



Forum of Regulators

Report on Road Map for Reduction in Cross Subsidy

April 2015

Assisted
By:

pwc

Contents

1. Overview	6
1.1. Background of the study	6
1.2. Objective of the study	6
1.3. Scope of work	6
1.4. Phase wise approach for completion of the assignment	7
2. Cross subsidies in electricity tariff	9
2.1. What are cross subsidies?	9
2.2. The economics of cross subsidies in electricity tariff	10
3. Legislative, regulatory provisions and Judgments of the APTEL	11
4. Overview of cross subsidies in electricity tariff in India	16
4.1. Methodology for calculation of cross-subsidies	17
4.2. Review of ACoS coverage across states	17
4.3. Selection of states for further study on cross subsidies	29
5. Review of cross subsidy levels in selected states	33
5.1. Madhya Pradesh	34
5.2. Maharashtra	37
5.3. Delhi	40
5.4. Punjab	43
5.5. Himachal Pradesh	45
5.6. Bihar	47
5.7. Andhra Pradesh	51
5.8. Meghalaya	53
5.9. Rajasthan	56
5.10. Kerala	59
6. Cost of supply – calculation methodologies and review of Indian states	62
6.1. Reference point for calculation of cross subsidies: category wise cost of supply vs. average cost of supply	62
6.2. Embedded cost approach	63
6.3. Simplified approach	67
6.4. Need for undertaking detailed cost of supply studies	70
7. Reduction of cross subsidies	71
7.1. International experiences of electricity sector reforms and cross subsidy reduction	71
7.2. Strategies for reducing cross subsidies	83
8. Way forward and recommendations	92
9. Concluding note	94

10. Annexures	96
10.1. Cost of supply calculation based on APTEL judgement in Appeal Nos. 102 of 2010	96
10.2. Trajectories required for elimination of cross subsidies (based on ACoS)	104
11. About PwC	109

List of abbreviations

Abbreviation	Full Form
ABR	Average Billing Rate
ACoS	Average Cost of Supply
AERC	Assam Electricity Regulatory Commission
APTEL	Appellate Tribunal For Electricity
AVVNL	Ajmer Vidyut Vitran Nigam Limited
BESCOM	Bangalore Electricity Supply Company
BPL	Below Poverty Line
BRPL	BSES – Rajdhani Power Limited
BYPL	BSES – Yamuna Power Limited
CoS	Cost of Supply
CSPDCL	Chhattisgarh State Power Distribution Company Limited
DERC	Delhi Electricity Regulatory Commission
DVVNL	Dakshinachal Vidyut Vitran Nigam Limited
EA 2003	Electricity Act, 2003
FOR	Forum of Regulators
GESCOM	Gulbarga Electricity Supply Company
HESCOM	Hubli Electricity Supply Company
HPSEB	Himachal Pradesh State Electricity Board
JdVVNL	Jodhpur Vidyut Vitran Nigam Limited
JVVNL	Jaipur Vidyut Vitran Nigam Limited
KESCO	Kanpur Electricity Supply Company
KSEBL	Kerala State Electricity Board Limited
MERC	Maharashtra Electricity Regulatory Commission
MESCOM	Mangalore Electricity Supply Company
MSEDCL	Maharashtra State Electricity Distribution Company Limited
MVVNL	Madhyanchal Vidyut Vitran Nigam Limited
NBPDCL	North Bihar Power Distribution Company Limited
NEP	National Electricity Policy
PSERC	Punjab State Electricity Regulatory Commission
PSPCL	Punjab State Power Corporation Limited

Abbreviation	Full Form
PUVNL	Puranvanchal Vidyut Vitran Nigam Limited
PVVNL	Paschimanchal Vidyut Vitran Nigam Limited
SBPDCL	South Bihar Power Distribution Company Limited
SDP	State Domestic Product
SERC	State Electricity Regulatory Commission
TANGEDCO	Tamil Nadu Generation and Distribution Company
TP	Tariff Policy
TPDDL	TATA Power Delhi Distribution Limited

1. Overview

1.1. Background of the study

The Forum of Regulators (FOR) has been constituted by the Government of India in terms of Section 166 (2) of the Electricity Act, 2003 (EA 2003). The Forum is responsible for harmonization, coordination and ensuring uniformity of approach amongst the Electricity Regulatory Commissions across the country, in order to achieve greater regulatory certainty in the electricity sector.

FOR has discussed the issue relating to tariff rationalization in distribution sector. Historically, across most of the utilities, industrial and commercial consumers have been paying a higher tariff, whereas domestic and agricultural consumers pay lower tariff than their cost of supply. It is this difference between the applicable average tariff of a consumer category and the cost of supply to that consumer category that is generally referred to as Cross-Subsidy.

The EA 2003 has enabled under section 62(3), provision of cross-subsidies based on load factor, power factor, voltage, total consumption of electricity during any specified period or the time at which the supply is required or the geographical position of any area, the nature of supply and the purpose for which the supply is required. However, the Act has at the same time, required the SERCs to progressively reduce cross subsidy in tariff so as to ensure that the tariffs reflect the cost of supply. The SERCs are expected to draw a road map for reduction of cross subsidy.

In fact, reduction of cross subsidy or tariff rationalization has been the main driver of tariff reforms and it is for this reason that the independent regulatory commissions were envisaged through Electricity Regulatory Commissions Act, 1998. In order to suitably address this issue and in the light of the provisions contained in the EA 2003, National Electricity Policy and the Tariff Policy, FOR decided that a study be carried out on Road Map for Reduction in Cross Subsidy, while analysing the progress made by these utilities in this regard across various states and identifying the best practices adopted by various SERCs for reducing the cross subsidy. PricewaterhouseCoopers Private Ltd. (PwC) was appointed by FOR to assist in carrying out the tasks required for the study.

1.2. Objective of the study

To devise principles for determination of cross subsidy and suggest a roadmap for reduction of cross subsidy as per the requirement of the Electricity Act 2003, the National Electricity Policy and the Tariff Policy.

1.3. Scope of work

As per the Terms of Reference, PwC is required to carry out detailed analysis of the existing cross subsidy in tariffs, which would include the following:

- Identification of principles of tariff design, subsidy & cross subsidy as specified under the Electricity Act, 2003, Electricity and Tariff Policies and various regulations notified by appropriate Electricity Regulatory Commission(s).
- Comprehensive analysis of nature and principles and determinants of tariff and cross subsidy as adopted by various SERCs in tariff design vis-à-vis the principles of tariff design.
- Identifying the measures adopted by SERCs, if any, for reduction of cross subsidy.
- Identification of gaps, if any, in the measures adopted so far towards reduction of cross subsidy.

- Identification and analysis of different methods of determination of cross subsidy.
- Suggesting a model for determination of cross subsidy and road map for reduction of cross subsidy.
- Recommendations & Way forward

1.4. Phase wise approach for completion of the assignment

In order to meet requirements of the Scope of Work, PwC, in consultation with the Forum of Regulators adopted a phase wise approach for completion of the assignment.

Phase	Topics to be covered
Phase 1- Inception Report	<p>1. What are cross subsidies – concepts and economic theory</p> <p>2. Review of legal and regulatory framework for cross-subsidies in India</p> <p>3. Review of status of cross subsidies across states in India, covering:</p> <ul style="list-style-type: none"> • Average cost vs. average tariff for major categories - domestic, commercial, industrial and agriculture • Review of levels of cross-subsidies across all states including methodology of cross subsidy calculation • Consumer awareness about cross subsidy - test the number of APTEL cases/petitions in each state • Identification of ten Indian states which ideally present the status of sector, while taking cost reflection tariff, T&D loss, other relevant important parameters into consideration, for detailed review in Phase 2
Phase 2- Review of experience of Indian States	<p>1. Review of the performance of states since 2003</p> <ul style="list-style-type: none"> • Review of existing and past levels of cross subsidies • Review of attempts made by states towards reduction of cross-subsidies • Review of cross subsidy roadmap, if any, including comparison between actual and targeted performance <p>The above exercise to be done for the 10 Indian states identified in Phase 1</p> <p>2. Study cost of supply methodology followed across states, including:</p> <ul style="list-style-type: none"> • Review of methodology for calculation of cost of supply • Principles of cost allocation being practiced by various SERCs. • Generation of different scenario for cost allocation and suggestions thereof. <p>The above exercise will be done for the 10 Indian states identified in Phase 1</p>

Phase	Topics to be covered
Phase 3- International Review	<p>Review of cross subsidies, structure and procedure used for elimination in the international context, in the following countries:</p> <ul style="list-style-type: none"> • Philippines • Thailand • Brazil • Australia <p>Based on the review, derive key learnings from each country.</p>
Phase 4- Recommendations for India	<p>Evolving a roadmap for reduction of cross subsidies in India across various phases of development. The roadmap will cover:</p> <ul style="list-style-type: none"> • The possible scenarios, in case no measures are initiated to reduce cross subsidy • Suggest different road map (phase-wise) for reduction of cross subsidy
Phase 5- Draft report	<p>Draft consolidated report and presentation to FOR</p>
Phase 6- Final report	<p>Final consolidated report after incorporating comments from FOR</p>

2. Cross subsidies in electricity tariff

2.1. What are cross subsidies?

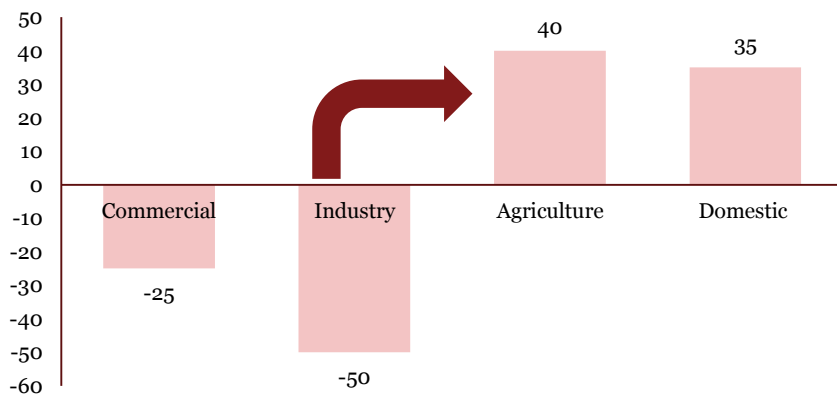
Cross-subsidies in electricity tariff can be defined as a mechanism whereby some consumer groups are charged a higher tariff as compared to the cost of supplying power to them. The additional revenue generated from them is used to tide over the revenue shortfall from other consumer groups, who are charged lesser tariff as compared to the cost of supplying power to them.

Cross subsidies are targeted at consumer groups who either do not have enough paying capacity or need to be supported for undertaking economic activities (e.g., agriculture, power looms, etc.), which in some way benefit the larger section of society. In case of cross subsidies, subsidisation is inbuilt in the tariff, unlike any external support (e.g., government funds) which is provided in the case of direct subsidy. Cross subsidy is a matter of tariff design, which can be adjusted depending on the intended level of cross-subsidisation. Some of the established methods to implement cross subsidies through tariff design are the following:

Category-wise

In this type of cross subsidy some categories of consumers such as commercial, industrial, etc. pay more than the cost of supply to cover the shortfall in revenue from other categories of consumers such as domestic, agriculture, etc. Such cross subsidies are widely prevalent in India.

Figure 1 Illustrative depiction of category -wise cross subsidies



Intra-category

In this type, cross subsidies occur within the same consumer category, where segmental tariff exists for different level of energy consumption. In such a situation, consumption at higher tariff slabs generates cross subsidies for the consumption at lower tariff slabs. For example, consumption level is divided in slabs such as 0-50 units, 50-100 units and 100-300 units, etc. within the domestic category. Normally the tariff for the higher slab (For example tariff for 100-300 units higher than tariff for 50-100 unit slab) is kept higher assuming the people who are consuming more energy can afford to pay more. In such cases, the consumer whose consumption is falling in higher slabs subsidizes the consumer whose consumption falls in lower slabs.

Geographical

The cost of supplying electricity may not be uniform for consumers located at various geographical locations like hilly/plane, urban/rural etc. area due to various factors such as lower consumer density, lower per capita consumption, difference in hours and quality of supply etc. Most of the distribution utilities have a lower tariff for consumers residing in rural/hilly areas vis-à-vis consumers residing in urban/plane areas without factoring in the cost of supply. In such cases, urban consumers might be cross subsidizing the rural consumers.

2.2. The economics of cross subsidies in electricity tariff

Detrimental impact of high cross-subsidies

High levels of cross subsidies result in wastage of economic resources. In the subsidized sectors it encourages electricity consumption to a point where the value attached to incremental consumption is lower than the cost of supply. Lower power tariffs may result in indiscriminate pumping of ground water by farmers (Forum of Indian Regulators (FOIR), 2010). On the other hand, higher tariffs (than the cost of supply) charged to commercial/industrial consumers pushes up their cost of product/services, which leaves them uncompetitive in today's era of globalisation. High cross subsidy may also lead to revenue loss for state utilities, as they incentivize industries to scale up 'captive power generation' to bypass the grid.

Cross subsidies are also a major hurdle in operationalization of open access in India. As per law consumers with load more than 1 MW are not bound to buy power from the distribution licensee and can source power from any generator. However large industrial users cannot switch to an alternate cheaper power supplier due to levy of high cross subsidies surcharge. The surcharge varies from state to state, for example it is 15% of retail tariff in Gujarat, 32% in Karnataka, 41% in Delhi, and 52% in West Bengal.

As and when the retail supply market is thrown open to competition, the first segment to avail the benefits of competition would be large consumers with load 1 MW or above. If these consumers move away to other retail suppliers, the distribution network operator (which would continue supplying power to other consumer categories) would suffer a loss, because significant cross subsidies would get eroded.

Policy implications

Stokiewicz (2005)¹ notes that implementation of cross subsidies requires careful consideration of certain issues including – estimates of demand, cost of service studies and cost reflectivity, avoiding uneconomic bypass and different consumer base configurations.

- **Cost of service studies and cost reflectivity:** Underlying the idea of efficient cross subsidies is the idea that rigorous cost-of-service studies have been done and that they have been used to implement a cost reflective rate design. In many states in India, either cost-of-service studies have not been done, or done long before the advent of reforms.
- **Avoiding uneconomic bypass:** Carrying cross subsidies too far can lead large or wealthy customers to bypass the system and self-generate. The reason is that if the cross subsidies leave the large users worse off than taking stand-alone service in terms of price or service quality, they have an incentive to leave the system.
- **Different consumer base configurations:** Usually implementation of cross-subsidies assumes that large and wealthy users of electricity account for the majority of the load being served and that they are the economic elites. However, in many cases, large customers may not be that wealthy, and may be unable to absorb additional tariff to implement cross subsidies to the extent that the political process may want. It may also 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.

¹ Stokiewicz Paul M., 2005, *Cross-Subsidies through fixed charges: Minimizing Electricity Consumption Distortion*, Public Utility Research Center, University of Florida

3. Legislative, regulatory provisions and Judgments of the APTEL

One of the salient objectives of the electricity reforms beginning with the Electricity Act, 2003 (EA 2003) was reduction in the level of cross subsidies in tariff. The EA 2003, the National Electricity Policy, 2005 and the Tariff Policy, 2006 specify the framework to reduce cross subsidies in retail tariffs in India.

This section studies the regulatory framework on cross subsidies. Relevant provisions of EA 2003, various policies, regulations and directives have been noted. The EA 2003 requires that while framing terms and conditions for the determination of tariff, SERCs should be guided by the Tariff Policy and the National Electricity Policy.

3.1.1. The Electricity Act, 2003

The EA 2003 prescribes that cross subsidies in electricity tariffs should be reduced. Further, while differentiation in tariff across consumers was allowed with varying load factor, power factor, voltage, consumption and geographical location, it was envisioned that post reforms tariffs would progressively move towards cost of supplying electricity to these consumers.

Wherever subsidisation is required (in case of Lifeline² consumers, agriculture etc.), the EA 2003 favoured a more transparent method of direct subsidies over cross subsidies. The detailed portions of the EA 2003 are noted below for reference.

Section 61 of EA 2003 prescribes the following in regard to tariff determination:

“...the Appropriate Commission shall, subject to the provisions of this Act, specify the terms and conditions for the determination of tariff, and in doing so, shall be guided by the following, namely:-

...

(f) multiyear tariff principles;

*(g) that the **tariff progressively reflects the cost of supply** of electricity and also, **reduces cross-subsidies** in the manner specified by the Appropriate Commission;*

...

(i) the National Electricity Policy and Tariff Policy.”

The original provision of Section 61(g) *“the tariff progressively reflects the cost of supply of electricity and also, reduces and eliminates cross subsidies within the period to be specified by the Appropriate Commission”* was replaced by *“the tariff progressively reflects the cost of supply of electricity and also reduces cross subsidies in the manner specified by the Appropriate Commission”* by an amendment under Electricity (Amendment) Act, 2007 w.e.f. 15.6.2007. Therefore the SERCs can draw their own roadmap for cost reflective tariffs wherein the cross subsidies may be minimised and not eliminated.

Section 62 of the EA 2003 states the following:

“...the Appropriate Commission shall not, while determining the tariff under this Act, show undue preference to any consumer of electricity but may differentiate according to the consumer's load factor, power factor, voltage, total consumption of electricity during any specified period or the time at which the supply is

² Below Poverty Line (BPL) consumers who consume below a specified level of electricity units, as defined by appropriate SERCs

required or the geographical position of any area, the nature of supply and the purpose for which the supply is required”.

Section 65 states the following:

“If the State Government requires the grant of any subsidy to any consumer or class of consumers in the tariff determined by the State Commission under section 62, the State Government shall, notwithstanding any direction which may be given under section 108, pay, in advance and in such manner as may be specified, the amount to compensate the person affected by the grant of subsidy in the manner the State Commission may direct, as a condition for the licence or any other person concerned to implement the subsidy provided for by the State Government”.

3.1.2. National Electricity Policy

The National Electricity Policy (NEP) was notified by the Government of India in compliance with Section 3 of the EA 2003. NEP acknowledges that cross subsidies had risen to unsustainable levels. Therefore it is imperative to understand the various clauses of NEP and their implications on the roadmap for reduction in cross subsidies. The following clauses of NEP are relevant to this study:

Clause 1.2: *“Electricity is an essential requirement for all facets of our life. It has been recognized as a basic human need. It is a critical infrastructure on which the socio-economic development of the country depends. Supply of electricity at reasonable rate to rural India is essential for its overall development. Equally important is availability of reliable and quality power at competitive rates to Indian industry to make it globally competitive and to enable it to exploit the tremendous potential of employment generation. Services sector has made significant contribution to the growth of our economy. Availability of quality supply of electricity is very crucial to sustained growth of this segment.”*

Clause 5.5 discusses on the recovery of cost of services and targeted subsidies. Sub-clause 5.5.2 states the following: *“A minimum level of support may be required to make the electricity affordable for consumers of very poor category. **Consumers below poverty line who consume below a specified level, say 30 units per month, may receive special support in terms of tariff which are cross-subsidized.** Tariffs for such designated group of consumers will be at least 50 % of the average (overall) cost of supply. This provision will be further re-examined after five years.”*

Clause 5.5.3: *“Over the last few decades cross-subsidies have increased to unsustainable levels. Cross subsidies hide inefficiencies and losses in operations. **There is urgent need to correct this imbalance without giving tariff shock to consumers.** The existing cross-subsidies for other categories of consumers would need to be reduced progressively and gradually.”*

3.1.3. Tariff Policy, 2006

In compliance with Section 3 of the EA 2003, the Government of India notified the Tariff Policy in January 2006, subject to periodic amendments. The Tariff Policy acknowledges that in terms of the Section 61 (g) of the EA 2003, SERCs shall be guided by the objective that the tariff progressively reflects the efficient and prudent cost of supply of electricity.

Clause 8.3 suggests that tariffs be linked to the cost of service. The following clauses of the Tariff Policy are noteworthy.

“(1) In accordance with the National Electricity Policy, consumers below poverty line who consume below a specified level, say 30 units per month, may receive a special support through cross subsidy. Tariffs for such designated group of consumers will be at least 50% of the average cost of supply. This provision will be re-examined after five years.

