CHAPTER 5

CONCLUSION

5.1 INTRODUCTION

The findings, conclusions and recommendations of the study are contained in this chapter. Results of the analysis have been evolved in the form of a suggestive framework.

5.2 CONCLUSION AND RECOMMENDATIONS OF THE STUDY

Literature suggests that in a competitive environment of retail power market, tariff set by the regulator needs to move towards cost-to-serve with some protection for the poor to serve societal needs. Failure by the State Regulators to adopt cost-to-serve retail tariff model is likely to be one of the causers of financial distress of Indian power sector.

The distribution utility, the cross-subsidisers and the cross-subsidised are the three critically affected stakeholders, apart from the government and the investors, as discussed through this study. Introduction of competition without addressing the issue of achievement of cost-of-supply for both the cross-subsidisers and the cross-subsidised is considered a non-starter, as competition is being thrust upon a highly imperfect situation (without level playing field). Absence of an inter-connected strategy to deal with the three segments is a grave concern for the sector, which is not given due consideration. The strategy to be adopted is a delicate balancing game - unless the payment of exit charge for the cross-subsidisers is adequately compensatory, the tariff of the cross-subsidised, who are left with the utility, has to increase to achieve the balance. Introduction of competition will falter if the exit charge is set at too high a level, as the cross-subsidisers have no motivation to leave the system. **If tariff is inadequate / inappropriately designed with reference to**

cost-of-service, as has been the experience in India, the utility fails to perform as it is financially strained. There is an overarching need to protect the distribution utilities, who are in considerable financial distress, and being mostly State-owned, often bear the brunt of populist policies. Unless the issue of cost-of-supply based tariff is resolved satisfactorily, competition cannot be introduced with a fair degree of sustainable success.

Encouraging open access is an acute business problem faced by the electricity sector. Lopsided encouragement is given to consumers with high demand (1 MW and above in most States) to move out of a distribution licensee's system. These high-demand, high tariff-paying customers are the cross-subsidisers. When they leave the system, the cross-subsidy paid by them is entirely lost to the distribution licensee (if they become captive users) or partially recompensed for non-captive users. Logic demands that the compensation be based on actual cost of supplying electricity to these customers, if the financially distressed distribution licensees and / or the other customers, are to be protected. However, the real cost to serve the potentially exiting customers is not known / discussed. Under the circumstances, an accurate cost-of-supply study would reveal the extent of cross-subsidy in the system.

It is in this context that the need for an appropriate cost-of-supply model was perceived and a replicable cost-to-serve model based on real life data of a utility, has been developed through the study, which would be of help to the policy-makers and other stakeholders. **The cost-to-serve modelling has been sliced to the minimum possible strata or segment for appropriate policy interventions. Too broad-based a stratification on the basis of categories of supply, usually centred around the nature of supply (e.g. "residential", "commercial", "industrial" etc.), hides the inefficiencies and anomalies, and camouflages the real cost to serve the lowest consumer segments. Thus, apart from voltage level-wise cost-of-service, the detailed model, based on peak load analysis, moves further into the realm of nature of supply i.e. residential, commercial, industrial etc. and segments each such category into consumption levels and cogently establishes that cost *inter alia* varies with the level of consumption as well as voltage, nature of**

supply etc. Even for higher voltages, the cost to serve a consumer connected at 6 KV / 11 KV is higher than that of a consumer connected at 33 KV / 132 KV / 220 KV. This differentiation needs to be recognised in a framework of competition as the alternative suppliers will be inclined to serve on the basis of real cost-to-serve, bringing undesired volatility into the sector. Incidentally, the Appellate Tribunal for Electricity has recognised that there is wide difference in the cost of supply at 11 KV and 132 / 220 KV, fixation of uniform tariff for all consumers of the same category receiving supply at any voltage from 11 KV to 220 KV is incorrect and has recommended separate tariff for consumers receiving supply at such higher voltages.[75]

This study fills that void in understanding of segment-wise cost-of-supply, by providing the basic framework. The guiding principles on the basis of which cost-of-supply studies can be initiated for other entities are established through this endeavour.

