to procure power from other states, they must enter into bilateral contracts on the round the clock basis of trading.
- For a lower price in wholesale market more attention has to be paid on adequate regulation in exchange market as improper structure will lead to market failure. This is because the market will rely on market forces and competition and not regulations which in turn, will minimize generation costs and build trust in companies for long term finance for power systems.
- Gradual opening up of the market to consumers who consume lesser than 1 MW can help to promote the retail market. Thus even if not now, in the near future, open access must be mandated for consumers consuming a load below 1 MW.
- Parallel licensing can help to provide access to transfer of customer service and supply to new entities on existing network, ensuring non-discriminatory access to transmission and distribution network.

Level 3: Reforms in Open Access Design

A reformation in the structural design of Open Access Framework is required.

- Prima-facie the cross subsidies as being charged by distribution companies appear to be a constraint towards development of a competitive power market. A shift from completely regulated and state run distribution companies' based scenario to Open Access practices is a major change. To bring this change, it is highly important to implement them in steps, in that sense phasing out of cross subsidy

over a planned timeframe in line with the guidelines of the NEP and NTP is desired. At the time of enactment of Electricity Act 2003 it was envisaged that this would be brought down to zero in five years' time, which was later brought down to 20% of the initial amount by 2010-11. However this hasn't been achieved yet. Reduction and subsequent elimination of cross subsidy would bring the power market a step closer to competitive market. As witnessed earlier in other competitive markets, when buyers and sellers are free to decide on their source of buying and selling, efficiency comes into the system resulting in market determined prices and further efficiency gains.

- Imposition of a singularized open access charge that differs from state to state to prevent pancaking of the different charges.
- Rationalization of tariff with more stress on cost reflective tariff that also includes the concept of cost of services.
- Strong monitoring to ensure mandatory bandwidth of getting cross subsidy to +/-20% of the average cost of supply is a highly needed requirement.
- Cross subsidization for consumer categories must be made different. Large consumers are not necessarily wealthy which makes them, unable to absorb additional tariff to implement cross subsidies to the extent that the political process may want. It also maybe be the case that much of the load is accounted for through smaller residential loads, though many of these customers may be wealthy. If this is the case, a mechanism may be evolved to determine who will be providing the subsidy and who will receive the subsidy, based on income.
- Wheeling charges must be charged only to the extent of using the distribution network and not be charged on the entire distribution network.
- SLDCs should revise the CSS periodically such that there is a balance between incentives for both stakeholders, i.e. Distribution Companies and Open Access consumers. CSS should be made correlated to extent of open access accessibility in the state.

- There is no consistency in regulations followed by state regulators in determination of wheeling charges and cross subsidy surcharge. Due to unavailability of voltage wise data on cost and distribution losses, state regulators have to allocate costs and losses between the wheeling and retail supply functions on the basis of assumptions. Moreover, in the absence of proper data, cost of supply cannot be properly determined which affects the estimation of cross subsidy surcharge. Thus collection of such data is necessary.
- The retail market can be given a push by promoting PPAs and long term contracts at the retail level, gradually opening up the open market to those with contract demand less than 1MW.
- Quality based pricing differentiated for wholesale bulk consumers who go the OA way. Partial Open Access can also be a way to ensure gradual penetration. Partial Open Access can help to bi-furcate the discom's revenue from consumers on the basis of time based contracts for open access and regulated tariff, so that neither the consumer has to pay a large open access charge, nor should the discoms have to pay a skewed cross subsidy. This is an immediate solution for those distribution companies which have very high financial losses.
- Local bodies and franchisees at the rural level can help to ensure further penetration of OA that can help in rural electrification.

Level 4: External Factors

There is a need to address the problems of congestion in network, power scheduling, power evacuation infrastructure, balancing parameters and other institutional reforms.

- There is a lack of proper implementation of provision in electricity bill regarding direct sale of surplus power by captive power plants outside states, as CPP needs permission from state government as well as

require approval for usage of SEB's Transmission network. Thus provisions must be made to ensure the same.

- The independence of Load DespatchCentres is a necessary condition for the health of the power market. SLDC should be ring-fenced from all generation, transmission and distribution utilities of the State. This can be done through metering and creation of an electrical boundary. Apart from this introduction of a system of certification of system operators by an independent body is necessary as well, along with laying down of standard operating procedures which would be adopted by the SLDCs.
- The current process of availing Open Access is extremely cumbersome with innumerable rounds of NOCs and other formalities to be fulfilled. This must be simplified in order to ensure that more number of consumers can avail open access.
- Modification of scheduling preference from long term contracts to short term contracts can help to reduce problems related to non-clearance and partial clearance of bids in power trading.
- Congestion management in order to increase available transmission capacity is extremely important. India currently follows a highly time consuming format of area split congestion management. In order to remove market inefficiencies and market power we must follow a more time based congestion management system which involves a lot of efficient scheduling.
- Capacity shortages can be reduced by the separation of carriage and content such that the wires belong to one company while the supply of power can be done by some other company. This can help to ensure fair competition, as otherwise the more dominant company owns the wiring, which gives rise to access issues.
- SERCs shouldn't discourage generators from entering the open access market. Their actions to force IPPs and CPPs to sell their surplus power only to state utilities, as stated by the Electricity Act 2003,

Section 11, has created inefficiencies in the power market. Thus a modification of that policy is a great necessity.

- Electricity grid management is an important aspect of load balancing to ensure successful implementation of OA. The ex-ante, real time and post facto functions are key aspects of load balancing. Due to the current targets for 2022, and the increase in renewable energy commissioning grid integration, more sophisticated ancillary services are being put to use.