*(2) For achieving the objective that the tariff progressively reflects the cost of supply of electricity, **the SERC would notify roadmap within six months with a target that latest by the end of year 2010-2011***

tariffs are within ± 20 % of the average cost of supply. The roadmap would also have intermediate milestones, based on the approach of a gradual reduction in cross subsidy.

(3) While fixing tariff for agricultural use, the imperatives of the need of using ground water resources in a sustainable manner would also need to be kept in mind in addition to the average cost of supply. Tariff for agricultural use may be set at different levels for different parts of a state depending on the condition of the ground water table to prevent excessive depletion of ground water. Section 62 (3) of the Act provides that geographical position of any area could be one of the criteria for tariff differentiation. A higher level of subsidy could be considered to support poorer farmers of the region where adverse ground water table condition requires larger quantity of electricity for irrigation purposes subject to suitable restrictions to ensure maintenance of ground water levels and sustainable ground water usage.”

The EA 2003, the Tariff Policy and the National Electricity Policy specify intentions to reduce cross subsidies in retail tariffs in a time bound manner. The National Electricity Policy acknowledged that the current level of cross subsidy was unsustainable and it was being used to hide inefficiencies and losses in the system.

The statutory provisions emphasised need to correct this imbalance without giving tariff shock to consumers, while progressively reducing the existing cross subsidies. But even after the initiation of power sector reforms, the Indian power sector is yet to achieve significant progress in reducing cross subsidies prevailing in the system.

3.1.4. Judgements by the Appellate Tribunal of Electricity

Since the enactment of the EA 2003, several disputes have arisen over the issue of cross subsidies in tariff and in some cases consumers have approached the Appellate Tribunal of Electricity (APTEL) citing non-compliance of provisions of the EA 2003, Tariff Policy and National Electricity Policy. Over time consumer awareness has increased. A review of Judgements of APTEL over the last five years shows that as many as 73 Judgements related to issues of cross subsidies, cost of supply and cost subsidy surcharge were dealt with by the Tribunal. The rulings by the APTEL in these Appeals provide further clarity on the issue of cross subsidies.

Interpretation of provisions regarding cross subsidy

For example, in **Appeal Nos. 102 of 2010** in the matter of **Tata Steel Ltd. Vs. Orissa Electricity Regulatory Commission & Another**, the APTEL, after considering the provisions of the EA 2003, the National Electricity Policy, Tariff Policy and the Regulations of the Appropriate Commission, concluded that no prejudice would have been caused to any category of consumers with regard to the issues of cross subsidy and cost of supply if:

- *the cross subsidy calculated on the basis of cost of supply to the consumer category is not increased but reduced gradually,*
- *the tariff of consumer categories is within $\pm 20\%$ of the average cost of supply except the consumers below the poverty line, and*
- *tariffs of different categories of consumers are differentiated only according to the factors given in Section 62(3) and there is no tariff shock to any category of consumer.*

Need for calculation of category wise cost of supply

In **Appeal Nos. 931 of 2007** in SIEL Limited, New Delhi v/s PSERC & Ors the APTEL also emphasized the **need for determination of category wise cost of supply**. It stated that cost to supply a consumer

category is not the same as average cost of supply for the distribution system as a whole and average cost of supply cannot be used in calculation of cross subsidy instead of actual cost of supply.

The APTEL has also not accepted the plea of SERCs that calculation of category wise cost of supply may not always be possible. In **Appeal Nos. 102 of 2010** it stated that –

“In our opinion, it will not be prudent to wait indefinitely for availability of the entire data and it would be advisable to initiate a simple formulation which could take into account the major cost elements. There is no need to make distinction between the distribution charges of identical consumers connected at different nodes in the distribution network. It would be adequate to determine the voltage-wise cost of supply taking into account the major cost element which would be applicable to all the categories of consumers connected to the same voltage level at different locations in the distribution system.”

Publishing of data related to cross subsidies

The APTEL also stated that the practice of the state commissions to club several categories while calculating the category wise cost of supply is contrary to the legislative provisions. In judgement on **Appeal Nos. 102 of 2010**, it has stated that – *“According to the Tariff Policy, the tariff of all categories of consumers except those below poverty line have to be within $\pm 20\%$ of the total average cost of supply. The variation of tariffs of different category with respect to average cost of supply has not been correctly determined by the State Commission. The State Commission has erred in clubbing different consumer categories having different tariff in one category based on voltage of supply.”*

Creation of new tariff categories

In other appeals, the APTEL has opposed the creation of new tariff categories, with tariff higher than cost of supply, on account of higher ‘ability to pay’. In the **Appeals No. 68 and 69 of 2008** preferred by the **Multiplex Association of India against the Tata Power Co. Ltd. and Reliance Energy Ltd.**, the Hon’ble APTEL ruled the following –

“We observed ... that Section 62(3) of the Electricity Act directs that the Commission shall not show any undue preference to consumers of electricity while it does allow differentiation according to the consumer’s (a) load factor, (b) power factor, (c) voltage, (d) total consumption of electricity during any specified period or the time at which supply is required, (e) the geographical position of any area, (f) the nature of supply and (g) the purpose for which the supply is required. We observed that the purpose of creating a new classification of LT-IX was not covered by any of the grounds on which the Commission could differentiate certain consumers on the ground that they indulge in ‘unwarranted commercial consumption’ or had ‘a huge capacity to pay’ or had potential to ‘conserve energy’”.

Further, in **Appeal No. 29, 30, 31, 32 and 33 of 2008** preferred by various consumers of the newly created category of LT-IX versus MERC, MSEDCL and Reliance Energy Ltd, the Hon’ble APTEL observed that:

“The average cost of supply is modulated by numerous factors like AT&C losses, purchase cost of power, efficiency of operation, collection efficiency, theft of power, etc. In any case the percentage deviation of tariff fixed for subsidizing category of consumers with respect to average cost of supply should remain constant, if the cross subsidies is not reduced.

Summary of legislative, regulatory provisions and Judgments of the APTEL

From the review of legal and regulatory provisions set out by the EA 2003, National Electricity Policy, Tariff Policy and the Judgements of the APTEL in this regard it can be concluded that:

- The cross subsidy for a consumer category is the difference between cost to serve that category of consumers and average tariff realization of that category of consumers.

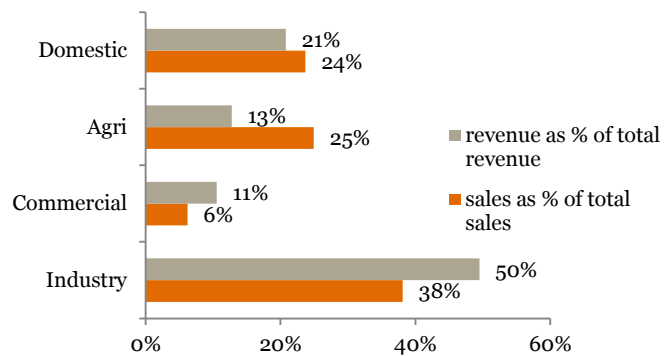
-
- Cross subsidies should be calculated with reference to category-wise cost of supply and not average cost of supply.
 - While the cross subsidies have to be reduced progressively and gradually to avoid tariff shock to the subsidized categories, the cross subsidies may not be eliminated.
 - The tariff for different categories of consumer may progressively reflect the cost of electricity to the consumer category but may not be a mirror image of cost to supply to the respective consumer categories.
 - Cross subsidies may gradually be reduced but should not be increased for a category of subsidizing consumer.
 - The tariffs should be within $\pm 20\%$ of the average cost of supply by the end of FY 2010-11 to achieve the objective that the tariff progressively reflects the cost of supply of electricity.
 - The tariffs can be differentiated according to the consumer's load factor, power factor, voltage, total consumption of electricity during specified period or the time or the geographical location, the nature of supply and the purpose for which electricity is required.

4. Overview of cross subsidies in electricity tariff in India

Cross subsidies are widely prevalent in electricity tariffs in India. Category-wise cross subsidies in electricity tariff are evident in all states.

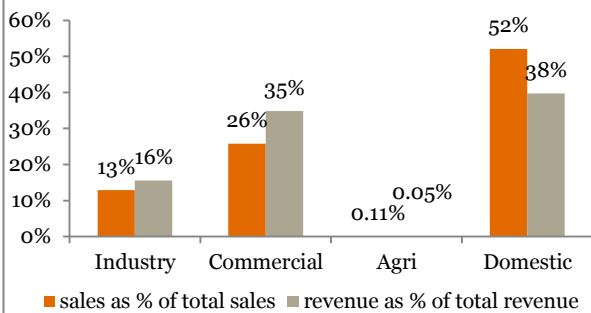
Generally we observe that the agricultural consumers take a higher share of total power supplied while industrial consumers share the major revenue burden, therefore cross subsidizing the former category. For example, in Andhra Pradesh, agricultural consumers are heavily cross subsidized against industrial consumers. While agricultural consumer category consumes approximately 25% of total power in the state, it accounts for just 13% of revenue (including subsidy). On the other hand industrial category consumes just 38 % of power while accounting for 50% of the revenue.

Figure 2: Revenue vs. sales in Andhra Pradesh



Source: APERC FY2013-14 tariff order

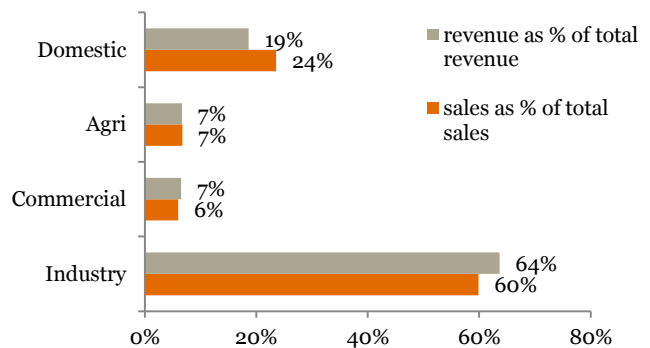
Figure 3: Revenue vs. sales in Delhi



Source: DERC FY2014-15 tariff order

In the states of Madhya Pradesh, Punjab, Himachal Pradesh and Uttarakhand it is observed that share of total sales and share of total revenue are in line with each other for all the major consumer categories (domestic, agriculture, industry and commercial). However this does not imply absence of cross subsidies. There can be significant level of intra category cross subsidies, for example, from higher slabs of domestic consumption to lower slabs or from consumption at higher voltage level/ big industrial consumers to consumption at lower voltage level/ smaller industrial consumers.

Figure 4 Revenue vs. sales in Himachal Pradesh



Source: HPERC FY2014-15 Tariff order

A review of the most recent tariff orders of 29 Indian states was conducted to identify the methodology used by the SERCs for calculation of cross subsidies and levels of the same across important consumer categories. Information was gathered regarding cross subsidies approved by the state commissions for the 'ensuing' year or the year for which tariff had been approved³. The review brought out some interesting features, as well as lacunas, in depiction of cross-subsidies in India.

4.1. Methodology for calculation of cross-subsidies

Most SERCs identify cross subsidies generated by or given to a consumer category by calculating the **ratio of the Average Billing Rate (ABR) to Average Cost of Supply (ACoS)**. The ACoS is the average cost imposed by all consumers on the system irrespective of their individual cost of supply in order to supply electricity. The method, often called the **ACoS coverage method**, helps identify the consumer categories which are unable to generate enough revenues to cover the cost of supply. As per the Tariff Policy, SERCs need to target that tariffs are within $\pm 20\%$ of the average cost of supply. Therefore this method can also be used to measure the extent to which the state commissions have been able to implement the guidelines of the Tariff Policy.

ACoS coverage of a consumer category = Average Billing Rate/ Average Cost of Supply of the Discom

Some SERCs also calculate the **aggregate amount of cross subsidy in rupee terms**. This figure signifies the amount of revenue which is collected from certain consumer categories (like industrial and commercial users) paying higher ABR in order to compensate for the loss of revenue from other consumer categories (like domestic and lifeline users). The method has been used by the SERCs in Punjab, Jharkhand etc. Such depiction of cross subsidies indicates the external monetary support that would be required in order to eliminate cross subsidies without changing the tariff rates.

Some SERCs like the Maharashtra Electricity Regulatory Commission have formulated a roadmap for reduction in cross subsidies wherein the effectiveness of the roadmap is measured by the reduction in **cross subsidies as a percentage of total revenue** of the licensee.

4.2. Review of ACoS coverage across states

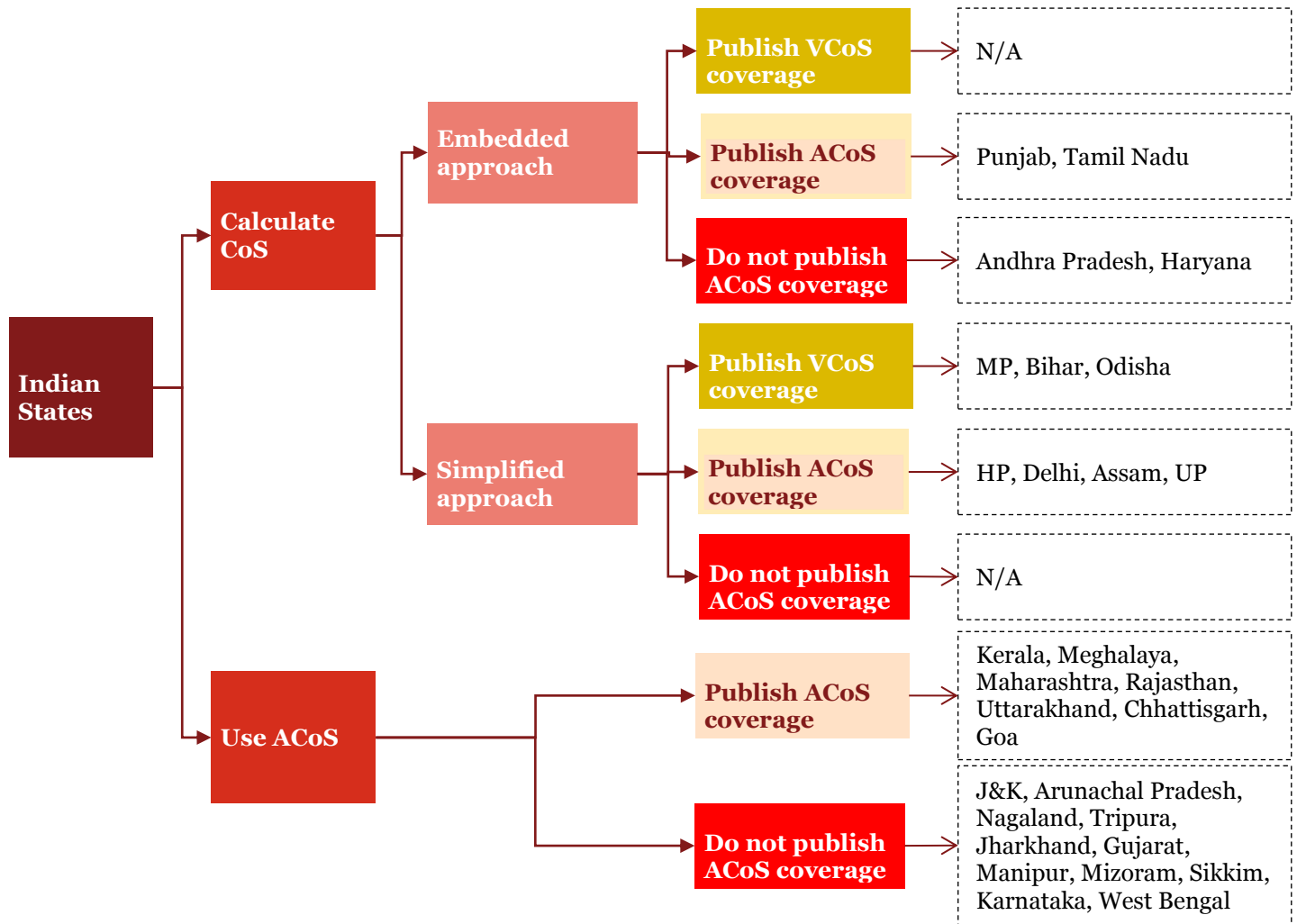
Information regarding ACoS coverage is not uniform and is not available for some of the states

Out of 29 Indian states, only 16 states calculate cross subsidies in their tariff orders by dividing the category wise Average Billing Revenue (ABR) with category wise Cost of Supply (CoS) or an Average Cost of Supply (ACoS). These states are Delhi, Bihar, Himachal Pradesh, Uttarakhand, Madhya Pradesh, Assam, Punjab, Chhattisgarh, Rajasthan, Meghalaya, Maharashtra, Tamil Nadu, Odisha, Kerala, Uttar Pradesh and Goa. The other states have published the ACoS and ABR for different categories however have not published the data regarding ACoS coverage in the tariff orders or have not published such information at all.

Out of the 16 states mentioned above, a majority of 13 states calculate cross subsidy as a % of ACoS and not category wise cost of supply. Even though Punjab calculates category wise CoS, the State Commission continues to use ACoS for cross subsidy measurement.

³ Depending upon the year for which the latest tariff order is available, the 'ensuing year' would refer to FY2014-15, FY2013-14 or FY2012-13

Figure 5: Methods used by Indian states for cross subsidy measurement



Even for the states which publish the cost coverage data, the classification of consumer categories is not uniform -

- Delhi, Bihar, Madhya Pradesh, Himachal Pradesh, Chhattisgarh, Rajasthan, Meghalaya, Tamil Nadu, Odisha, Kerala, Uttar Pradesh and Goa publish ACoS coverage data for based on broad consumer categories like industrial (HT, LT and EHT), commercial, agricultural, domestic and BPL.
- Maharashtra, Goa and Punjab divide the consumer categories based on consumption slabs and publish ACoS coverage data for them. For example, in Maharashtra for domestic category the ACoS coverage is 70% for consumption upto 100 units and 118% for consumption of 101 to 300 units.
- State of Assam publishes ACoS coverage for based on connected load of consumer. For example ACoS coverage for domestic category for category below 5 kW is 87% and 105% for above 5 kW.

Therefore the information available is not uniform and in some states different categories may be clubbed while calculating the ACoS coverage ratios even though as per directions of the APTEL the SERCs are required to calculate cross subsidies for all consumer categories.

Further, the SERCs do not always publish information on slab-wise/ sub category-wise sales and revenue which prevents identification of intra-category cross subsidy. For example, in the domestic category, consumers in the higher slabs of consumption cross subsidize consumption of the lower slabs however the extent of such cross subsidies are difficult to capture with the information available.

In some states, for certain categories, the ACoS coverage⁴ is well beyond the $\pm 20\%$ limit as specified in the Tariff Policy

- In states such as Delhi, Bihar, Madhya Pradesh and Chhattisgarh, ACoS coverage for industrial and commercial consumers is beyond the maximum limit of 120%.

Table 1 States with consumer categories above 120% ACoS coverage

State	Consumer Categories with > 120% of ACoS coverage
Assam	Temporary supply
Chhattisgarh	Non domestic, railway, LT industrial, railway, heavy industries, steel industries, mines and cement industries, low load factor industries
Delhi	Non Domestic, Small Industrial Power, Advertisements & Hoardings, DJB (BYPL and BRPL)
Goa	LT Commercial (above 1000 units), LTP Motive power, HTI Industrial, EHTI Industrial, Temporary Supply
Madhya Pradesh	LV Non-Domestic, LV Industrial, HV Railways, HV Coal mines, HV Industrial, HV Non Industrial
Maharashtra	Domestic (above 301 units), Industrial, Commercial, Public services, Advertisement and Hoarding, Railways, LT Temporary
Rajasthan	Non domestic (JVNL)
Tamil Nadu	HT Industries, Railways, Commercial, HT Temporary, Pvt Educational Institutes,
Bihar	HTSS (North), RTS-I (North), Public Water Works (North)
Assam	Temporary Supply
Uttar Pradesh	KESCO: Non Domestic, Small & Medium Power, Large & Heavy Power MVVNL/PuVVNL/PVVNL/DVVNL: Small & Medium Power, State Tube Wells, Non Industrial Bulk Load, Irrigation

Source: SERC tariff orders

- On the other hand ACoS coverage for agricultural and domestic users is below the limit of 80% in states such as Delhi, Chhattisgarh, Goa and Rajasthan.