Where the tariff of a customer is higher than his cost-of-supply, the variance between the tariff paid by him and his cost-of-supply, is the cross-subsidy handed out by him, whereas, for a customer with tariff lower than his cost-of-supply, the variance between the tariff paid by him and his cost-of-supply, is the cross-subsidy enjoyed by him.

The results of the study exhibit the details of divergence of cost-to-serve, through the ratio of cost-of-supply of a few HT segments vis-à-vis the lifeline segment in Table 5.1.

[75] Judgment of the Appellate Tribunal for Electricity in Appeal Nos. 13 and 198 of 2010 and 42 of 2011 dated July 26, 2012, available at the website of the Tribunal at http://aptel.gov.in/judgementnew.html, last accessed on May 22, 2016.

Table 5.1: Illustration of HT Segment Cost-of-Supply vis-à-vis Lifeline Cost

Consumer Category	Cost-of-Supply of Segments as Percentage of Average Tariff	Cost-of-Supply of Segments as Percentage of Lifeline Cost
LT Residential Lifeline	193%	100%
HT 33 KV other than Traction	64%	**33%**
HT Metro Railway	77%	40%
HT Industrial below 33 KV	71%	**37%**
HT Commercial below 33 KV	93%	48%
HT Residential and HT Co-operative Housing Societies	93%	48%
HT Tramways	75%	**39%**
HT Public Water Works and Public Utility	65%	**34%**
HT Construction Power, Private Educational Institutions, HT Sports Complex and Auditorium	84%	43%
Overall HT	77%	**40%**

LT indicates both Low and Medium Voltages (below 6 Kilovolts); HT indicates High Voltage (from 6 Kilovolts to 33 Kilovolts)

Source: Present study.

Divergence of cost-to-serve, through the ratio of residential segment with monthly consumption upto 60 kWh vis-à-vis cost-of-supply of a few HT segments, is another indicator, furnished through Table 5.2, which reflects a highly skewed position as well.

Table 5.2: Illustration of HT Segment Cost-of-Supply vis-à-vis Residential Segment with Monthly Consumption upto 60 kWh

Consumer Category	Cost-of-Supply of Segments as Percentage of Average Tariff	Cost-of-Supply of Segments as Percentage of Residential with monthly consumption upto 60 kWh
LT Residential with monthly consumption upto 60 kWh	129%	100%
HT 33 KV other than Traction	64%	**50%**
HT Metro Railway	77%	60%
HT Industrial below 33 KV	71%	**55%**
HT Commercial below 33 KV	93%	72%
HT Residential and HT Co-operative Housing Societies	93%	72%
HT Tramways	75%	**58%**
HT Public Water Works and Public Utility	65%	**51%**
HT Construction Power, Private Educational Institutions, HT Sports Complex and Auditorium	84%	65%
Overall HT	**77%**	**60%**

LT indicates both Low and Medium Voltages (below 6 Kilovolts); HT indicates High Voltage (from 6 Kilovolts to 33 Kilovolts)

Source: Present study.

The conclusion from this study is that **consumers drawing power at 33 KV (non-traction) cost only 33% of the cost of lifeline consumers per kWh and 50% of the cost of residential consumers consuming upto 60 kWh a month**. Similarly, the **cost per kWh of a high voltage industrial consumer, drawing power at 6 KV, is only 37% of the cost of lifeline consumers and 55% of the cost of residential consumers consuming upto 60 kWh a**

month. For high voltage industrial customers, average tariff across the 25 utilities studied under Objective 2, is assessed at 120% of average cost (Table 4.8), whereas their cost is 71% of average cost (Table 5.2). Residential customers consuming 100 kWh a month has a tariff of 71% of average cost (Table 4.8), whereas their cost-to-serve is significantly higher as all LT consumers have cost above average cost (for 60 kWh monthly consumption for residential consumers, cost is 129% of average cost (Table 5.2)). The sharp anomaly in cost vis-à-vis tariff and resultant cross-subsidy is brought out by above indicative numbers. In the context, Table 4.33 illustrates the cross-subsidy framework for the designated utility for cost-of-supply study, and depicts the skewed position of cost vis-à-vis tariff. While this table is utility-specific, broad contours of the problem can be gauged from the numbers.