Table 2 States with consumer categories below 80% ACoS coverage

State	Consumer Categories with < 80% of ACoS coverage
Assam	BPL, Small rural industries upto 20 kW
Chhattisgarh	Domestic, agricultural
Delhi	Domestic, agricultural
Goa	LT domestic, LT low income, LT Commercial (upto 100 units), LT/HT agricultural
Madhya Pradesh	Agricultural
Maharashtra	BPL, domestic (upto 100 units), Agricultural, PWW
Meghalaya	Domestic, BPL, agricultural
Rajasthan	Agricultural (metered), Agricultural (flat)
Tamil Nadu	Domestic, agricultural, Lift irrigation, Bulk Supply, Cottage industries
Uttarakhand	Domestic, BPL, Private Tube Wells
Bihar	Domestic II, Domestic III, Non Domestic III, Irrigation IAS II (North), HTSS (South)
Kerala	LT V Agricultural, LT Domestic, LT XI Public Lighting

⁴ Depending upon the year for which the latest tariff order is available, the 'ensuing year' would refer to FY 2014-15, FY 2012-13 and FY 2011-12

State	Consumer Categories with < 80% of ACoS coverage
Uttar Pradesh	KESCO: Departmental Employees MVVNL/PuVVNL/PVVNL/DVVNL: Domestic, Private Tube Wells, Departmental Employees

Source: SERC tariff orders

- We can observe huge gap between maximum ACoS coverage and minimum ACoS coverage across states, which suggests high amount of cross subsidization.

Table 3 State wise consumer category with maximum and minimum ACoS coverage

State	Maximum ACoS coverage		Minimum ACoS coverage ⁵	
	Category	ACoS Coverage	Category	ACoS Coverage
Maharashtra	Advertisement & Hoarding	420%	LT Agricultural (metered)	42%
Delhi	Advertisement & Hoarding (BRPL)	183%	Agricultural (BYPL)	38%
Bihar	HTSS (North)	124%	Domestic II (South)	56%
Chhattisgarh	Low load factor Industries	164%	Agricultural	58%
Uttar Pradesh	HV 1 Non Industrial bulk loads	134%	Private Tube Wells	29%
Tamil Nadu	Temporary Supply	222%	LT Agricultural	50%
Goa	Hoarding/sign boards	204%	Domestic (upto 60 units)	33%
Assam	Non Domestic Temp Supply	162%	Small Industry Rural upto 20kW	78%
Uttarakhand	Non Domestic	116%	PTW	36%
Madhya Pradesh	HV Non Industrial	136%	Agricultural	77%
Kerala	HT Industrial	117%	LT V Agricultural	45%
Meghalaya	LT Commercial	118%	Agricultural	55%
Rajasthan	Non Domestic	118%	Agricultural (metered)	69%
Punjab	Bulk Supply LT	118%	Agricultural Pumpsets	80%
Himachal Pradesh	Bulk Supply	118%	Domestic	82%

Source: SERC tariff orders

⁵ Excluding BPL consumer category

4.2.1. Category wise analysis of cross subsidies across states

Based on the review of tariff orders of all the states, 4 broad consumer categories can be identified i.e. domestic, agricultural, commercial and industrial which when combined account for 80% to 90% of the energy sales for discoms. It can be observed that generally agricultural and domestic categories are subsidized by commercial and industrial categories. We have done a further analysis of these 4 broad categories for all the states.

Table 4 ACoS coverage comparison for broad consumer categories of all Indian states

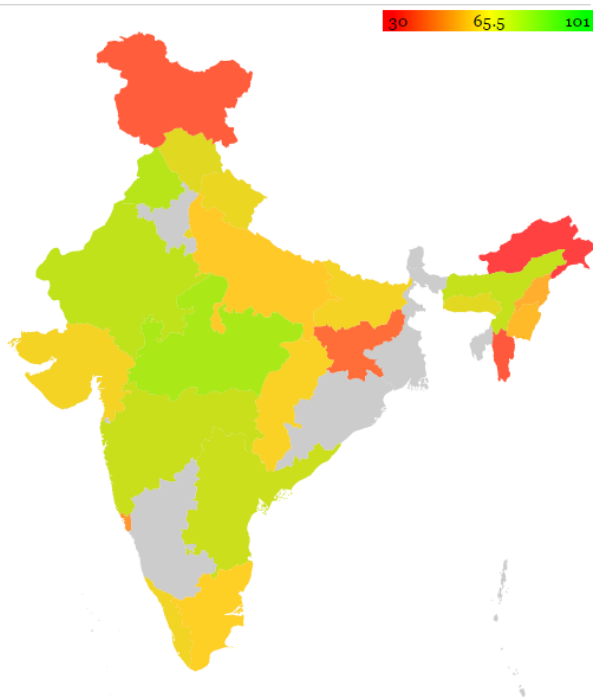
State ⁶	FY	ABR				ACoS	ACoS coverage			
		Domestic	Agri-cultural	Industr-ial	Comm-ercial		Domestic	Agri-cultural	Industr-ial	Comm-ercial
North										
Jammu & Kashmir	FY15	2.13	2.57	3.87	3.54	5.69	37%	45%	68%	62%
Himachal Pradesh	FY15	4.10	5.11	5.50	5.62	5.22	82%	98%	105%	108%
Uttarakhand	FY15	3.06	1.19	4.54	4.80	4.16	74%	29%	109%	115%
Punjab	FY15	5.60	4.71	6.76	6.82	5.88	95%	80%	115%	116%
Delhi	FY15	5.44	3.15	9.02	9.98	7.38	74%	43%	122%	135%
Rajasthan	FY14	5.49	4.14	6.03	7.05	5.97	92%	69%	101%	118%
Uttar Pradesh	FY15	3.87	2.45	7.28	6.55	6.11	63%	40%	119%	107%
West										
Gujarat	FY15	3.69	1.32	5.57	4.10	5.27	70%	25%	106%	78%
Goa	FY15	1.93	1.88	4.34	3.78	3.78	51%	50%	115%	100%
Maharashtra	FY13	4.89	2.41	7.50	10.28	5.56	88%	43%	135%	185%
Madhya Pradesh	FY15	4.87	3.75	6.02	6.59	4.84	101%	78%	124%	136%
Chhattisgarh	FY15	2.99	2.54	5.42	6.27	4.40	68%	58%	123%	143%
East										
Jharkhand	FY13	2.36	0.74	6.33	5.95	5.69	41%	13%	111%	105%
Bihar	FY15	4.50	5.96	6.39	6.95	6.46	70%	92%	99%	107%
Meghalaya	FY15	4.16	2.98	6.03	6.33	5.38	77%	55%	112%	118%
Arunachal Pradesh	FY15	4.00	-	3.77	5.00	13.26	30%	-	28%	38%
Assam	FY14	5.41	5.61	6.02	7.06	6.01	90%	93%	100%	117%
Manipur	FY15	3.82	2.70	3.76	4.66	6.36	60%	42%	59%	73%
Nagaland	FY15	4.05	2.70	4.55	5.73	6.76	60%	40%	67%	85%
Mizoram	FY15	3.26	2.10	6.22	4.83	9.02	36%	23%	69%	54%
South										
Tamil Nadu	FY14	3.46	2.62	6.83	7.78	5.24	66%	50%	130%	148%
Andhra Pradesh	FY14	4.59	2.69	6.83	8.90	5.25	87%	51%	130%	169%
Kerala	FY15	3.76	2.47	6.09	9.21	5.28	71%	47%	115%	174%

Source: PwC analysis

⁶ States of Harayana, Karnataka, West Bengal, Odisha, Sikkim and Tripura do not have sufficient information in their tariff orders for carrying out the category wise ACoS coverage analysis. Data for Andhra Pradesh includes Telangana.

Domestic Category

Figure 6 ACoS coverage heat map for domestic consumer category



Domestic consumer category is below 50% ACoS coverage in the states of Jammu & Kashmir, Jharkhand, Arunachal Pradesh and Mizoram.

In Madhya Pradesh, the ACoS coverage for domestic category has reached 100%.

Intra-category cross subsidy can be observed in the states of Assam and Maharashtra. In Assam (between 5 kW to 20 kW of supply) and in Maharashtra (above 100 unit consumption) even the domestic category is subsidising category with the ACoS coverage of above 100%.

While in absolute terms for most of the states the domestic category is below 80% ACoS coverage, when compared with each other on a heat map, most of the states have similar range of ACoS coverage.

Table 5 Comparison of ACoS coverage for domestic category

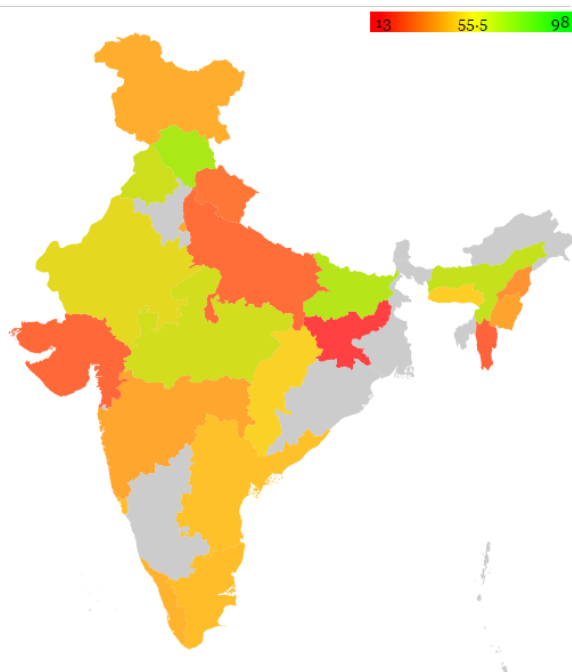
State	FY	Discom	Domestic Category ACoS coverage
Delhi	FY15	TPDDL	72%
	FY15	BYPL	73%
	FY15	BRPL	77%
Himachal Pradesh	FY15	HPSEB	82%
Uttarakhand	FY13	UPCL	73%
Uttar Pradesh	FY15	MVVNL/PuVVNL/PVVNL/DVVNL	65%
Madhya Pradesh	FY15	Madhya/Poorvi/Paschim Kshetra Vidyut Vitran Co	100%
Assam	FY1	Assam Power Dist.	above 0.5 kW to 5 kW: 87% above 5 kW to 20 kW: 105% HT above 25 kW: 99%
Punjab	FY15	Punjab State Power Corp.	Upto 100 Units: 82% 101-300 Units: 109% Above 300 Units: 116%
Chhattisgarh	FY15	CSPDCL	68%
Rajasthan	FY14	JVVNL	93%
	FY14	AVVNL	90%
	FY14	JdVVNL	93%
Meghalaya	FY15	Meghalaya Power Distr. Corp.	LT: 76% HT: 115%

State	FY	Discom	Domestic Category ACoS coverage
Maharashtra	FY13	MSEDCL	LT BPL-21% LT (0-100)-70% LT(101-300)-118% LT(301-500)-147% LT(501-1000)-160%
Tamil Nadu	FY14	Tamil Nadu Generation and Dist.	66%
Goa	FY15	Electricity Dept. of Goa	0-60 units: 33% 61-250 units: 48% 251-500 units: 77% Above 500 units: 90%
Kerala	FY15	KSEBL	71%
Bihar	FY15	North Bihar Power Distribution Co	Domestic I – 100% Domestic II – 64% Domestic III – 73%
	FY15	South Bihar Power Distribution Co	Domestic I – 100% Domestic II – 56% Domestic III – 63%

Source: SERC tariff orders

Agricultural Category

Figure 7 ACoS coverage heat map for agricultural consumer category



Agricultural category is below 50% of ACoS coverage in Jammu & Kashmir, Uttarakhand, Delhi, Uttar Pradesh, Gujarat, Goa, Maharashtra, Jharkhand, Manipur, Nagaland, Mizoram, Kerala and Tamil Nadu.

Only 4 states of Himachal Pradesh, Punjab, Assam and Bihar show ACoS coverage within the +/-20% range. These figures subsume direct govt. subsidy given by the government.

In Punjab while the entire tariff is funded by state govt., in Bihar the actual tariff payable by agricultural consumers amounts to ~25% ACoS coverage. In Himachal Pradesh, actual tariff paid by consumer is just Rs. 0.50 per unit, the rest being funded by state govt.

In most of the states the agricultural category is the most subsidized (excluding BPL category). However in Jammu & Kashmir, Himachal Pradesh and Bihar the domestic category is more subsidized than agricultural category.

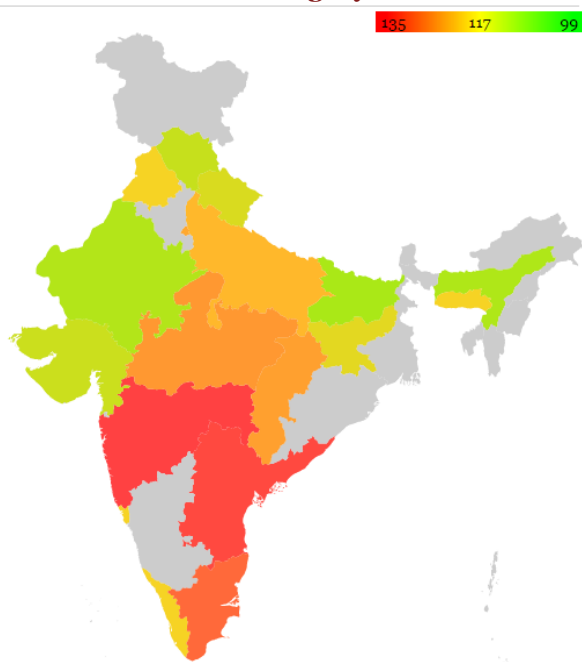
Table 6 Comparison of ACoS coverage for agricultural category

State	FY	Discom	Agricultural Category ACoS coverage
Delhi	FY15	TPDDL	43%
	FY15	BYPL	38%
	FY15	BRPL	43%
Himachal Pradesh	FY15	HPSEB	105%
Uttarakhand	FY13	UPCL	36%
Uttar Pradesh	FY15	MVVNL/PuVVNL/PVVNL/DVVNL	Private Tube Wells: 29% Lift Irrigation: 123%
Madhya Pradesh	FY15	Madhya/Poorvi/Paschim Kshetra Vidyut Vitran Co	LV Agriculture - 77% Irrigation - 88%
Assam	FY14	Assam Power Dist.	upto 7.5 HP - 85% above 7.5 HP - 95%
Punjab	FY15	Punjab State Power Corp.	80%
Chhattisgarh	FY15	Chhattisgarh State Power Dist.	58%
Rajasthan	FY14	JVVNL	metered: 71% flat: 72%
	FY14	AVVNL	metered: 68% flat: 69%
	FY14	JdVVNL	metered: 68% flat: 70%
Meghalaya	FY15	Meghalaya Power Distr. Corp.	55%
Maharashtra	FY13	MSEDCL	LT unmetered- 44% LT metered - 42% HT - 56%
Tamil Nadu	FY14	Tamil Nadu Generation and Dist.	LT: 50% Lift irrigation: 67%
Goa	FY15	Electricity Dept. of Goa	49%
Kerala	FY15	KSEBL	45%
Bihar	FY15	North Bihar Power Distribution Co	Irrigation IAS I – 100% Irrigation IAS II – 66%
	FY15	South Bihar Power Distribution Co	Irrigation IAS I – 100% Irrigation IAS II – 86%

Source: SERC tariff orders

Industrial Category

Figure 8 ACoS coverage heat map for industrial consumer category⁷



Western and Southern states continue to charge high tariff in order to support agricultural consumers.

The states of Delhi, Madhya Pradesh, Chhattisgarh, Andhra Pradesh, Tamil Nadu and Maharashtra have ACoS coverage beyond 120% limit.

While in most of the states the industrial consumers form subsidising category there are a few exceptions to the trend, particularly in north eastern states. States of Jammu & Kashmir, Arunachal Pradesh, Manipur, Nagaland and Mizoram have below 100% ACoS coverage for industrial consumer category. For the purpose of heat map such states have been ignored.

High amount of intra-category cross subsidisation can be observed across states with HT consumers subsidising LT consumers. In Delhi, SIP consumers subsidise LIP consumers.

Table 7 Comparison of ACoS coverage for industrial category

State	FY	Discom	Industrial Category ACoS coverage
Delhi	FY15	TPDDL	SIP - 122% LIP - 106%
	FY15	BYPL	SIP - 130% LIP - 116%
	FY15	BRPL	SIP - 129% LIP - 113%
Himachal Pradesh	FY15	HPSEB	105%
Uttarakhand	FY13	UPCL	110%
Uttar Pradesh	FY15	MVVNL/PuVVNL/PVVNL/DVVNL	Small & Medium Power: 128% Large & Heavy Power: 123%
Madhya Pradesh	FY15	Madhya/Poorvi/Paschim Kshetra Vidyut Vitran Co	LV-Industrial: 122% HV-Coal mines: 135% HV Industrial: 123%
Assam	FY14	Assam Power Dist.	LT Small Industries rural: 78% LT Small Industries urban: 82% HT Small Industries upto 50 kVA: 83% HT Industries-I 50kVA to 150 kVA: 105% HT Industries-II above 150 kVA: 102% Tea, Coffee & Rubber: 120%
Punjab	FY15	Punjab State Power Corp.	Small supply: 104%

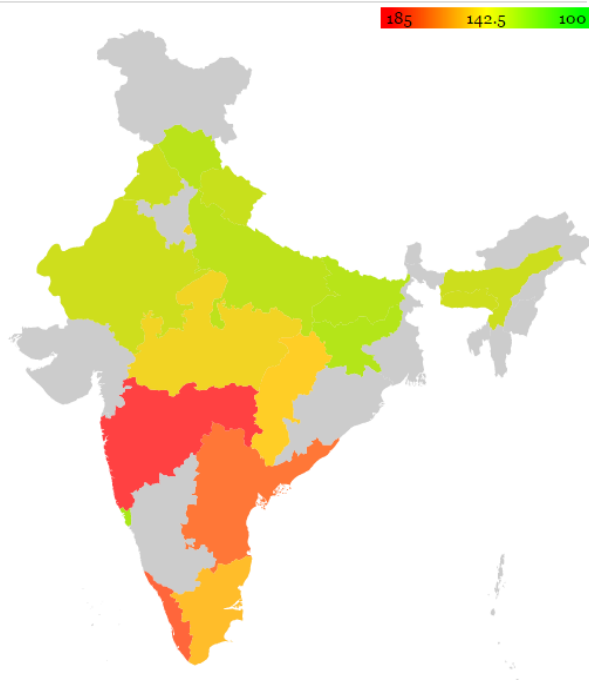
⁷ The heat map ignores states where the ACoS coverage for industrial category is below 100%

State	FY	Discom	Industrial Category ACoS coverage
			Medium Supply - 113% Large supply - 116%
Chhattisgarh	FY15	Chhattisgarh State Power Dist.	LT industry - 123% Heavy industries - 138% HV Steel industries – 111% EHV Steel industries – 126% Mines, Cement, other industry – 138% Low load factor industries – 164%
Rajasthan	FY14	JVVNL	Small supply: 99% Medium Supply - 104% Large supply - 100%
	FY14	AVVNL	Small supply: 95% Medium Supply - 95% Large supply - 100%
	FY14	JdVVNL	Small supply: 97% Medium Supply - 99% Large supply - 114%
Meghalaya	FY15	Meghalaya Power Distr. Corp.	HT - 115% EHT - 108%
Maharashtra	FY13	MSEDCL	LT – 129% HT – 135%
Tamil Nadu	FY14	Tamil Nadu Generation and Dist.	LT - 118% HT - 141%
Goa	FY15	Electricity Dept. of Goa	HTI: 122% Ferro Metallurgical/Steel Melting /Power intensive:102% Steel Rolling: 110% ICE: 125% IT high Tech: 100% EHT: 122%
Kerala	FY15	KSEBL	LT – 113% HT – 117% EHT 66 kV – 112% EHT 110 kV – 105%
Bihar	FY15	North Bihar Power Distribution Co	HT I - 112% HT II - 117% HT III - 101% HTSS - 124%
	FY15	South Bihar Power Distribution Co	HT I - 107% HT II - 107% HT III - 92% HTSS - 76%

Source: SERC tariff orders

Commercial Category

Figure 9 ACoS coverage heat map for commercial consumer category



Like the industrial category, commercial category also has high ACoS coverage across states.