Indian policy documents had mandated progression towards ±20% of average cost-of-supply, which essentially means that the tariff of the cross-subsidisers should be within 120% of the average cost-of-supply and that of the cross subsidised segments should be above 80% of the average cost-of-supply. In the backdrop of the finding that the **cost to serve the entire high voltage segment is less than the average cost, a proposal to bring their tariff only within 120% of average cost-of-supply, would mean that a huge gap would still remain in the system and may prove inadequate for sector reforms.**

Similarly, since the cost-of-supply of **all low and medium voltage categories have been found to be more than the average cost, the proposal to bring such consumers to a level just above 80% of the average cost, would mean continuation of a highly lopsided tariff structure with insufficient progression towards cost-of-supply.** Moreover, the analysis carried out through Objective 2 has demonstrated that even ±20% of average cost-of-supply has not been attained (Table 4.8).

The absence of a well-co-ordinated policy framework is established through various policy-related documents. Reference may be drawn to the Economic Survey of 2015-16, which prescribes cross-subsidisation within the residential category with higher cost being loaded upon higher consumption (with price

inelasticity), thus relieving burden on industry as well as making tariff simple and transparent (Ministry of Finance, Government of India, 2016). On a similar issue, the Union Power Minister reportedly requested all members of Lok Sabha on 28 July, 2016 to convince their respective State Governments to offer electricity to industries at a fixed rate for a long term period of 10 / 15 years, to meet industrial necessity of uninterrupted power (Business Standard, 2016). While the stated objective is undoubtedly a movement towards lowering of industrial tariff (as also demonstrated by international experience), unless the modalities are made clearer (subsidy by States, as tariff determination is a prerogative of the State Electricity Regulatory Commissions or cross-subsidy reduction i.e. increasing tariff of other categories / segments etc.), it cannot be immediately seen how such objectives shall be implemented. These current examples are drawn to exhibit the paucity of inter-connected strategisation.

The 2003 Act envisages payment of cross-subsidy surcharge to protect the cross-subsidised consumers and additional surcharge in case of stranding of assets due to exit of consumers.[76] There are multiple associated issues. Consumers using electricity from captive sources are not required to pay any exit charge to compensate for cross-subsidy. For others, it is stating the obvious that if the cross-subsidy surcharge is too onerous, there is no impetus for the high voltage consumers to leave the system and the objective of ushering in competition is thwarted. If it is too low, either the distribution utilities or the poorer end-consumers are affected. This study is not entering into the debate of inadequacy or otherwise of the formula mooted for cross-subsidy surcharge calculation (Ministry of Power, Government of India, 2016), the logic behind excluding captive consumers from its ambit and other like points. The study focusses on articulated decision-making and is primarily trying to carve out a path of exclusion of non-economic drivers to weed out artificiality from the process.

[76] Sections 38(2)(d), 39(2)(d), 40(d) 42(2), 61(g) of the Electricity Act, 2003 (36 of 2003) notified on June 10, 2003 read with amendments made through the Electricity (Amendment) Act, 2007 (26 of 2007 dated May 29, 2007.

Another aspect derived from the study is due allocation of consumer-specific costs. When carriage and content are separated (separation of wire business and retail business), as are being mooted through policy changes (proposed amendments to the Electricity Act, 2003), there would a further necessity of arriving at actual cost-to-serve of retail business, which is being addressed through the model. **Thus, the research suggests economic decision-making based on cost considerations and progression towards cost-of-supply for all categories except the lifeline**, which is detailed in subsequent paragraphs.

An approach for addressing the problems of tariff / subsidy of poor or vulnerable consumers in India has been derived through this research. Economic aspect of protection for "lifeline customers" or "Below Poverty Line customers" ("BPL" customers) has been examined and the magnitude of support need for lifeline category is assessed. **Some solutions to address the support quantum is proposed through this research, preferably through universal charge on all consumption except lifeline, as practised in the Philippines, with some modifications / suggestions to tailor it to fit Indian needs.**

To detail it further, various literature highlighted that special benefits for the poor are not directly available in a competitive model. In a structured situation, special dispensations for the vulnerable consumers are usually secured through legislative intent (Hunt & Shuttleworth, 1996). Global understanding was attempted through study of selected countries where electricity reforms have been successful or countries which are undertaking a process of electricity reform. Lessons were culled out from this study and validated in the context of a developing economy with a large poverty headcount (Chatterjea & Dwivedi, 2016). From the literature, it was found out that there are various factors which are influencing the policy processes. For instance, the pre-dominant view emerging from the survey is that there exists a lack of understanding of the selection process for the subsidised segment. Extensive review of the tariff process of utilities across India was undertaken to discover the policies and processes for understanding vulnerability. Attempts in this respect were found to be so variegated, that it could be

concluded that there is no serious effort to give a coherent shape to the problem of identifying the vulnerable segments. Thus, a holistic view of the problem is attempted through comprehensive research to address this issue which extended into design of an appropriate cost-of-supply model. However, achieving cost-of-supply based tariff without addressing the issue of the vulnerable section of the society, may not yield the desired results. India has the highest population of poor, in the world. Making electricity services available and affordable for such a multitude, is a problem of immense magnitude.

Countries devise separate strategies to deal with the problems affecting the vulnerable strata of consumers. Such strategies are expected to cover the problem of making electricity affordable for the lifeline segment. While India has significant policies on electrification, i.e. the capital cost of laying down electricity lines to reach the unelectrified customers, the other side of the coin - the issue of sustainability, i.e. the prices at which the poor customers will obtain electricity together with the connected problem of sustainability of the distribution utility to sell at such prices, is somewhat obscure. Learning from international experience, such a maintainable policy needs to be conceived and implemented. It cannot be overemphasized that both the questions of electricity affordability for the vulnerable consumers and financial sustainability of the distribution segment of the electricity industry, which has a staggering accumulated loss of Rs.3.8 trillion, have to be covered through the gamut of the policy documents.

The present policy which encourages competition through open access to electricity wires without making adequate provisions for support of the sector, is lopsided and has been criticised. There is even a view that once the subsidy paying consumers i.e. the cross-subsidisers move out of the system of the distribution utility, prices paid by other consumers will automatically increase and resolve the issue of cross-subsidy. This has also been termed as "reform by stealth" (Dubash N. K., 2011). This concept is found to be too optimistic. Once again, the overarching need of stringing together all the policy elements is perceived.

Policy documents need to be based on informed choices. It is necessary to acknowledge the extent of cross-subsidy in the system before India embarks on a path of achieving cost-of-supply or encourages customers to move out of a distribution licensee's system. International literature cautions against short-cuts in reform steps / treading a reform path without following a demarcated procedure (Kessides, 2012). Meandering along a path of reform without line of sight on cost of supply, is missing a singularly important step in the path. Literature also suggests that the poor are the hardest hit when reform is undertaken (Thomas, 2005), (Davies, Wright, & Price, 2005), (Haselip, Dyner, & Cherni, 2005). The current study emphasises that the path is to be treaded warily, as the magnitude of the problem is very large. One cannot afford to ramble through, without fully appreciating the electricity need of the largest poor population in the world.

India's policy documents on lifeline consumption are also incomplete. On the issue of electricity for poor consumers, a consumption level has merely been stated with a view that electricity should be made available to these consumers at a minimum of 50% of average cost-of-supply (Ministry of Power, Government of India, 2016). The problems are on many counts.