The ACoS coverage is even above 150% in states of Maharashtra, Andhra Pradesh and Kerala. As per heat map the average range in commercial category (represented by yellow shade) is close to 140% ACoS coverage.

While in most of the states the commercial consumers form subsidising category there are a few exceptions to the trend, particularly in north eastern states. States of Jammu & Kashmir, Gujarat, Arunachal Pradesh, Manipur, Nagaland and Mizoram have below 100% ACoS coverage for commercial consumer category. For the purpose of heat map such states have been ignored.

Table 8 Comparison of ACoS coverage for commercial category

State ⁸	FY	Discom	Commercial Category ACoS coverage
Delhi	FY15	TPDDL	HT - 131% LT - 136%
	FY15	BYPL	HT - 132% LT - 143%
	FY15	BRPL	HT - 132% LT - 141%
Himachal Pradesh	FY15	HPSEB	108%
Uttarakhand	FY13	UPCL	116%
Uttar Pradesh	FY15	MVVNL/PuVVNL/PVVNL/DVVNL	108%
Madhya Pradesh	FY15	Madhya/Poorvi/Paschim Kshetra Vidyut Vitran Co	136%
Assam	FY14	Assam Power Dist.	LT Commercial Load above 0.5 kW to 20 kW: 119% HT commercial 25 kVA & above: 115%
Punjab	FY15	Punjab State Power Corp.	116%
Chhattisgarh	FY15	Chhattisgarh State Power Dist.	143%
Rajasthan	FY14	JVVNL	122%
	FY14	AVVNL	116%

⁸ Data of ACoS coverage is not published for Commercial consumer category in tariff order of Kerala State Electricity Board for KSEB for FY2014-15

State ⁸	FY	Discom	Commercial Category ACoS coverage
	FY14	JdVVNL	116%
Meghalaya	FY15	Meghalaya Power Distr. Corp.	LT: 118% HT: 117%
Maharashtra	FY13	MSEDCL	LT non-domestic-176% HT commercial- 201%
Tamil Nadu	FY14	Tamil Nadu Generation and Dist.	LT: 144% HT: 164%
Goa	FY15	Electricity Dept. of Goa	0-100 units: 87% 101-1000 units: 110% Above 1000 units: 125%
Bihar	FY15	North Bihar Power Distribution Co	Non Domestic I - 100% Non Domestic II - 113% Non Domestic III - 75%
	FY15	South Bihar Power Distribution Co	Non Domestic I - 100% Non Domestic II - 105% Non Domestic III - 65%

Source: SERC tariff orders

Categorization of states according to cross subsidies levels

Based on the broad category wise comparison we can categorize the Indian states into three categories as shown below in the matrix. The **x axis** represents the number of subsidised categories (out of domestic and agricultural) below 80% ACoS coverage and the **y axis** represents the number of subsidising categories (out of industrial and commercial) above 120% ACoS coverage⁹.

Figure 10 Categorization of states based on their current levels of cross subsidies

Subsidising categories (+)	Industry & Comm >120% ACoS coverage	-	Maharashtra Madhya Pradesh Andhra Pradesh	Delhi Chhattisgarh Tamil Nadu
	Industry or Comm <120% ACoS coverage	-	-	Kerala
	Industry & Comm <=120% ACoS coverage	Punjab Himachal Pradesh Assam	Rajasthan Bihar	Uttarakhand, Uttar Pradesh, Goa, Meghalaya, Jharkhand, Gujarat
		Agri & Domestic >=80% ACoS coverage	Agri or Domestic <80% ACoS coverage	Agri & Domestic <80% ACoS coverage
		Subsidised categories (-)		

⁹ The matrix excludes states where all consumer categories are below 100% ACoS coverage. These are Jammu & Kashmir, Arunachal Pradesh, Manipur, Mizoram and Nagaland

4.3. Selection of states for further study on cross subsidies

A review of the cross subsidies across various states in India reveals significant diversity in levels and nature of cross subsidies. The states of Madhya Pradesh, Punjab, Himachal Pradesh and Uttarakhand have been successful in reducing cross subsidies to some extent. However, significant amount of cross subsidies are still present in other states like Delhi, Maharashtra and Andhra Pradesh.

We have selected 10 states to perform a detailed analysis on cross subsidies in such states which will look into the attempts made by these states in reduction of cross subsidies and way forward for achieving the targets of the Tariff Policy. These states are: Himachal Pradesh, Rajasthan, Delhi, Punjab (North), Kerala, Andhra Pradesh (South), Maharashtra, Madhya Pradesh (West), Bihar and Meghalaya (East and North East).

We have taken into account below mentioned factors for shortlisting these states:

- **Region:** states have been chosen from each of the 4 regions i.e. north, south, east and west so as to represent a wide demographic in our study
- **Data availability:** states which have published ACoS coverage data in their tariff orders have been given preference
- **ACoS coverage:** from each region, states which show large deviation from the $\pm 20\%$ limit of ACoS coverage have further been selected in order to study reasons behind higher cross subsidies
- **Major categories of sales:** in order to represent a wide spectrum of economic conditions, we selected states with varying level of energy sales in each of the 4 categories i.e. industry, commercial, domestic and agricultural

North Region:

States	Max ACoS coverage beyond 120%	Min ACoS Coverage below 80%	Major category by sales	ACoS coverage published	Major subsidizing category	Major subsidized category
Delhi	✓	✓	Domestic	✓	Commercial	Domestic
Haryana	NA	NA	Industrial	NA	NA	NA
Himachal Pradesh	-	-	Industrial	✓	Industrial	Domestic
Jammu & Kashmir	NA	NA	Domestic	NA	NA	NA
Punjab	-	-	Industrial	✓	Industrial	Agricultural
Rajasthan	-	✓	Agricultural	✓	Industrial	Agricultural
Uttar Pradesh	✓	✓	Domestic	✓	Industrial	Domestic
Uttarakhand	-	✓	Industrial	✓	Industrial	Domestic

Source: Tariff Orders of SERCs

- Himachal Pradesh has been chosen to represent hilly states. The state has been able to implement the Tariff Policy guidelines of retaining cross subsidies within $\pm 20\%$ of ACoS.
- Delhi and Uttar Pradesh have majority sales in Domestic category. Out of these Delhi has been chosen as unlike other states, in Delhi, commercial category is the major subsidizing category.

- Punjab has been chosen as it has majority of sales in Agricultural category. Punjab has very small deviation from $\pm 20\%$ limit of ACoS coverage giving us an opportunity to see any steps taken by Punjab to achieve the desired cross subsidy levels.
- We have chosen Rajasthan as the state like Punjab, has very small deviation from $\pm 20\%$ limit of ACoS coverage giving us an opportunity to see any steps taken to achieve the desired cross subsidy levels.

South Region:

States	Max ACoS coverage beyond 120%	Min ACoS Coverage below 80%	Major category by sales	ACoS coverage published	Major subsidizing category	Major subsidized category
Andhra Pradesh	NA	NA	Agriculture	NA	NA	NA
Karnataka	NA	NA	Agriculture	NA	NA	NA
Kerala	-	✓	Domestic	✓	Commercial	Domestic
Tamil Nadu	✓	✓	Domestic	✓	Industrial	Domestic

Source: *Tariff Orders of SERC*

- Out of the 4 states in south region, Andhra Pradesh and Karnataka have agricultural category as major consumer. We choose to study Andhra Pradesh, as Karnataka does not publish category wise data which is needed to make meaningful cross subsidy study.
- Out of Kerala and Tamil Nadu we choose Kerala owning where better quality of data is available.

East and North East Region:

States	Max ACoS coverage beyond 120%	Min ACoS Coverage below 80%	Major category by sales	ACoS coverage published	Major subsidizing category	Major subsidized category
Arunachal Pradesh	NA	NA	Industrial	NA	NA	NA
Assam	-	-	Domestic	✓	Industrial	Domestic
Bihar	✓	✓	Domestic	✓	Industrial	Domestic
Jharkhand	NA	NA	Domestic	NA	NA	NA
Manipur	NA	NA	Domestic	NA	NA	NA
Meghalaya	-	✓	Industrial	✓	Industrial	Domestic
Mizoram	NA	NA	Domestic	NA	NA	NA
Nagaland	NA	NA	Domestic	NA	NA	NA
Odisha	NA	NA	NA	✓ (voltage-wise)	NA	NA
Sikkim	NA	NA	Industrial	NA	NA	NA
Tripura	NA	NA	Domestic	NA	NA	NA

Source: *Tariff Orders of SERC*

- From the north east region, Meghalaya which regularly publishes ACOS coverage information has been chosen for further analysis.
- Also we choose Bihar as subject of further study, because the energy consumption in this state is highly skewed towards Industrial and Domestic categories. Bihar would also allow us to investigate the cross subsidy trajectory in case of states at the onset of power sector reforms.

West Region:

States	Max ACoS coverage beyond 120%	Min ACoS Coverage below 80%	Major category by sales	ACoS coverage published	Major subsidizing category	Major subsidized category
Goa	✓	✓	Industrial	✓	Industrial	Domestic
Gujarat	NA	NA	Industrial	NA	NA	NA
Chhattisgarh	✓	✓	Industrial	✓	Industrial	Domestic
Maharashtra	✓	✓	Industrial	✓	Industrial	Domestic
Madhya Pradesh	✓	✓	Agricultural	✓	Industrial	Agricultural

Source: *Tariff Orders of SERC*

- From the west region of India, we choose the states of Maharashtra and Madhya Pradesh as both these states had prepared a roadmap to reduce cross subsidies between consumer categories over a 5 year period. While the roadmap period for Madhya Pradesh ended in FY2010-11, we can still find consumer categories which have ACoS coverage outside the limit of $\pm 20\%$. Similarly in Maharashtra, the roadmap aims to eliminate cross subsidy by the FY2015-16.

These 10 states combined represent approximately 40% of population of India. These states represent a wide diversity in respect of the stage of economic development and development of the power sector:

- Per capita electricity consumption of 202 kWh in Rajasthan to 1419 kWh in Delhi
- State Domestic Production (SDP) of 103 billion rupees in Meghalaya to 6981 billion rupees in Maharashtra
- Annual Per Capita income of Rs. 12,477 in Bihar to Rs. 1,12,021 in Delhi
- BPL population of 55% in Bihar to 12% in Punjab
- Agricultural output as % of SDP varying from 25% in Madhya Pradesh to 1% in Delhi
- Industrial output as % of SDP varying from 22% in Punjab to 6% in Delhi

Table 9: Brief profile of selected states

<p>Andhra Pradesh</p> <p>Per capita electricity consumption: 852 kWh SDP: Rs. 3628 Billion Per capita income: Rs. 79,871 Agricultural output as % of SDP: 20% Industrial output as %of SDP: 13%</p>	<p>Madhya Pradesh</p> <p>Per capita electricity consumption: 627 kWh SDP: Rs. 1709 Billion Per capita income: Rs. 35,801 Agricultural output as % of SDP: 25% Industrial output as %of SDP: 17%</p>
<p>Delhi</p> <p>Per capita electricity consumption: 1419 kWh SDP: Rs. 1877 Billion Per capita income: Rs. 1,12,021 Agricultural output as % of SDP: 1% Industrial output as %of SDP: 6%</p>	<p>Maharashtra</p> <p>Per capita electricity consumption: 1010 kWh SDP: Rs. 6981 Billion Per capita income: Rs. 91,625 Agricultural output as % of SDP: 9% Industrial output as %of SDP: 20%</p>
<p>Bihar</p> <p>Per capita electricity consumption: 122.11 kWh SDP: Rs. 1295 Billion Per capita income: Rs. 12,477 Agricultural output as % of SDP: 23% Industrial output as %of SDP: 6%</p>	<p>Meghalaya</p> <p>Per capita electricity consumption: 388 kWh SDP: Rs. 103 Billion Per capita income: Rs. 58,903 Agricultural output as % of SDP: 16% Industrial output as %of SDP: 13%</p>
<p>Himachal Pradesh</p> <p>Per capita electricity consumption: 1198 kWh SDP: Rs. 340 Billion Per capita income: Rs. 92,006 Agricultural output as % of SDP: 18% Industrial output as %of SDP: 18%</p>	<p>Rajasthan</p> <p>Per capita electricity consumption: 202 kWh SDP: Rs. 1947 Billion Per capita income: Rs. 28,366 Agricultural output as % of SDP: 24% Industrial output as %of SDP: 19%</p>
<p>Kerala</p> <p>Per capita electricity consumption: 554 kWh SDP: Rs. 1808 Billion Per capita income: Rs. 97,848 Agricultural output as % of SDP: 9% Industrial output as %of SDP: 7%</p>	<p>Punjab</p> <p>Per capita electricity consumption: 1412 kWh SDP: Rs. 1370 Billion Per capita income: Rs. 49,446 Agricultural output as % of SDP: 24% Industrial output as %of SDP: 22%</p>

5. Review of cross subsidy levels in selected states

In this section we review the movement of cross subsidies in the ten selected states namely, Madhya Pradesh, Rajasthan, Andhra Pradesh, Maharashtra, Delhi, Meghalaya, Bihar, Punjab, Himachal Pradesh and Kerala. For states of Madhya Pradesh and Maharashtra, which had prepared a roadmap for reduction of cross subsidies, the actual values of cross subsidy coverage over the years is mapped against the targeted cross subsidy levels as per the roadmap. For other states like Delhi, Punjab, Rajasthan and Bihar which although did not have a roadmap for reduction of cross subsidy however published cross subsidy coverage or cross subsidy levels in their tariff orders, we studied the movement of these cross subsidies among their consumer categories and tried to establish not only the major subsidizing and subsidized categories but also whether their tariffs are moving towards or away from their cost of supply. Further for states like Andhra Pradesh, Meghalaya, Kerala and Himachal Pradesh, which historically did not measure the level of cross subsidy in their tariff orders, wherever sufficient data was available we calculated both the cross subsidy coverage and cross subsidy levels in order to quantify the impact of these subsidies.

Methodology for review of selected states

The following analysis were carried out for the 10 selected states –

1. **Cross subsidy:** by comparing category wise ABR to ACoS, we carried out following analysis -
 - a. Identified major subsidising/subsidised categories
 - b. Whether ACoS coverage is within +/- 20% range
2. **Movement trend of ACoS coverage:** Using 3 year or 2 year moving average, we studied the movement of category wise ACoS coverage and established whether their tariffs are moving towards or away from their ACoS.
3. **Roadmap of Cross Subsidy reduction:** For Madhya Pradesh and Maharashtra, the actual values of cross subsidy coverage over the years, was mapped against the targeted cross subsidy levels as per the roadmap.
4. **Cross subsidy level:** By using the below mentioned formula we calculated the external financial support required from state governments to eliminate cross subsidy.

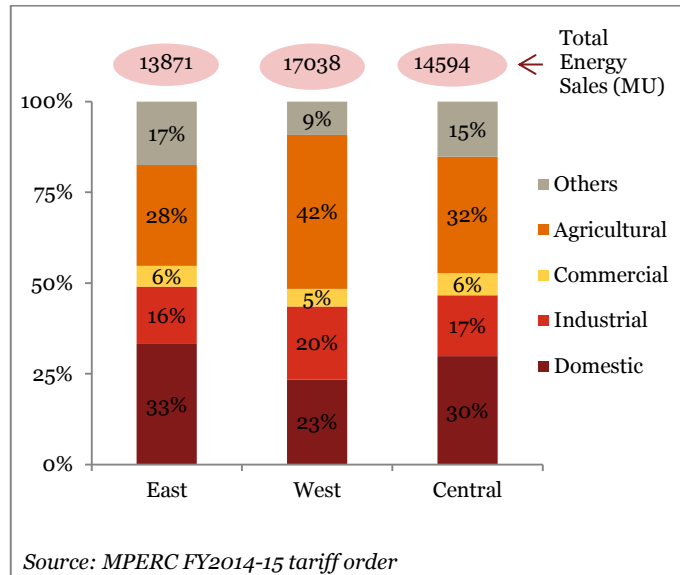
$$\text{Cross subsidy level} = (\text{ABR} - \text{ACoS}) * \text{energy sales}$$

5.1. Madhya Pradesh

Madhya Pradesh is one of the largest states in India in terms of area. There are three Discoms in the state - M.P. Poorv Kshetra Vidyut Vitran Co (east), M.P. Paschim Kshetra Vidyut Vitran Co (west) and M.P. Madhya Kshetra Vidyut Vitran Co (central). In all these three Discoms, agriculture and domestic consumers form a major part of energy sales.

Madhya Pradesh Electricity Regulatory Commission (MPERC) publishes data regarding cross subsidies at a state level however not for individual Discoms. MPERC published the ACoS coverage data for the first time in its FY2006-07 tariff order. In the same year, a roadmap was published to reduce cross subsidies within a period of next 5 years in compliance with the provisions of the Tariff Policy.

Figure 11 MPERC – category wise energy sales for all Discoms in FY2014-15



Cross subsidy reduction roadmap and actual level of cross subsidy

In September 2006, the State Commission notified a road map for reduction of cross subsidy to bring it within $\pm 20\%$ of ACoS by FY2010-11. In the roadmap, consumer categories were classified into two classes - categories having tariffs within $\pm 20\%$ of ACoS and categories having tariff above $+20\%$ or below -20% of ACoS.

Categories having tariffs within $\pm 20\%$ of ACoS in FY2006-07: It was proposed to align the tariffs of these categories so as to achieve 100% ACoS coverage by FY2010-11 with a defined path. At the end of FY2010-11, most of the categories were close to their targeted 100% ACoS coverage.

Table 10 MPERC – cross subsidy reduction roadmap for categories within $\pm 20\%$ ACoS coverage

Categories	FY07	FY08	FY09	FY10	FY11	Actual FY11
Trajectory for cross subsidies in the Roadmap						
Domestic (30-50 units)	80%	85%	90%	95%	100%	95%
Domestic (50-100 units)	89%	92%	94%	97%	100%	
Domestic (above 100 units)	106%	106%	106%	106%	106%	
Public Water Works	84%	88%	92%	96%	100%	90%
Street Lights	101%	101%	101%	101%	101%	92%
HT water works	91%	94%	96%	98%	100%	96%
Bulk Users	108%	106%	104%	102%	100%	100%
Bulk Supply to exemptees	81%	86%	91%	95%	100%	88%

Source: MP power sector reforms DFID Support to MPERC, September 2006 and MPERC FY2010-11 tariff order

Categories having tariff above +20% or below -20% of ACoS in FY2006-07: It was proposed that the average tariffs of these categories need to be aligned at a faster rate with the ACoS to bring them in the +/-20% range by FY2010-11. The targets of the roadmap were met in a limited way. The subsidizing categories like Non Domestic, Industry, Railway Traction and Coal Mines in FY2010-11 still had ACoS coverage above 120%. On the other hand among the subsidized categories, domestic had achieved 95% ACoS coverage in FY2010-11 while agriculture remained below 80%.

Table 11 MPERC – cross subsidy reduction roadmap for categories outside ±20% ACoS coverage

Categories	FY07	FY08	FY09	FY10	FY11	Actual FY11
Categories below 20% of ACoS	Trajectory for cross subsidies in the Roadmap					
Domestic (0-30 units)	76%	77%	78%	79%	80%	95%
Agriculture (first 300 units)	57%	61%	65%	69%	73%	75%
Agriculture (above 300 units)	72%	74%	76%	78%	80%	
Categories above 20% of ACoS	Trajectory for cross subsidies in the Roadmap					
Non Domestic	160%	150%	140%	130%	120%	139%
LT Industry	149%	141%	134%	127%	120%	124%
Railway Traction	133%	130%	127%	123%	120%	125%
Coal Mines	158%	148%	139%	129%	120%	129%
HT Industrial/Non Industrial	127%	125%	124%	122%	120%	121%/126%

Source: MP power sector reforms DFID Support to MPERC, September 2006 and MPERC FY2010-11 tariff order

Movement of cross subsidies in the state during last five years

The table below shows the movement of category wise ACoS coverage during the last five years. The ACoS coverage information was evaluated on two counts:

- Whether ACoS coverage is within +/- 20% as mandated by the Tariff Policy
- Whether ACoS coverage is converging towards or diverging from ACoS¹⁰

It is observed that the tariff for Domestic is at 100% ACoS coverage and the tariff for LT Agriculture is also only marginally below the 80% of ACoS, as prescribed by the Tariff Policy (the ACoS coverage values indicated in the table are inclusive of advance subsidy given by state government to Agriculture consumers¹¹). For both the categories the ACoS coverage has moved towards the prescribed limits.

Cost coverage for Industrial and Commercial category (both LT and HT) continues to be outside the prescribed limits of +/-20% of ACoS. There has been a consistent movement towards ACoS for LT Industrial category, however no such trend is observed in the tariff for Commercial category and other Industrial categories.

¹⁰ Cost coverage should ideally be evaluated using the category wise cost of supply. However, in order to make the data comparable with previous years, ACoS coverage is used for all years.

¹¹ The bill for the consumer covered under the tariff schedule LV 5.4 is calculated at the rates specified under the tariff schedule LV 5.1. The consumer is required to pay at the rates specified under tariff schedule LV 5.4 and the balance amount is paid by the State Govt. as advance subsidy to the Distribution licensee.

- ⊗ Subsidizing category
- Subsidized category

Table 12 MPERC – category wise ACoS coverage movement from FY11 to FY15

	FY11	FY12	FY13	FY14	FY15	Trend*	Subsidizing / subsidized category
LT category							
Domestic	95%	95%	97%	98%	100%	Towards ACoS	-
Non Domestic	139%	140%	136%	140%	136%	Uneven	⊗
Industrial	124%	123%	123%	122%	122%	Towards ACoS	⊗
Agriculture	75%	73%	77%	75%	77%	Towards ACoS	□
HT category							
Railway Traction	125%	124%	124%	125%	121%	Towards ACoS	⊗
Industrial	121%	119%	121%	120%	123%	Away from ACoS	⊗
Non-Industrial	126%	129%	119%	137%	137%	Away from ACoS	⊗
Irrigation, PWW and other than Agriculture	96%	98%	85%	91%	88%	Away from ACoS	□

Source: Tariff orders issued by MPERC

*based on 3 year moving average

Prevalent level of cross subsidy in rupee terms

The tariff orders of the State Commission do not publish the absolute level of cross subsidy (in rupee terms) for each consumer category however the same can be calculated by the following formula:

$$\text{Cross Subsidy in rupee terms} = (\text{ABR} - \text{ACoS}) * \text{Energy Sales}$$

Table 13: MPERC – category wise cross subsidy amount (in rupees crore) from FY11 to FY15

	FY11	FY12	FY13	FY14	FY15
LT					
Domestic	(136)	(182)	(129)	(159)	39
Non Domestic	228	290	363	437	436
Industrial	77	88	119	133	135
Agriculture	(805)	(929)	(1,156)	(1,425)	(1,715)
HT					
Railway Traction	166	182	205	226	225
Industrial	380	423	505	610	688
Non-Industrial	76	108	146	171	160
Irrigation, PWW and other than Agriculture	(7)	(4)	(45)	(22)	(35)

Source: PwC analysis

From the above table it is observed that as on FY2014-15, in order to eliminate cross subsidies for subsidized categories, without increasing tariffs, an amount of approx Rs. 1750 crore would be required from the State Government. In spite of the tariff for agriculture category moving towards the ACoS, the actual amount of cross subsidies to this category have increased by 113% between FY 2010-11 and FY 2014-15 on account of increase in

sales from 7254 MU in FY2010-11 to 15734 MU in FY2014-15. As a result the cross subsidies paid out by the industrial and commercial consumers have also increased correspondingly.

5.2. Maharashtra

In the state of Maharashtra, electricity is supplied mainly by four distribution licensees: BEST, MSEDCL, RInfra-D and TPC-D. Out of these, BEST, RInfra-D and TPC-D supply electricity only to Mumbai whereas MSEDCL supplies to some parts of Mumbai and the rest of Maharashtra. While cross subsidies are prevalent in the tariffs of all four licensees, this report focusses on MSEDCL which has the largest share of sales and the highest levels of cross subsidies.

The cross subsidy reduction roadmap and actual level of cross subsidy

MERC published ACoS coverage for the first time in its FY2001-02 tariff order. In FY2003-04 i.e. the year when EA 2003 was enacted, only three major consumer categories were outside the range of +/- 20% ACoS coverage. These were LT Non Domestic (138% ACoS coverage) and LT/HT Agriculture (69% and 50% ACoS coverage). However by FY2006-07, tariffs for most of the consumer categories had moved away from ACoS, taking their ACoS coverage beyond the +/-20% range, with HT Seasonal at 154% ACoS coverage and LT Agriculture-metered at 39% ACoS coverage.

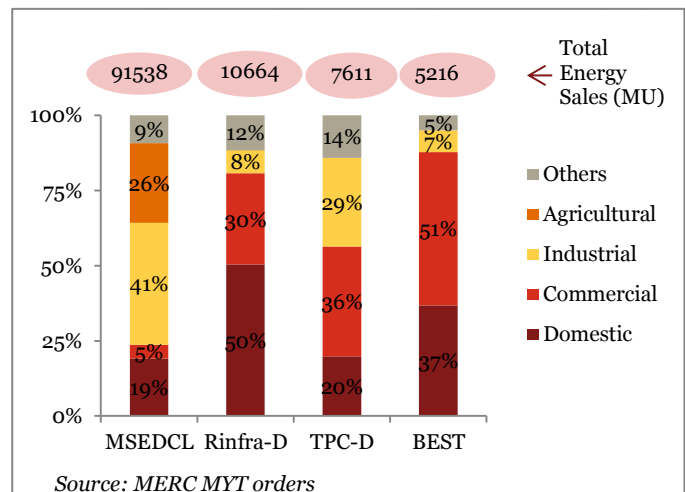
In May 2012 a roadmap was set out by MERC to reduce cross subsidy by FY2015-16 and the ACoS coverage for all categories within +/- 20%. Two scenarios were discussed in this roadmap. The first scenario roadmap could not accommodate sufficient increase in tariff for a few categories like BPL, agriculture and public water works (PWW) without giving tariff shock. As an alternative, an accelerated roadmap was considered in scenario 2, where tariff of such categories was raised beyond tariff shock, so as to reach the desired level of cross subsidy reduction within the specified frame of 5 years. However scenario 2 required external monetary support for certain consumer categories in order to prevent tariff shock.

The following table gives the trajectory for reducing ACoS coverage under the first scenario. The table also shows the actual ACoS coverage for various consumer categories for FY2012-13. Deviation can be seen in ACoS coverage for most of the categories from their targeted ACoS coverage in FY2012-13.

Table 14 MSEDCL - cross subsidy reduction roadmap

	FY11	FY12	FY13	FY14	FY15	FY16	Actual FY13
LT Category	Trajectory for cross subsidies in the Roadmap						
BPL	20%	21%	23%	25%	27%	29%	21%
Domestic (0-100 units)	64%	70%	76%	83%	90%	98%	70%
Domestic (101-300 units)	112%	112%	112%	100%	100%	100%	118%
Domestic (301-500 units)	147%	120%	120%	115%	110%	110%	147%
Domestic (501-1000 units)	167%	120%	120%	120%	115%	115%	160%

Figure 12 MERC – category wise energy sales for all Discoms in FY2014-15



	FY11	FY12	FY13	FY14	FY15	FY16	Actual FY13
Non Domestic	149%	142%	135%	120%	118%	118%	176%
PWW	49%	53%	58%	63%	69%	75%	53%
Agriculture unmetered	51%	56%	61%	66%	72%	78%	44%
Agriculture metered	37%	40%	43%	47%	51%	55%	42%
Industrial	117%	117%	117%	117%	110%	110%	129%
Street Lighting	79%	86%	94%	100%	100%	100%	84%
Temporary	262%	262%	262%	262%	262%	262%	275%
Adv. & Hoardings	395%	395%	395%	395%	395%	395%	420%
Crematorium	60%	65%	71%	77%	84%	92%	67%
HT Category	Trajectory for cross subsidies in the Roadmap						
Industrial	124%	124%	120%	119%	116%	111%	135%
Commercial	184%	150%	145%	131%	120%	120%	201%
Railways	131%	120%	120%	120%	120%	112%	140%
PWW	91%	99%	100%	100%	100%	100%	99%
Agriculture	54%	58%	63%	69%	75%	82%	56%
Bulk Supply	94%	100%	100%	100%	100%	100%	98%

Source: Roadmap to reduce cross subsidies in Maharashtra, May 2012 and MSEDCL tariff order for FY2012-13

Movement of cross subsidies in the state during last five years

The table below gives the movement of ACoS coverage from FY2008-09 to FY2012-13 i.e. for a period of five preceding the latest tariff order. The ACoS coverage information was evaluated on two counts:

- Whether ACoS coverage is within +/- 20% as mandated by the Tariff Policy
- Whether ACoS coverage is converging towards or diverging from ACoS¹²

The ABR values used for the calculation of ACoS coverage in the above tables are derived from the revenue available to the utility from the category and hence subsume any subsidy given to the agriculture consumers.

As of FY2012-13 ACoS coverage for most of the consumer categories was outside the range +/-20% range. Also in the five year period under study, ACoS coverage for most of the categories has moved away from the ACoS except for agriculture category. The BPL and agricultural categories as of FY2012-13 have ACoS coverage of just 21% and ~50% respectively.

⊗ Subsidizing category

□ Subsidized category

Table 15 MSEDCL – category wise ACoS coverage movement from FY09 to FY13

	FY09	FY10	FY11	FY12	FY13	Trend*	Subsidizing/ subsidized category
HT Industrial							
HT-I Express	127%	124%	128%	135%	138%	Away from ACoS	⊗

¹² Cost coverage should ideally be evaluated using the category wise cost of supply. However, in absence of category wise cost of supply ACoS has been used

	FY09	FY10	FY11	FY12	FY13	Trend*	Subsidizing/ subsidized category
HT-I Non-Express	123%	116%	119%	128%	130%	Away from ACoS	⊗
HT-I Seasonal	155%	147%	158%	156%	160%	Away from ACoS	⊗
HT Commercial (others)	-	179%	186%	198%	201%	Away from ACoS	⊗
HT Railway	130%	123%	132%	138%	140%	Away from ACoS	⊗
HT Agriculture	49%	49%	54%	54%	56%	Towards ACoS	□
LT Domestic	104%	96%	84%	84%	88%	Away from ACoS	□
BPL	-	-	-	21%	21%	-	□
LT Non-Domestic (others)	173%	148%	151%	173%	176%	Away from ACoS	⊗
LT Agriculture –Unmetered				42%	44%	Towards ACoS	□
LT Agriculture – Metered	39%	42%	45%	40%	42%	Towards ACoS	□
LT Industrial	114%	100%	118%	128%	129%	Away from ACoS	⊗

Source: MSEDCL tariff orders and PwC analysis

*based on 3 year moving average

Prevalent level of cross subsidy in rupee terms from FY09 to FY13

The tariff orders do not publish the rupee terms of cross subsidy for each consumer category, however, the same can be calculated by the following formula:

$$\text{Cross subsidy level} = (\text{ABR} - \text{ACoS}) * \text{energy sales}$$

From the table below, it is observed that in order to eliminate cross subsidies for subsidizing categories without increasing the tariff of subsidized categories, an amount of approx. Rs. 8033 crore would have been required from state government in FY2012-13.

During the last five years, the domestic and LT agricultural (metered) categories have shown significant increase in the cross subsidy amount. The benefit of increase in cross subsidy amount of HT industrial category has gone to these two categories of domestic and LT agricultural (metered).

Table 16 MERC – category wise cross subsidy amount (in rupees crore) from FY09 to FY13

	FY09	FY10	FY11	FY12	FY13
HT Industrial	2,099	2,104	2,765	4,384	5,488
HT Commercial (others)	-	343	609	983	1,207
HT Railway	138	136	203	268	329
HT Agriculture	(106)	(121)	(99)	(156)	(159)
LT Domestic	174	(204)	(900)	(1080)	(1,015)
BPL	-	-	(24)	(91)	(95)
LT Non-Domestic (others)	564	640	870	1,231	1,670
LT Agriculture –Unmetered	(2,874)	(1,803)	(1,697)	(3,490)	(3,321)
LT Agriculture – Metered	(1,676)	(1,485)	(1,677)	(3,169)	(3,443)
LT Industrial	249	(6)	521	581	666

Source: PwC analysis

5.3. Delhi

The state of Delhi has three major distribution companies – BSES Rajdhani Power Ltd (BRPL), BSES Yamuna Power Ltd (BYPL) and North Delhi Power Ltd (NDPL; renamed to Tata Power Delhi Distribution Ltd - TPDDL in June 2011).

Domestic and commercial categories are main consumers of electricity in Delhi forming 78% of total energy sales, unlike other states where agricultural and industrial categories form majority of sales. Traditionally the commercial consumers have been the subsidizing category and the domestic consumers the subsidized category.

Movement of cross subsidies in the state during last five years

DERC started publishing ACoS coverage for various consumer categories from its tariff order of FY2012-13. Although the state commission calculates voltage wise cost of supply, it continues to use ACoS for the measurement of cross subsidy. The ACoS coverage information was evaluated on two counts:

- Whether ACoS coverage is within +/- 20% as mandated by the Tariff Policy
- Whether ACoS coverage is converging towards or diverging from ACoS¹³

In all Discoms as on FY2014-15, the ACoS coverage for Large Industrial Consumers is within prescribed limit of +/- 20% however the ACoS coverage for Domestic, Non Domestic and Small Industrial consumer categories is outside the prescribed range. ACoS coverage for Agricultural and Domestic consumer categories are either moving away from ACoS or show an uneven trend in the last 3 years, for all Discoms.

In Delhi, the government pays subsidy to the Discoms in order to either absorb tariff hikes or extend concessionary tariffs with lower monthly consumption to domestic consumers. The ABR values used for the calculation of ACoS coverage are derived from the revenue available to the utility from the category and hence subsume any subsidy given to the Domestic or Agriculture consumers.

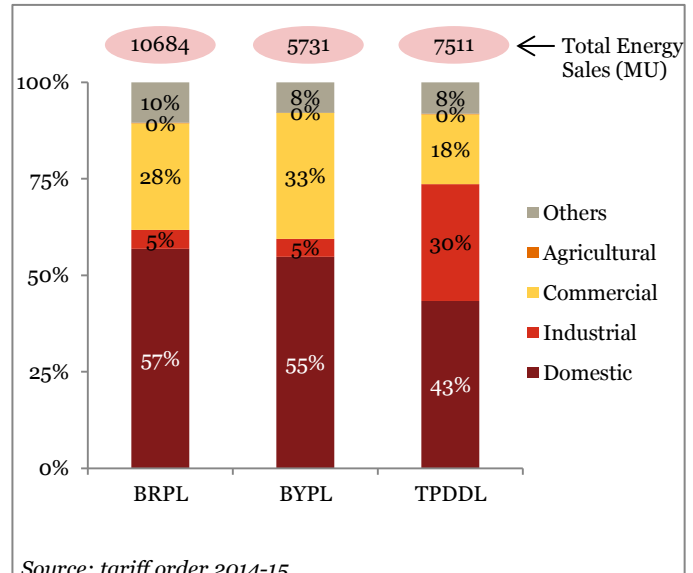
- ⊗ Subsidizing category
- Subsidized category

Table 17 DERC - category wise ACoS coverage movement for TPDDL (NDPL) from FY12 to FY15

	FY12	FY13	FY14	FY15	Trend*	Subsidizing/ subsidized category
Industrial	105%					
Small Industrial Producers		-	-	122%	-	⊗

¹³ Cost coverage should ideally be evaluated using the category wise cost of supply. However, in order to make the data comparable with previous years, ACoS coverage is used for all years.

Figure 13 DERC – category wise energy sales for all Discoms in FY2014-15



Source: tariff order 2014-15

	FY12	FY13	FY14	FY15	Trend*	Subsidizing/ subsidized category
up to 10 kW		149%	142%	129%	Towards ACoS	⊗
10-100 kW		131%	134%	121%	Uneven	⊗
>100 kW		159%	160%	144%	Uneven	⊗
Large Industrial Producers		120%	118%	106%	Towards ACoS	⊗
Non Domestic	121%					
HT – Non Domestic		150%	148%	131%	Towards ACoS	⊗
LT – Non Domestic		-	-	136%	-	⊗
up to 10 kW		154%	151%	134%	Uneven	⊗
> 10 kW to 100 kW		148%	153%	136%	Uneven	⊗
>100 kW		172%	173%	156%	Uneven	⊗
Agriculture	35%	49%	51%	43%	Uneven	□
Domestic	67%	87%	82%	72%	Away from ACoS	□

Source: DERC Tariff orders and PwC analysis

Table 18 DERC - category wise ACoS coverage movement for BRPL from FY12 to FY15

	FY12	FY13	FY14	FY15	Trend*	Subsidizing/ subsidized category
Industrial	101%					
Small Industrial Producers		-	-	129%	-	⊗
up to 10 kW		-	131%	125%	Towards ACoS	⊗
10-100 kW		134%	136%	128%	Uneven	⊗
>100 kW		160%	163%	152%	Uneven	⊗
Large Industrial Producers	119%	121%	113%	Uneven	⊗	
Non Domestic	120%					
HT – Non Domestic		139%	142%	132%	Uneven	⊗
LT – Non Domestic		-	-	141%	-	⊗
Up to 10 kW		147%	140%	139%	Towards ACoS	⊗
> 10 kW to 100 kW		147%	152%	140%	Uneven	⊗
>100 kW		171%	175%	161%	Uneven	⊗
Agriculture	32%	48%	48%	43%	Away from ACoS	□
Domestic	69%	87%	100%	77%	Uneven	□

Source: DERC Tariff orders and PwC analysis

Table 19 DERC - category wise ACoS coverage movement for BYPL from FY12 to FY15

	FY12	FY13	FY14	FY15	Trend*	Subsidizing/ subsidized category
Industrial	99%					
Small Industrial Producers		-	-	130%	-	⊗
up to 10 kW		122%	129%	129%	Away from ACoS	⊗
10-100 kW		-	130%	130%	-	⊗
>100 kW		145%	147%	150%	Away from ACoS	⊗
Large Industrial Producers	110%	116%	116%	Away from ACoS	⊗	

	FY12	FY13	FY14	FY15	Trend*	Subsidizing/ subsidized category
Non Domestic						
HT – Non Domestic		133%	137%	132%	Uneven	⊗
LT – Non Domestic		-	-	143%	-	⊗
Up to 10 kW	111%	139%	143%	139%	Uneven	⊗
> 10 kW to 100 kW		142%	148%	145%	Uneven	⊗
>100 kW		159%	164%	161%	Uneven	⊗
Agriculture	30%	44%	-	38%	Away from ACoS	□
Domestic	62%	79%	79%	73%	Away from ACoS	□

Source: DERC Tariff orders and PwC analysis

*since slab wise data was not available in FY12, the trend of convergence or divergence from ACoS is observed from the variation in ACoS coverage between FY13 and FY15

Prevalent level of cross subsidy in rupee terms during last five years

The following formula is used to measure the cross subsidy in rupee terms for all consumer categories:

$$\text{Cross Subsidy in rupee terms} = (\text{ABR} - \text{ACoS}) * \text{Energy Sales}$$

The table below gives the cross subsidy amount in rupees crore for major consumer category, calculated based on the above formula. As on FY2014-15, in order to eliminate cross subsidy for subsidizing categories, without increasing the tariff for subsidized categories of all three Discoms i.e. TDDPL, BRPL and BYPL, financial support of approx. Rs. 702 crore, Rs. 1015 crore and Rs. 596 crore respectively i.e. a total of Rs. 2288 crore would be required from state government.