First, just a level-wise fixation of electricity consumption for the poor, is itself internationally criticised as the benefits do not necessarily reach the intended consumers. There are both issues of subsidy leakage and inadequate coverage through a vague threshold. Consumption pattern of various consumers, even at the same voltage level, widely varies with their monthly income. Definition of poor or vulnerable consumers from family income aspect seems a much more realistic option. Designation of lifeline families through a nation-wide scheme covering other aspects (could be cooking gas etc., though a subsidy-free regime has already commenced for sections of cooking gas users) is a more desirable solution. Using current instruments in focus like the Aadhar card, with a suitable marker, could be used as the instrument of choice with family-wise consolidation. While the exercise is of considerable nation-wide magnitude, it is re-emphasized that the extent of the problem, due to the size of Indian poor population, is also huge. There is inadequate appreciation of the

magnitude of the problem as the distribution utilities being mostly State-owned, and many of them being highly loss making, the problem of making electricity affordable for the poor is lost in the quagmire of all other overwhelming problems of the sector. The recent scheme ("Uday" Scheme) for operational and financial turnaround of the utilities (Ministry of Power, Government of India, 2015) endeavours to reduce electricity losses ("AT & C Losses") and efficiency improvement through streamlining of coal / power purchase activities of distribution companies as well as reduction of interest cost (through take-over of debts by the respective State Governments and conversion to bonds) (Morgan Stanley Research, 2016). The financial measures have been criticised as simple conversion of 75% of accumulated losses of the distribution companies to State debts at lower interest rates and thereby "greening" of the non-performing assets of the banks, without addressing the issue of improving financial health of the companies, particularly where aggregate electricity sales revenue barely touches 80% of the cost of supply (Sethi, 2016). Uday Scheme does not provide any guideline on reduction of *inter-se* subsidy in the system or the issue of protection of the poor. Thus, need for an articulated policy is an imperative and it may not be controverted that acceptance of the problem and aggregation of electricity need at family levels for the vulnerable segment, is the first step towards assuaging the problem.

Second, after defining family income, electricity consumption level may be additionally chosen to be fixed. A survey report indicates that a family with annual income of Rs.75,000, is consuming, on an average, around 60 kWh a month (Indian Institute of Social Welfare and Business Management, 2005) - Table 2.4 may be referred. Consumption of 60 kWh per month, or 2 kWh a day, seems to be a good consumption indicator. This can be refined or bolstered with additional studies.

Third, apart from consumption level, another possible refinement is relying on the connected load of the household. If it is decided through the policy that

five lights (Light-emitting diode i.e. LED lamps),[77] two fans, a small television set, minor charging equipment like a mobile charger will be allowed at a lifeline tariff to a poor household, the consumption level at an acceptable load factor (33% derived through representative data) is found to be around 60 kWh a month. The corresponding connected load is 250 watts. Table 5.3 reflects a consumption assessment table.

Table 5.3: Lifeline Consumption Assessment

Electrical Appliance[78]	Number	Load in Watts	Total Load in Watts
Light-emitting Diode (LED, 100 watt incandescent equivalent)[79]	5	20	100
Ceiling Fan	3	40	120
Television set (12"black and white)	1	20	20
Miscellaneous (mobile charger etc.)			10
Total			**250**
Load factor based on representative data	33%		
Consumption in a month	**59.4 kWh**		

Thus, Rs.75,000 annual family income, 60 kWh consumption per month and a connected load of 250 watts, are stringing well together. There is scope for tightening or broadening the definition, as desired, on the basis of actual surveyed data on a larger base than the sample size of 7000, which has been used in the referred study (Indian Institute of Social Welfare and Business Management, 2005) as an indicative measure, together with actual data on the extent of subsidy that can be borne by the system.

[77] With the UJALA Scheme (Retrieved 20 February 2017 from http://www.eeslindia.org/Home.aspx) of Energy Efficiency Services Limited (EESL), involving mass distribution of LED lamps at affordable prices across India, LED wattage may be used for lifeline consumption assessment.
[78] Wattage from Electrical Appliance Typical Energy Consumption: Chabot Space and Science Center: Retrieved July 12, 2016 from http://www.chabotspace.org/assets/BillsClimateLab/Electrical%20Appliance%20Typical%20Energy%20Consumption%20Table.pdf (all appliances except LED lamps)
[79] Wattage from LED Light Bulbs: Comparison Charts: Retrieved 20 February 2017 from http://eartheasy.com/live_led_bulbs_comparison.html#c

Fourth, the basic policy should preferably be set at the national level. Setting the policy of exit system for the cross-subsidisers is being conceived at the national level, whereas the policy for the cross-subsidised is free-floating and left at political whimsy. This is an inherent defect of the policy initiative and unless the policy elements are well-strung together, the distribution business will continue to languish. The problem of electricity featuring in the "Concurrent List" of the Indian Constitution may need to be surmounted for this objective of unification of policies.