Table 20 TDDPL – category wise cross subsidy amount (in rupees crore) from FY12 to FY15

	FY12	FY13	FY14	FY15
Industrial	56	297	414	328
Commercial	140	344	432	349
Agriculture	(6)	(5)	(4)	(5)
Domestic	(553)	(251)	(365)	(697)

Source: PwC analysis

Table 21 BRPL - category wise cross subsidy amount (in rupees crore) from FY12 to FY15

	FY12	FY13	FY14	FY15
Industrial	4	78	102	95
Commercial	326	655	797	786
Agriculture	(6)	(5)	(6)	(6)
Domestic	(907)	(413)	16	(984)

Source: PwC analysis

Table 22 BYPL - category wise cross subsidy amount (in rupees crore) from FY12 to FY15

	FY12	FY13	FY14	FY15
Industrial	(3)	44	74	53
Commercial	107	321	448	531
Agriculture	(0)	(0)	-	(0)
Domestic	(612)	(374)	(392)	(596)

Source: PwC analysis

5.4. Punjab

The Punjab State Power Corporation Limited (PSPCL) is the electricity Distribution Company in Punjab. The state has similar amount of energy sales in between the categories of Domestic, Industrial and Agricultural.

Punjab State Electricity Regulatory Commission (PSERC) started functioning in the year 2001. The Punjab State Electricity Board (PSEB) however continued to be a vertically integrated entity till 2010. In 2010, PSEB was unbundled into Punjab State Power Corporation Limited (PSPCL) and Punjab State Transmission Corporation Limited (PSTCL).

The State Commission in its tariff order of FY2002-03, published the category wise cross subsidy generated in rupee terms based on ACoS. In order to further work towards eliminating cross subsidies PSERC directed PSEB to take up studies in respect of voltage wise cost of service to each consumer category of consumers for FY2004-05. However in tariff order of FY2004-05, the State Commission decided to continue measuring cross subsidy using ACoS.

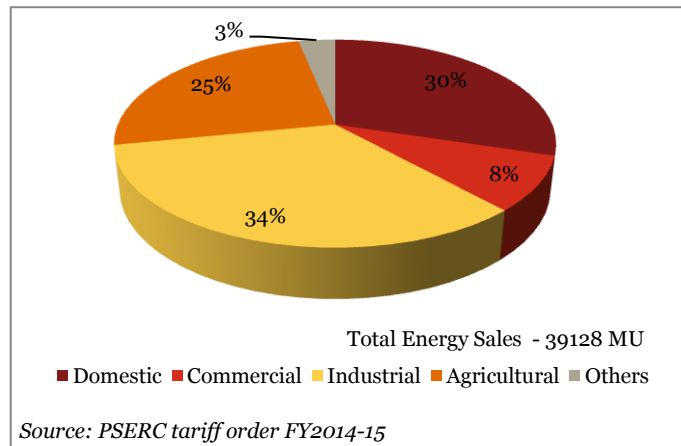
Movement of cross subsidies in the state during last five years

From the tariff orders of FY2010-11 onwards, PSERC started publishing ACoS coverage along with cross subsidy in rupee terms. The ACoS coverage information was evaluated on two counts:

- Whether ACoS coverage is within +/- 20% as mandated by the Tariff Policy
- Whether ACoS coverage is converging towards or diverging from ACoS¹⁴

The subsidized categories are Domestic and Agricultural Pumpset categories while the rest are the subsidizing categories. As of FY2014-15 all consumer categories are within the range of $\pm 20\%$ ACoS coverage. Power is given free of cost to agricultural consumers while tariff hikes for Domestic BPL consumers is absorbed through state subsidy. The ABR values used for the calculation of ACoS coverage are derived from the revenue available to the utility from the category and hence subsume any subsidy given to the Domestic or Agriculture consumers.

Figure 14 PSERC – category wise energy sales in FY2014-15



¹⁴ Cost coverage should ideally be evaluated using the category wise cost of supply. However, in order to make the data comparable with previous years, ACoS coverage is used for all years.

⊗ Subsidizing category

□ Subsidized category

Table 23 PSERC - Category wise ACoS coverage movement from FY11 to FY15

Category	Slab	FY11	FY12	FY13	FY14	FY15	Trend*	Subsidizing/ subsidized category
Domestic	Upto 100	78%	81%	84%	85%	82%	Towards ACoS	□
	101-300	111%	111%	110%	110%	109%	Towards ACoS	⊗
	> 300	117%	117%	116%	117%	116%	Towards ACoS	⊗
NRS	Upto 100	126%	126%	120%	117%	116%	Towards ACoS	⊗
	>100				120%	116%	Away from ACoS	⊗
Industrial	SP	102%	102%	103%	105%	104%	Away from ACoS	⊗
	MP	112%	113%	112%	114%	113%	Away from ACoS	⊗
	LP	114%	116%	116%	118%	116%	Away from ACoS	⊗
Agricultural Pumpset		79%	80%	83%	77%	80%	Away from ACoS	□

Source: PSERC tariff orders and PwC analysis

*based on 3 year moving average

The table below gives the hike in ABR done between FY2010-11 to FY2014-15. We can observe that in FY2011-12 and FY2013-14, the tariff hike for Domestic and Agricultural categories was higher than the hike in ACoS and ACoS coverage of other consumer categories. This resulted in ACoS coverage for Domestic and Agricultural consumer categories to move towards ACoS. However during FY2013-14 and FY2014-15, unlike previous years the tariff hike for Industrial category was more than ACoS which led to movement of away from ACoS.

Table 24 PSPCL –year on year hike in category wise ABR and ACoS

	FY12	FY13	FY14	FY15
Domestic	3%	18%	8%	-1%
NRS	8%	10%	6%	-1%
Industrial SP	9%	16%	10%	1%
Industrial MP	9%	15%	9%	1%
Industrial LP	10%	16%	9%	-
Agricultural Pumpset	11%	20%	-	6%
ACoS	9%	16%	7%	2%

Source: PwC analysis

Prevalent level of cross subsidy in rupee terms during last five years

PSERC in its tariff orders publishes cross subsidy in rupee term as well along with ACoS coverage. The table below gives the level of cross subsidy (in rupee crore) for major consumer categories. We can observe that in order to eliminate cross subsidies for subsidizing categories without increasing the tariffs for subsidized categories, the state government will have to bear a financial burden of Rs. 1478 crores in FY2014-15.

Table 25 PSERC – Category wise cross subsidy amount (in rupees crore) from FY11 to FY15

Category	FY11	FY12	FY13	FY14	FY15
Domestic (upto 100 units)	8	(192)	(153)	(138)	(335)
NRS	272	316	305	351	312
Industrial SP	6	10	13	29	24
Industrial MP	80	104	119	160	154
Industrial LP	558	716	692	1064	970
Agricultural Pumpset	(942)	(994)	(994)	(1490)	(1143)

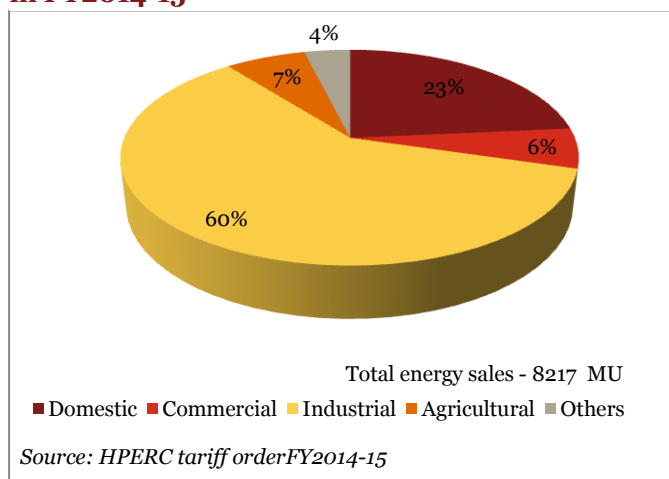
Source: PSERC tariff orders

5.5. Himachal Pradesh

The state of Himachal Pradesh has Himachal Pradesh State Electricity Board Limited (HPSEBL) as the sole distributor of electricity. Industrial category is the largest consumer categories forming 60% of energy sales in the state.

The State Commission published ACoS coverage for various consumer categories in its FY2005-06 tariff order. Only Agricultural and Industrial (EHT) categories were outside the range of +/- 20% ACoS coverage in that year with 36% and 133% ACoS coverage respectively. Domestic category had ACoS coverage of 81% (including the direct subsidy from the GoHP). Therefore at the time when Tariff Policy came in 2006, the cross subsidy levels in the state were not far from their targeted numbers.

Figure 15 HPSEBL – category wise energy sales in FY2014-15



Movement of cross subsidies in the state during the last five years

HPERC published category wise ACoS coverage in its MYT order of FY2014-15 to FY2018-19. The ACoS coverage values for FY2010-11 to FY2013-14 years have been calculated based on the energy sales, revenue figures and ACoS published in tariff orders. The ACoS coverage information was evaluated on two counts:

- Whether ACoS coverage is within +/- 20% as mandated by the Tariff Policy
- Whether ACoS coverage is converging towards or diverging from ACoS¹⁵

As on FY2014-15, all consumer categories are within the +/- 20% range of ACoS coverage. The State Commission further plans to bring these ACoS coverage values within +10% and -15%, by the end of the third control period i.e. FY2018-19.

¹⁵ Cost coverage should ideally be evaluated using the category wise cost of supply. However, in order to make the data comparable with previous years, ACoS coverage is used for all years.

⊗ Subsidizing category

□ Subsidized category

Table 26 HPERC - Category wise ACoS coverage movement from FY11 to FY15

	FY11	FY12	FY13	FY14	FY15	Trend*	Subsidizing/ subsidized category
Industrial Power	90%	102%	104%	106%	105%	Away from ACoS	⊗
Domestic ¹⁶	66%	80%	80%	82%	82%	Towards ACoS	□
Irrigation and drinking water	78%	96%	97%	108%	105%	Away from ACoS	⊗
Commercial	118%	125%	114%	114%	108%	Towards ACoS	⊗
NDNC	115%	123%	114%	114%	103%	Towards ACoS	⊗

Source: HPERC tariff orders and PwC analysis

*based on 3 year moving average

The ABR used for calculation of ACoS coverage in the previous section is inclusive of subsidy provided by Government of Himachal Pradesh for Agricultural and Domestic categories. In its FY2012-13 tariff order, the state commission published the table for contribution of GoHP in tariffs for Domestic BPL and other consumers.

Table 27 HPERC - direct subsidy from GoHP

Description	Units/month	Approved Tariff for FY13 (Rs./kWh)	GoHP Subsidy for FY13 (Rs./kWh)	Effective Tariff after subsidy (Rs./kWh)
BPL Consumers	0-40	2.50	1.80	0.70
Other Consumers	0-40	2.85	1.85	1.00
	0-125	3.00	1.90	1.10
	126-250	3.90	1.70	2.20
	Above 250	4.00	0.75	3.25
	Prepaid Consumers	3.00	1.90	1.10
Agricultural	Upto 20kW	3.00	2.50	0.50
LT Agricultural		4.00	3.50	0.50
HT Agricultural	Above 20 kW	4.25	3.75	0.50
EHT Agricultural		3.95	3.25	0.50

Source: HPERC FY2012-13 tariff order

The table below gives us the year on year hike in ABR for major consumer categories. From the ACoS coverage movement table we observed that in FY2010-11, the ACoS coverage of consumer categories was unbalanced with even Industrial consumers being subsidized. Facilitated by the moderate increase in ACoS between FY2010-11 and FY2014-15 (only 4% CAGR growth), the State Commission was able to realign its tariff in this five year period. Tariff hikes for Domestic category were done in FY2011-12, FY2012-13 and FY2013-14 in order to bring the ACoS coverage within the +/-20% range.

¹⁶ The Domestic category ACoS coverage for FY14 and FY15 is excluding BPL category sales.

Table 28 HPERC –year on year hike in category wise ABR and ACoS

	FY12	FY13	FY 14	FY15
Industrial Power Supply	3%	16%	15%	0%
Domestic	11%	14%	10%	1%
Irrigation and drinking water	12%	14%	13%	1%
Commercial	-3%	3%	14%	-6%
NDNC	-2%	5%	13%	-9%
ACoS	-9%	14%	13%	1%

Source: PwC analysis

Prevalent level of cross subsidy in rupee terms during last five years

The following formula is used to measure the cross subsidy in rupee terms for all consumer categories:

$$\text{Cross Subsidy in rupee terms} = (\text{ABR} - \text{ACoS}) * \text{Energy Sales}$$

We can see from the table that while in FY2010-11 the Industrial category was a subsidized category, it has become a subsidizing category in later years. No major change can be observed for other categories in the cross subsidy amount from FY2010-11 to FY2014-15. Considering major consumer categories in order to eliminate cross subsidy for subsidizing categories without increasing the tariffs for subsidised categories, an additional amount of Rs. 223 crore will be needed from GoHP in FY2014-15.

Table 29 HPERC – category wise cross subsidy amount (in rupees crore) for FY11 to FY15

	FY11	FY12	FY 13	FY 14	FY 15
Industrial	(165)	36	82	157	138
Domestic	(172)	(103)	(129)	(196)	(217)
Irrigation and drinking water	(42)	(7)	(6)	(7)	(6)
Commercial	24	40	25	35	20
NDNC	5	9	7	8	2

Source: PwC Analysis

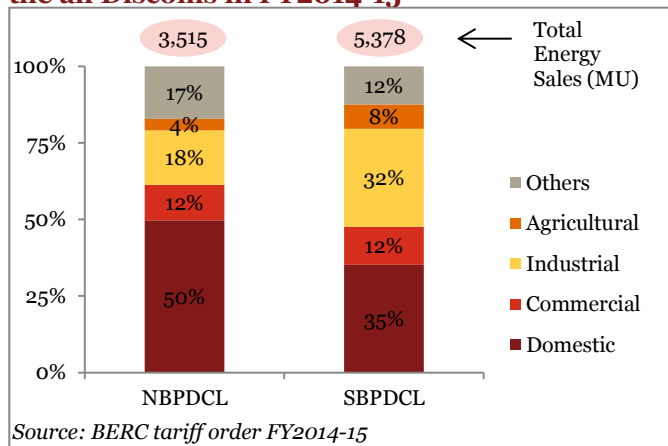
5.6. Bihar

The Bihar State Electricity Board was unbundled in November 2012 into five companies which included two distribution companies- North Bihar Power Distribution Company Limited (NBPDC) and South Bihar Power Distribution Company Limited (SBPDCL).

The biggest consumers of electricity in Bihar are the Domestic Consumers followed by the Industry.

Bihar Electricity Regulatory Commission (BERC) came up with its first tariff order in FY2006-07. In this tariff order, cross subsidy in rupee per unit terms was published by the state commission, which was calculated as the difference between ABR and ACoS for various consumer categories. It was observed that back then most of the consumer categories had ABR below ACoS. Therefore at the time when Tariff Policy came in 2006, most of the categories were

Figure 16 BERC – category wise energy sales for the all Discoms in FY2014-15



subsidised. While Agricultural category (IAS-1) had ACoS coverage of just 10%, Non Domestic – II (the most subsidizing category) had ACoS coverage of 111% in FY2006-07.

Movement of cross subsidies during last five years

From FY2011-12, the State Commission began publishing data on ACoS coverage in its tariff orders. In its tariff order of FY2013-14 and FY2014-15, BEREC calculated cross subsidy coverage using both voltage wise CoS and ACoS¹⁷. For our analysis we evaluate the ACoS coverage information on two counts:

- Whether ACoS coverage is within +/- 20% as mandated by the Tariff Policy
- Whether ACoS coverage is converging towards or diverging from ACoS¹⁸

In its tariff order of FY2014-15 i.e. after unbundling of BSEB, ACoS coverage for two Discoms was published separately. Although both Discoms charge same tariff, significant differences can be seen between the ACoS coverage between the two Discoms due to different ACoS values. Categories like HTSS and HTS-III which are subsidizing in NBPDC, are subsidized categories in SBPDCL.

For the FY2010-11, the ACoS coverage has been calculated based on category wise energy sales, revenue and ACoS data published in the tariff order.

⊗ Subsidizing category

□ Subsidized category

Table 30 BEREC - category wise ACoS coverage movement from FY11 to FY15

	FY11	FY12	FY13	FY14	FY15		Trend*	Subsidizing/ subsidized category
					North (N)	South (S)		
Domestic								
Kutir Jyoti	39%	40%	29%	47%	100%	100%	Towards ACoS	-
Domestic - I	20%	32%	34%	52%	100%	100%	Towards ACoS	-
Domestic -II	54%	57%	65%	78%	64%	56%	N: Towards ACoS S: Uneven	□
Commercial								
Non-Domestic – I	42%	42%	42%	69%	100%	100%	Towards ACoS	
Non-Domestic - II	113%	116%	132%	107%	113%	105%	Towards ACoS	⊗
Non-Domestic -III	57%	62%	62%	65%	75%	65%	Towards ACoS	□
Irrigation								
IAS – I	22%	28%	21%	18%	100%	100%	Uneven	
IAS – II	92%		102%	81%	66%	86%	Away from ACoS	□
Industrial LT								
LTIS – I	100%	93%	108%	93%	97%	94%	N: Uneven S: Towards ACoS	□
LTIS – II	104%	103%	122%	97%	97%	90%	Towards ACoS	□

¹⁷ However the revenue subsidy extended by state government to consumer categories is still being calculated based on the ACoS

¹⁸ Cost coverage should ideally be evaluated using the category wise cost of supply. However, in order to make the data comparable with previous years, ACoS coverage is used for all years.

	FY11	FY12	FY13	FY14	FY15	Trend*	Subsidizing/ subsidized category
Industrial HT							
HTS – I	102%	94%	119%	106%	112%	107%	Away from ACoS ⊗
HTS – II	100%	91%	111%	107%	117%	107%	Away from ACoS ⊗
HTS – III	98%	87%	105%	94%	101%	92%	Uneven ⊗□
HTSS	71%	64%	69%	85%	124%	76%	Towards ACoS ⊗□

Source: BERC Tariff orders

*based on 3 year moving average

Consumer categories of Kutir Jyoti, Domestic-I, Non Domestic-I and IAS-1 show a significant jump in ACoS coverage to 100% from FY2013-14 to FY2014-15, as the revenue gap between ABR and ACoS in FY2014-15 is funded via subsidy support from State Government as shown in below table. Total Government Subsidy to the two Discoms works out to be Rs. 760 crores in FY2014-15.

Table 31 Bihar - Direct subsidy receivable from state government for FY2014-15 (NBPDC)

	Average Tariff (Rs./Unit)	Average Cost of Supply (Rs./Unit)	Units Sold (MU)	Subsidy Amount (Rs Crore)
Kutir Jyoti – Rural	2.80	6.13	352.00	117.22
Kutir Jyoti – Urban	1.95	6.13	4.00	1.67
Domestic : Rural (DS –I)	2.61	6.13	558.00	196.42
Non- Domestic : Rural (NDS- I)	3.46	6.13	17.00	4.54
Irrigation and Agricultural Services-I: (IAS–I)	1.77	6.13	114.00	49.70
Total subsidy receivable from State Govt.				369.55

Source: BERC FY2014-15 tariff order

Table 32 Bihar - Direct subsidy receivable from state government for FY2014-15 (SBPDCL)

	Average Tariff (Rs./Unit)	Average Cost of Supply (Rs./Unit)	Units Sold (MU)	Subsidy Amount (Rs Crore)
Kutir Jyoti – Rural	2.76	6.68	182.00	71.34
Kutir Jyoti – Urban	1.95	6.68	2.00	0.95
Domestic : Rural (DS –I)	1.88	6.68	304.00	145.92
Non- Domestic : Rural (NDS- I)	2.84	6.68	7.00	2.69
Irrigation and Agricultural Services-I: (IAS–I)	1.56	6.68	331.00	169.47
Total subsidy receivable from State Govt.				390.37

Source: BERC FY2014-15 tariff order

In its tariff order of FY2013-14 and FY2014-15, in addition to ACoS coverage, BERC also calculated cross subsidy coverage using voltage wise CoS. The voltage wise CoS coverage is calculated for the entire state and not separately for the two discoms. The below table compares the cross subsidy percentage calculated using both

ACoS and voltage wise CoS. Since state government calculates subsidy amount as the difference between ABR and ACoS, categories like Kutir Jyoti, Non Domestic – I and IAS – I which show 100% ACoS coverage, fall to 93% coverage based on voltage wise CoS. Also it can be observed that since the State Commission calculates broad voltage wise CoS, the ACoS coverage and CoS coverage show similar figures.