Through comparison of lifeline cost-to-serve (from the cost-to-serve model based on real life data of a utility) and average lifeline tariff, the magnitude of support requirement for lifeline category is assessed. Since the support quantum is not daunting, the long standing issues can be handled without major financial difficulty through levy of a universal charge or by resorting to direct subsidy and some discussions along these lines are available (Chatterjea, Dwivedi, & Sengupta, 2016).

Thus, **need for the future is both tariff rationalisation for all other segments as well as treatment of the support need for the lifeline segment** (on the latter, the study has sought to offer some solutions). Going a step forward, it can also be expected that once tariff rationalisation takes place for non-lifeline segments, new initiatives will fall in place with correct economic signals. Presently, many innovations fail to take off as they are not economically viable at subsidised tariffs. Innovative signals like time-of-the-day tariff (fixed time-slots), time-of-use (real-time) tariff, interruptible tariff, demand-side management (DSM) measures as well as active promotion of roof-top solar installations, will all follow suit and find their markets. Once the economics are set right, there will be less wastage of national resources in pursuing apparently attractive but actually costlier options. Alternatives will then be weighed by the customers against their real cost-to-serve tariff and this will encourage them to take appropriate steps. In fact, going a step further (assisted by the Chilean model), electricity cost can also be derived for specific terrains or geographical regions, facilitating decisions on grid-connected or off-grid distributed generation (including solar), based on actual

cost-to-serve. These aspects provide scope for future research and has been included in the Scope for Future Research / Limitations chapter (Chapter 7).

5.3 CHAPTER SUMMARY

Cross-subsidy framework has a large gamut of issues and has been studied here in a holistic manner. Based on detailed process of analysis, the study has recommended a framework which provides a satisfactory solution addressing all major stakeholders. The recommendations define the suggested framework by outlining an apt policy and necessary interventions.

The crucial research gap was absence of understanding of actual cost of supply. All pricing decisions of Indian electricity sector are constrained in the absence of the same, as decisions are being undertaken based on imperfect knowledge. Choices on eventual tariff, subsidy needs, necessity of cross-subsidisation, introduction of competition, tariff of the end-consumer, once large customers exit the system, cost implications of segregation of wire and retail business (in case this proposed policy is implemented in actuality), proliferation of renewable generation through major initiatives, decisions on grid-connected or off-grid distributed generation - all need a rational working platform of costs. This study provides a basic framework for understanding cost-of-supply and consequent cross-subsidy in the perspective of the Indian electricity sector.

Absence of a strategy on cost-to-serve, which hinges together and balances the needs of the three major stakeholders (the distribution utility, the cross-subsidisers and the cross-subsidised) is a significant sector issue. Payment of adequately compensatory exit charge by the cross-subsidisers needs to be weighed against competition needs, which falters if the exit charge is set at too steep threshold. There is also an all-embracing need to protect the troubled distribution utilities. Unless the issue of cost-of-supply based tariff is resolved satisfactorily, competition cannot succeed. It is in this context that a replicable cost-of-supply model helps the policy-makers and other stakeholders, by providing a robust reference point for decisions. The model goes beyond category-wise cost-of-supply and delves into segment-wise costs, as only such stratification can provide correct economic signals for policy interventions.

Achieving cost-of-supply based tariff without addressing the issue of the vulnerable section of the society may not yield the desired results. The present research contributes by way of presenting an approach to addressing the problems of tariff / subsidy of poor or vulnerable consumers in India. Economic aspects of protection for "lifeline customers" or "Below Poverty Line customers" ("BPL" customers) have been examined and the magnitude of support need for lifeline category is assessed. Some solutions to address the support quantum is proposed through this research.