Table 33 BERC – comparison of cross subsidy coverage based on ACoS and voltage wise CoS

	Based on ACoS			Based on CoS	
	FY14	FY15		FY14	FY15
		North	South		
Domestic					
Kutir Jyoti	47%	100%	100%	47%	93%
Domestic – I	52%	100%	100%	52%	93%
Domestic –II	78%	64%	56%	71%	52%
Domestic - III	73%	73%	63%	73%	58%
Commercial					
Non-Domestic – I	69%	100%	100%	62%	93%
Non-Domestic - II	107%	113%	105%	96%	97%
Non-Domestic -III	65%	75%	65%	59%	61%
Irrigation					
IAS – I	18%	100%	100%	18%	93%
IAS – II	81%	66%	86%	73%	79%
Industrial LT					
LTIS – I	93%	97%	94%	84%	87%
LTIS – II	97%	97%	90%	88%	84%
Industrial HT					
HTS – I	106%	112%	107%	101%	104%
HTS – II	107%	117%	107%	107%	109%
HTS – III	94%	101%	92%	97%	97%
HTSS	85%	124%	76%	85%	77%

Source: BERC FY2014-15 tariff order

Prevalent level of cross subsidy in rupee terms during last five years

The following formula is used to measure the cross subsidy in rupee terms for all consumer categories:

$$\text{Cross Subsidy in rupee terms} = (\text{ABR} - \text{ACoS}) * \text{Energy Sales}$$

The below table gives us the cross subsidy in crore rupees for major consumer categories, calculated based on the above formula. In order to eliminate cross subsidy for subsidizing categories without increasing the tariffs for subsidised categories, an amount of Rs. 2106 crore and Rs. 5283 crore will be required for NBPDC and SBPDCL respectively from the State Government in FY2014-15.

Table 34 BERC – category wise cross subsidy amount (in rupees crore) from FY11 to FY15

	FY11	FY12	FY13	FY14	FY15	
					North	South
Domestic						
Kutir Jyoti	(698)	(936)	(1787)	(1482)	0	0
Domestic – I	(3539)	(3579)	(3794)	(2150)	0	0

	FY11	FY12	FY13	FY14	FY15	
Domestic – II	(4016)	(3660)	(2722)	(2614)	(1868)	(4123)
Commercial						
Non-Domestic – I	(58)	(99)	(70)	(38)	0	0
Non-Domestic – II	378	535	1013	365	307	210
Non-Domestic – III	(25)	(16)	(37)	(7)	(2)	(7)
Irrigation						
IAS – I	(1386)	(1684)	(1183)	(1784)	0	0
IAS – II	(29)		41	(238)	(238)	(88)
Industrial LT						
LTIS – I	0	(84)	87	(81)	(16)	(47)
LTIS – II	15	15	151	(21)	(10)	(60)
Industrial HT						
HTS – I	55	(317)	1006	299	200	267
HTS – II	0	(159)	264	103	72	86
HTS – III	(14)	(85)	62	(79)	2	(91)
HTSS	(1010)	(2000)	(755)	(507)	127	(874)

Source: PwC analysis

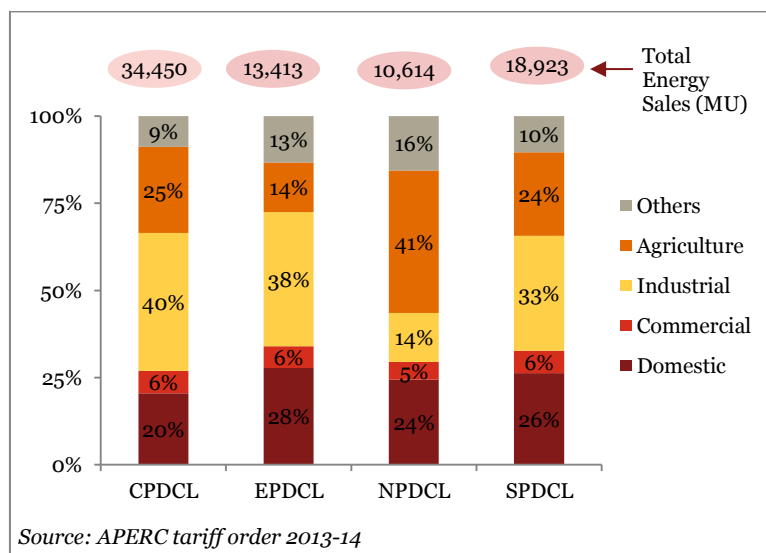
5.7. Andhra Pradesh

The state of Andhra Pradesh has four distribution companies - Central Power Distribution Company of A.P. Ltd. (CPDCL), Eastern Power Distribution Company of A.P. Ltd. (EPDCL), Southern Power Distribution Company of A.P. Ltd. (SPDCL) and Northern Power Distribution Company of A.P. Ltd. (NPDCL). These four Discoms were formed by unbundling of APTRANSCO in March 2000.

While in NPDCL, agricultural is the biggest category by energy sales, in other Discoms industrial is the biggest consumer category.

In the tariff order of FY2006-07, although ACoS coverage was not published, cross subsidy in rupee terms was published. In FY2006-07, a total of Rs. 3475.9 crore of cross subsidy was enjoyed by Domestic and Agricultural consumers in addition to Rs. 1351.67 crore of direct subsidy by GoAP. While the cross subsidy amount was highest between the consumer categories of CPDCL, NPDCL received the biggest share of direct subsidy from GoAP. Therefore at the time when Tariff Policy came in 2006, high levels of cross subsidy existed in the state.

Figure 17 APERC – category wise energy sales for all Discoms in FY2013-14



Movement of cross subsidies in the state during last five years

The State Commission in its tariff orders does not publish ACoS coverage data. However based on energy sales, revenue and cost of supply data available in tariff orders, the ACoS coverage has been calculated for a period

from FY2010-11 to FY2013-14. The data of FY2009-10 is not considered as the category wise revenue figures in the tariff order of FY2009-10 is exclusive of government subsidy and is therefore not comparable to data from others years. For our analysis we evaluate the ACoS coverage information on two counts:

- Whether ACoS coverage is within +/- 20% as mandated by the Tariff Policy
- Whether ACoS coverage is converging towards or diverging from ACoS¹⁹

As on FY2014-15 the subsidizing categories of LT Non Domestic and HT Industry show ACoS coverage outside the 120% limit. Most of the consumer categories show cross subsidy coverage movement towards ACoS.

- ⊗ Subsidizing category
- Subsidized category

Table 35 APERC - category wise ACoS coverage movement from FY10 to FY14

	FY11	FY12	FY13	FY14	Trend*	Subsidizing/ subsidized category
LT Category						
Domestic	103%	105%	100%	87%	Towards ACoS	□
Non Domestic	185%	175%	159%	169%	Towards ACoS	⊗
Industrial	136%	139%	137%	113%	Towards ACoS	⊗
Agricultural	39%	42%	42%	48%	Towards ACoS	□
HT Category						
Industrial- General	114%	114%	122%	128%	Away from ACoS	⊗
Industry - Other	168%	168%	165%	168%	Towards ACoS	⊗
Irrigation and Agriculture	102%	77%	74%	102%	Uneven	⊗

Source: PwC analysis

*based on 2 point moving average

From FY2010-11 onwards, the state commission in its tariff order worked out a Full Cost Recovery Tariff (FCRT), which results in zero revenue gap. Then based on the commitment of state government to provide direct subsidy to certain consumer categories, a Retail Supply Tariff Schedule (RSTS) is formed such that the revenue based on RSTS along with subsidy from government of Andhra Pradesh results in zero revenue gap. The ACoS coverage for FY2010-11 to FY2013-14 is calculated based on FCRT and therefore the figures are inclusive of government subsidy. The below table gives the subsidy committed by GoAP in order to fill the revenue gap created due to adoption of RSTS over FCRT. While FCRT mechanism works towards a steady rise in tariff of subsidized categories, the GoAP has year on year increased its direct subsidy to Agricultural consumers in order to keep the retail tariffs regulated.

Table 36 Andhra Pradesh - Direct subsidy given by GoAP

	FY11	FY12	FY13	FY14
Domestic	1,095	1,339	1,737	1,180
Industrial	24	-	-	-
Cottage Industries	4	7	-	-
Agriculture LT	2,043	2,375	3,620	4,301

¹⁹ Cost coverage should ideally be evaluated using the category wise cost of supply. However, in order to make the data comparable with other states, ACoS is used.

	FY11	FY12	FY13	FY14
Public Lighting	317	309	-	-
General	5	6	-	-
Lift Irrigation	22	26	2	-
Agriculture HT	1	-	-	-
Rural Co-operative	133	148	-	-
Agriculture (tatkal)	9	-	-	-
Total	3,653	4,210	5,359	5,481

Source: APERC Tariff orders

Prevalent level of cross subsidy in rupee terms during last five years

The following formula is used to measure the cross subsidy in rupee terms for all consumer categories:

$$\text{Cross Subsidy in rupee terms} = (ABR - ACoS) * \text{Energy Sales}$$

From the below table considering major consumer categories it can be observed that as on FY2013-14, in order to eliminate cross subsidies for subsidising categories, without increasing tariff for subsidised categories, would have required an amount of Rs. 6137 crore from the state government in FY2013-14.

Table 37 APERC - Cross subsidy amount for various consumer categories (in rupees crore)

	FY11	FY12	FY13	FY14
LT Category				
Domestic	144	279	(10)	(1,181)
Non Domestic	1,198	1,194	1,252	1,758
Industrial	361	417	528	213
Agricultural	(3,142)	(3,558)	(5,127)	(4,956)
HT Category				
Industrial – general	886	1,070	2,283	3,378
Industry – other	573	658	886	1,075
Irrigation and Agriculture	6	(90)	(126)	12

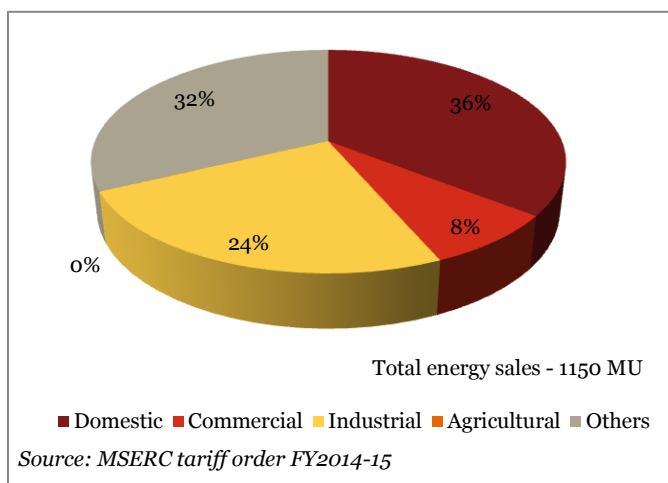
Source: PwC analysis

5.8. Meghalaya

Meghalaya state electricity board was unbundled in the year 2010 into four entities Meghalaya Energy Corporation Limited (MeECL), Meghalaya Power Distribution Corporation Limited (MePDCL), Meghalaya Power Generation Corporation Limited (MePGCL) and the Meghalaya Power Transmission Corporation Limited (MEPTCL). MePDCL is responsible for distribution of electricity in the state of Meghalaya. Industrial and Domestic categories together forming 60% of the energy sales in state, are the biggest consumer categories.

The State Commission in its tariff order of FY2010-11, published ACoS coverage for broad categories of

Figure 18 MePDCL – Category wise energy sales in FY2014-15



EHT, HT, LT Non Domestic and LT Domestic. Along with this, the state commission also gave a broad plan for reducing these cross subsidies by FY2013-14.

Table 38 MSERC - broad plan to reduce cross subsidies from FY12 to FY14

	FY11	FY12	FY13	FY14
	actual		proposed	
LT Domestic Category including consumption for Agricultural purposes, Kutir Jyoti and Crematorium	70%	74%	78%	82%
LT Non-domestic Category including consumption by industry, commercial establishments, general purposes, water supply systems and street lighting.	116%	114%	112%	110%
HT Category	111%	109%	107%	105%
EHT Category	106%	104%	102%	100%

Source: MSECR FY2010-11 tariff order

Movement of cross subsidies in the state during last five years

The state commission published the category wise ACoS coverage in its tariff order of FY2012-13 onwards. ACoS coverage for previous years has been calculated using the category wise energy sales, category wise revenue and ACoS data published by State Commission in its tariff orders. The ACoS coverage information was evaluated on two counts:

- Whether ACoS coverage is within +/- 20% as mandated by the Tariff Policy
- Whether ACoS coverage is converging towards or diverging from ACoS²⁰

It can be observed that in FY2014-15, the ACoS coverage for subsidising consumer categories are within the +/- 20% range however they show a trend of moving away from ACoS. On the other hand the subsidised categories show a trend of cross subsidy coverage moving towards ACoS however currently they are outside the +/- 20% range.

The ABR values used to calculate ACoS coverage in the previous section is exclusive of direct subsidy from state government. The state government provided RE subsidy to MePDCL in FY2012-13 and a provision had been kept for the same in FY2013-14.

- ⊗ Subsidizing category
- Subsidized category

Table 39 MSERC – Category wise ACoS coverage movement from FY11 to FY15

	FY11	FY12	FY13	FY14	FY15	Trend*	Subsidizing/ subsidized category
LT category							
Domestic	72%	69%	72%	73%	76%	Towards ACoS	□
Kutir Jyoti	6%	78%	69%	32%	56%	Uneven	□
Commercial	116%	109%	115%	115%	118%	Away from ACoS	⊗

²⁰ Cost coverage should ideally be evaluated using the category wise cost of supply. However, in absence of category wise cost of supply ACoS has been used

	FY11	FY12	FY13	FY14	FY15	Trend*	Subsidizing/ subsidized category
Agriculture	38%	38%	40%	46%	55%	Towards ACoS	□
HT category							
Industrial	111%	105%	111%	115%	115%	Away from ACoS	⊗
Commercial	111%	104%	111%	111%	117%	Uneven	⊗
EHT category							
Industrial	106%	97%	104%	106%	108%	Away from ACoS	⊗

Source: MSERC tariff orders and PwC analysis

*based on 3 year moving average

Prevalent level of cross subsidy in rupee terms during the last five years

The following formula is used to measure the cross subsidy in rupee terms for all consumer categories:

$$\text{Cross Subsidy in rupee terms} = (\text{ABR} - \text{ACoS}) * \text{Energy Sales}$$

During the last five years although the ACoS coverage for Domestic category shows a convergent trend towards ACoS, the amount of cross subsidy level in rupee terms has increased significantly. This can be attributed to 12% CAGR growth in energy sales to domestic category between this period. The energy sales to HT and EHT Industrial categories showed a ~50% hike in the year FY2012-13 due to which the cross subsidy amount increased significantly in that year. The decrease in cross subsidy amount for these categories after FY2013-13 is however not due to decrease in ACoS coverage but decrease in energy sales.

From the below table considering major consumer categories it can be observed that in order to eliminate cross subsidy for subsidising categories, without increasing the tariff for subsidised categories will require an amount of Rs. 557 crore from state government in FY2014-15.

Table 40 MSERC – category wise cross subsidy amount (in rupees crore) from FY11 to FY15

	FY11	FY12	FY13	FY14	FY15
LT Category					
Domestic	(24)	(340)	(159)	(364)	(519)
Kutir Jyoti	(2)	(8)	(10)	(53)	(38)
Commercial	3	20	49	51	63
Agriculture	(0)	(2)	(1)	(1)	(0)
HT Category					
Industrial	15	62	315	263	219
Commercial	1	3	16	20	24
EHT Category					
Industrial	5	(41)	187	126	89

Source: PwC analysis

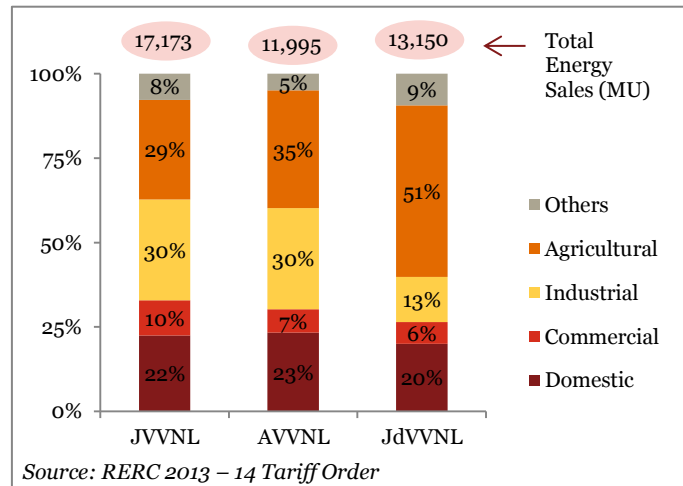
5.9. Rajasthan

In July 2000, the Rajasthan State Electricity Board (RSEB) was unbundled to form five entities out of which three were Discoms – Jaipur Vidyut Vitran Nigam Ltd. (JVVNL), Jodhpur Vidyut Vitran Nigam Ltd. (JdVVNL) and Ajmer Vidyut Vitran Nigam Ltd. (AVVNL).

Agricultural category accounts for 38% of the state's total energy sales and is the one of the major categories in all discoms.

As per the ARR orders published by RERC for FY2006-07, Agricultural consumers were the only subsidised category based on the ABR and ACoS figures. Therefore at the time when Tariff Policy came in 2006, even Domestic consumers were a subsidising category.

Figure 19 RERC – category wise energy sales for all discoms in FY2013 – 14



Movement of cross subsidies in the state during last five years

RERC started publishing ACoS coverage in its tariff order from FY2012-13 onwards. ACoS coverage for previous years has been calculated using the category wise energy sales, category wise revenue and ACoS data published by the State Commission in its tariff orders. The ACoS coverage information was evaluated on two counts:

- Whether ACoS coverage is within +/- 20% as mandated by the Tariff Policy
- Whether ACoS coverage is converging towards or diverging from ACoS²¹

Even though, a roadmap for reduction of cross subsidies was not prepared, except Agriculture category all other consumer categories are within the +/- 20% range of ACoS coverage as on FY2013-14. However it may be noted that a revenue gap of Rs. 1304 crores in FY2013-14 has been approved by the State Commission which may lead to increase/ imbalance in consumer tariffs in the future.

⊗ Subsidizing category

□ Subsidized category

Table 41 RERC - Category wise ACoS coverage movement for JVVNL from FY10 to FY14

JVVNL	FY10	FY11	FY12	FY13	FY14	Trend*	Subsidizing/ subsidized category
Domestic	78%	80%	85%	92%	93%	Towards ACoS	□
Non-Domestic	111%	114%	123%	125%	122%	Away from ACoS	⊗
Agriculture (Metered)	26%	27%	29%	42%	71%	Towards ACoS	□
Agriculture (Flat)	25%	26%	28%	42%	72%	Towards ACoS	□
Small Industry	87%	90%	104%	102%	99%	Towards ACoS	□

²¹ Cost coverage should ideally be evaluated using the category wise cost of supply. However, in absence of category wise cost of supply ACoS has been used

JVVNL	FY10	FY11	FY12	FY13	FY14	Trend*	Subsidizing/ subsidized category
Medium Industry	91%	95%	107%	106%	104%	Towards ACoS	⊗
Large Industry	91%	94%	100%	102%	101%	Towards ACoS	⊗

Source: RERC tariff orders

Table 42 RERC - Category wise ACoS coverage movement for AVVNL

AVVNL	FY10	FY11	FY12	FY13	FY14	Trend*	Subsidizing/ subsidized category
Domestic	79%	76%	86%	87%	90%	Towards ACoS	□
Non-Domestic	109%	104%	125%	122%	115%	Away from ACoS	⊗
Agriculture (Metered)	25%	24%	28%	39%	68%	Towards ACoS	□
Agriculture (Flat)	23%	23%	28%	40%	69%	Towards ACoS	□
Small Industry	84%	81%	97%	97%	95%	Towards ACoS	□
Medium Industry	85%	82%	99%	99%	95%	Towards ACoS	□
Large Industry	86%	83%	107%	106%	100%	Towards ACoS	-

Source: RERC tariff orders

Table 43 RERC - Category wise ACoS coverage movement for JdVVNL

JdVVNL	FY10	FY11	FY12	FY13	FY14	Trend*	Subsidizing/ subsidized category
Domestic	85%	83%	89%	87%	93%	Towards ACoS	□
Non-Domestic	115%	112%	127%	120%	116%	Away from ACoS	⊗
Agriculture (Metered)	25%	25%	28%	39%	68%	Towards ACoS	□
Agriculture (Flat)	25%	24%	28%	40%	70%	Towards ACoS	□
Small Industry	89%	87%	100%	95%	97%	Towards ACoS	□
Medium Industry	95%	92%	111%	101%	99%	Away from ACoS	□
Large Industry	94%	92%	107%	102%	114%	Away from ACoS	⊗

Source: RERC tariff orders

*based on 3 year moving average

There have been three tariff revisions in FY2011-12, FY2012-13 and FY2013-14 after the Tariff Policy. Below table shows the hike in ABR for various consumer categories. Agricultural consumers underwent significant tariff hikes in FY2012-13 and FY2013-14. This has led to increase in its ACoS coverage to approx. 70% in all discoms.

Table 44 RERC - year on year category wise hike in ABR

	FY12	FY13	FY14
Domestic	19%	15%	5%
Non-Domestic	23%	10%	-2%
Agriculture (Metered)	22%	58%	75%
Agriculture (Flat)	25%	62%	77%

	FY12	FY13	FY14
Small Industry	27%	9%	1%
Medium Industry	27%	8%	-1%
Large Industry	25%	10%	1%

Source: PwC analysis

These tariffs of Domestic and Agricultural consumers used for ACoS coverage calculation are inclusive of state government subsidy and subsume the subsidy given to the Agriculture consumers. The effective tariff payable by consumers after subsidy is shown in the table below.

Table 45 RERC - Government of Rajasthan subsidy for Domestic consumers in FY2013-14

	EC	Subsidy indicated to be received from GoR	Effective EC after subsidy
Domestic (0-50 units)			
BPL	Rs. 2.75/ unit	Rs 1.90/ unit	Rs 0.85/ unit
Small Domestic	Rs 3.00/ unit	Rs 1.30/ unit	Rs 1.70/ unit
Agriculture			
Metered general	Rs. 2.25/unit	Rs. 1.35/unit	Rs. 0.90/unit
Metered others	Rs. 3.85/unit	Rs. 1.75/unit	Rs. 2.10/unit
Unmetered general	Rs.285/ HP/ Month	Rs.200/ HP/ Month	Rs 85 /HP/Month
Unmetered others	Rs 430/HP/Month	Rs 200/HP/Month	Rs 230/HP/Month

Source: RERC FY2013-14 tariff order

Prevalent level of cross subsidy in rupee terms

The following formula is used to measure the cross subsidy in rupee terms for all consumer categories:

$$\text{Cross Subsidy in rupee terms} = (\text{ABR} - \text{ACoS}) * \text{Energy Sales}$$

The below table gives us the cross subsidy in crore rupees for major consumer category, calculated based on the above formula. From this analysis we observe that in order to eliminate cross subsidy for subsidizing categories without increasing the tariff for subsidized categories, the state government will need to put in additional financial support of Rs. 1017 crore, Rs. 1021 crore and Rs. 1362 crore for JVVNL, AVVNL and JdVVNL respectively in FY2013-14.

Table 46 RERC - Cross subsidy amount (in rupees crore) for various consumer categories in JVVNL

JVVNL	FY10	FY11	FY12	FY13	FY14
Domestic	(266)	(266)	(291)	(168)	(164)
Non-Domestic	49	70	138	189	225
Agriculture (Metered)	(765)	(848)	(1,518)	(1,313)	(743)
Agriculture (Flat)	(280)	(209)	(217)	(203)	(108)
Small Industry	(16)	(12)	5	3	(2)
Medium Industry	(24)	(16)	23	23	14
Large Industry	(132)	(99)	10	44	10

Source: PwC analysis

Table 47 RERC - Cross subsidy amount (in rupees crore) for various consumer categories in AVVNL

AVVNL	FY10	FY11	FY12	FY13	FY14
Domestic	(165)	(224)	(158)	(193)	(169)
Non-Domestic	20	11	66	74	79
Agriculture (Metered)	(804)	(985)	(969)	(978)	(576)
Agriculture (Flat)	(426)	(346)	(472)	(433)	(248)
Small Industry	(17)	(21)	(4)	(6)	(7)
Medium Industry	(39)	(53)	(4)	(4)	(21)
Large Industry	(150)	(204)	83	90	1

Source: PwC analysis

Table 48 RERC - Cross subsidy amount (in rupees crore) for various consumer categories in JdVVNL

JdVVNL	FY10	FY11	FY12	FY13	FY14
Domestic	(109)	(146)	(115)	(176)	(110)
Non-Domestic	32	30	70	69	83
Agriculture (Metered)	(977)	(1,213)	(1,951)	(1,805)	(1,021)
Agriculture (Flat)	(378)	(302)	(531)	(485)	(225)
Small Industry	(11)	(14)	0	(7)	(4)
Medium Industry	(10)	(17)	25	2	(2)
Large Industry	(27)	(44)	40	13	80

Source: PwC analysis

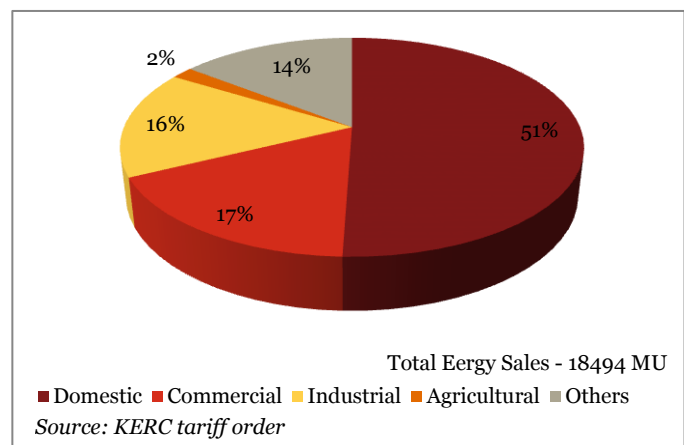
5.10. Kerala

Kerala State Electricity Board (KSEB) distributes electricity in the state of Kerala. It continues to remain as a bundled utility with generation, transmission and distribution functions. Domestic category alone accounts for 51% of energy sales in the state.

The State Commission had approved and published the 'Principles for Determination of Roadmap for cross subsidies Reduction for Distribution Licensees' Regulations, 2012 on 20th November 2012. The regulation stated that while ACoS should be used for the computation of cross subsidy levels for the next sixty months, voltage wise cost of supply be calculated thereafter. Section 3(2) of the regulation stated that –

'3(2)This methodology of determining cost of supply shall be applicable for a period of sixty months or such extended time as decided by the Commission. Thereafter the Cost of Supply shall be differentiated for various consumer categories as per the guidelines to be notified by the Commission....'

Figure 20 KERC – category wise energy sales in FY15



Movement of cross subsidies in the state during last five years

The State Commission published ACoS coverage in its FY2013-14 and FY2014-15 tariff orders. Based on the revenue, ARR and energy sales data provided by state commission in its tariff order before FY2013-14, the ACoS coverage is calculated for various consumer categories. The ACoS coverage information was evaluated on two counts:

- Whether ACoS coverage is within +/- 20% as mandated by the Tariff Policy
- Whether ACoS coverage is converging towards or diverging from ACoS²²

As of FY2014-15, most of the categories have ACoS coverage outside the +/- 20% range and show a trend of moving away from ACoS except for the domestic category. The State Government does not provide any direct subsidy for subsidised categories. The government however provides cash subsidy and waiver of electricity duty in order to close the revenue gap.

- ⊗ Subsidizing category
- Subsidized category

Table 49 KERC - Category wise ACoS coverage movement from FY11 to FY15

	FY11	FY12	FY13	FY14	FY15	Trend*	Subsidizing/ subsidized category
LT category							
Domestic	48%	49%	43%	61%	71%	Towards ACoS	□
Industrial	98%	102%	87%	111%	113%	Away from ACoS	⊗
Agricultural	23%	23%	20%	37%	45%	Towards ACoS	□
HT Category							
Industrial	-	-	89%	113%	117%	Away from ACoS	⊗
Agriculture	-	-	67%	93%	104%	Towards ACoS	⊗
Commercial	-	-	106%	167%	183%	Away from ACoS	⊗
EHT category							
EHT - 66 kV	-	-	81%	106%	112%	Away from ACoS	⊗
EHT - 110kV	-	-	75%	102%	105%	Towards ACoS	⊗

Source: KERC tariff orders and PwC analysis

*since category wise data was not available in FY11 and FY12 for HT and EHT categories, the trend of convergence/divergence from ACoS is observed from the variation in ACoS coverage between FY13 and FY15

Prevalent level of cross subsidy in rupee terms from FY11 to FY15

The tariff orders do not publish the category wise cross subsidy in rupee term. However the same can be calculated by the following formula:

$$\text{Cross Subsidy in rupee terms} = (\text{ABR} - \text{ACoS}) * \text{Energy Sales}$$

From the table below considering major consumer categories it is observed that in order to eliminate cross subsidy for subsidizing categories without increasing the tariff for subsidized category would require a financial

²² Cost coverage should ideally be evaluated using the category wise cost of supply. However, in absence of category wise cost of supply ACoS has been used.

support of Rs. 1512 crore from state government. It can be observed that in FY2012-13, Industrial category enjoyed more cross subsidy than Agricultural category.

Table 50 KERC – category wise cross subsidy amount (in rupees crore) from FY11 to FY15

	FY11	FY12	FY13	FY14	FY15
LT Category					
Domestic	(1466)	(1479)	(2143)	(2011)	(1420)
Industrial	(12)	9	(66)	8	79
Agricultural	(77)	(78)	(92)	(105)	(92)
HT Category					
Industrial	-	-	(81)	24	159
Agriculture	-	-	(1)	(0)	0
Commercial	-	-	272	287	274
EHT Category					
66 kV	-	-	(33)	(3)	22
110kV	-	-	(99)	(19)	20

Source: PwC analysis

6. Cost of supply – calculation methodologies and review of Indian states

6.1. Reference point for calculation of cross subsidies: category wise cost of supply vs. average cost of supply

A review of the reference point used by state commissions for calculating cross subsidies reveals that majority of the state commissions rely upon the average cost of supply for indicating cross subsidies levels. Among the ten states selected for our review, seven states – Punjab, Andhra Pradesh, Delhi, Madhya Pradesh, Bihar and Himachal Pradesh calculate voltage wise or category wise cost of supply.

Table 51: Calculation of category-wise/voltage-wise cost of supply across states

S.No.	State	Category wise/Voltage wise CoS	S.No.	State	Category wise/Voltage wise CoS
1	J&K	No	16	Sikkim	No
2	Arunachal Pradesh	No	17	Uttar Pradesh	Yes
3	Haryana	Yes	18	Karnataka	No
4	Bihar	Yes	19	Goa	No
5	Nagaland	No	20	Odisha	Yes
6	Tripura	No	21	Meghalaya	No
7	West Bengal	No	22	Rajasthan	No
8	Jharkhand	No	23	Chhattisgarh	No
9	Gujarat	No	24	Punjab	Yes
10	Manipur	No	25	Assam	Yes
11	Kerala	No	26	Madhya Pradesh	Yes
12	Andhra Pradesh	Yes	27	Uttarakhand	No
13	Maharashtra	No	28	Himachal Pradesh	Yes
14	Tamil Nadu	Yes	29	Delhi	Yes
15	Mizoram	No			

Source: PwC Analysis

Of the states under review, Punjab, Andhra Pradesh, Tamil Nadu and Assam carried out detailed cost of supply studies for determination of category-wise cost of supply using the ‘embedded cost’ approach. The ‘embedded cost’ method identifies and assigns the historical/ accounting costs that make up a utility’s Annual Revenue Requirement (ARR) to voltage/consumer categories based on various allocation factors.

However most state commissions have expressed inability in determining category-wise cost of supply in view of inadequate information. Taking into account the problems faced by state commissions, the APTEL

suggested²³ that in absence of data, it would be adequate to determine the voltage-wise cost of supply taking into account the major cost element which would be applicable to all the categories of consumers connected to the same voltage level. The APTEL also gave detailed guidelines for calculation of voltage wise cost of supply on an approximate basis.

A few state commissions have made attempts towards calculating voltage wise/category wise cost of supply on the basis of certain norms and assumptions. For example the Bihar State Electricity Commission has computed voltage-wise and category wise cost of supply using the methodology prescribed by the APTEL. It has also used the category wise CoS figures to calculate the extent of cross subsidies for each category. This approach of calculating CoS figures based on certain norms and assumptions, for the states of Delhi, Bihar, Himachal Pradesh, Odisha and Madhya Pradesh is explained in detail in annexures.

6.2. Embedded cost approach

This approach seeks to identify and assign the historical/ accounting costs that make up a utility's Annual Revenue Requirement (ARR) to various voltage/consumer categories based on various allocation factors.

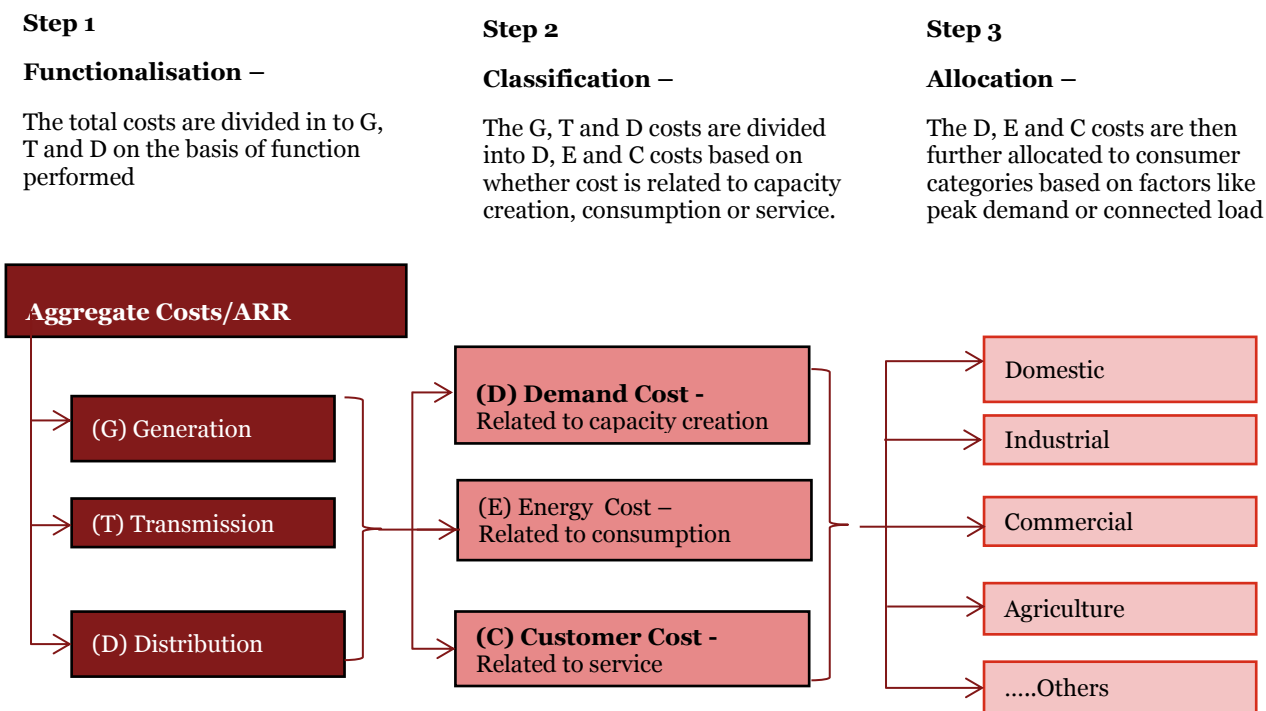
	Advantages	Disadvantages
Embedded Cost Approach	<ul style="list-style-type: none"> • Ease of implementation • Historical Data easily available • Embedded cost are closely aligned with revenue requirement of the utilities 	<ul style="list-style-type: none"> • Poor cost signal for efficient consumption since it does not reflect the true economic cost • Allocation of factors involves subjectivity

This approach consists of three steps: Functionalization, Classification and Allocation of Cost.

1. **Functionalization:** Functionalization is the process of dividing the total cost of the utility on the basis of the functions performed i.e. Power Purchase (Generation), Transmission and Distribution.
2. **Classification of costs:** The functionalized costs are then further classified into demand related, energy related and customer related costs as follows:
 - Demand Cost: The peak demand has to be met by the capacity of generation, transmission and distribution. Hence the cost related to capacity creation is termed as demand related cost.
 - Energy Cost: Energy related costs depend on the quantum of consumption of the users. Such costs are generally termed as variable cost and include costs such as fuel cost of generation, interest on working capital etc.
 - Customer Cost: Customer related costs are directly related to the services provided to customers. Though fixed in nature, these costs are associated with the functions of metering, service connection and other customer related activities.
3. **Allocation of costs to consumer categories:** In this step the costs classified as demand related, energy related or customer related are then allocated to various consumer categories based on factors like peak demand, energy sales, losses, connected load etc.

²³ Judgement in Appeal Nos. 102 of 2010 in the matter of Tata Steel Ltd. Vs. Orissa Electricity Regulatory Commission & Another, 2011

Figure 21 Embedded cost approach for calculating category wise CoS



The table below gives a snapshot of factors used by state commissions of Punjab, Assam, Andhra Pradesh and the FOIR report in their respective embedded cost approach models.

Table 52 Factors used for embedded cost approach in Punjab, Andhra Pradesh, Assam and FOIR report

	Particulars	FOIR	Assam	Punjab	Andhra Pradesh
Functionalization	Generation	PP & Gen/ fuel cost	PP & Gen/ fuel cost	PP & Gen/ fuel cost	PP & Gen/ fuel cost
	Transmission	Trans. related costs	Trans. related costs	Trans. related costs	Trans. related costs
	Distribution	Dist. related costs	Dist. related costs	Dist. related costs	Dist. related costs
Classification	Generation	Demand Related Energy Related	Demand Related Energy Related	Energy related	Demand Related Energy Related
	Transmission	Demand Related	Demand Related	Energy related	Demand Related
	Distribution	Demand related Energy related Customer related	Demand Related Customer Related	Demand related Energy related Customer related	Demand Related Customer Related

	Particulars	FOIR	Assam	Punjab	Andhra Pradesh
Allocation	Demand	Based on Coincident peak demand	Based on percentage peak causation at system by various categories	Based on effective load for consumer categories	Based on average peak CP method
	Energy	Energy cost in generation based on 'block growth approach'. Others based on share in sales	Based on energy sales to each consumer category	Based on energy purchased to meet sales of category	Based on energy sales & losses
	Customer	Based on number of consumers	Based on percentage off-peak causation at system by categories	Based on share in the total energy purchase	Based on allocation factor as per load/consumer

Source: PwC analysis

6.2.1. Suggested model for calculation of CoS

Based on whether energy supply in the state is constrained or not, we suggest two versions of methodology for calculation of category wise CoS using 'Embedded Cost Approach'. The difference between these two versions is in the classification of generation costs into demand related and energy related.

In case of states with un-constrained energy supply or energy surplus states, the system capacity is built to meet the peak system demand. Fixed power purchase cost (i.e. those which are associated with the capital cost of generation plant, depreciation, O&M expenses, etc) vary with the type and capacity and not with the energy generated from a given plant and hence are classified as demand related Cost. Variable Cost changes with the amount of electricity generated and hence are classified as energy related Cost, for example fuel cost.

However in case of energy deficit states the energy supply is controlled through various power regulation methods like load shedding or supply only during certain hours of a day. The system capacity built is therefore as per the energy supplied and not to meet the energy demand. Therefore in such cases the entire generation related costs should be classified as energy related costs.

Another variation that states can have in their Embedded Cost approach is the method of allocating demand related costs to various consumer categories. Distribution systems are designed to meet the system peak demand, therefore the contribution of each consumer category in system peak demand can be used as allocation factor. This approach is suitable for allocating demand costs related to power purchase. However distribution systems are built to serve local maximum demand hence investment are made on the basis of local peak demand. Therefore demand related distribution cost can be divided on the basis of non-coincident peak demand.

For the purpose of allocating customer related costs to various consumer categories, number of consumers in each category can be used as a parameter. However while HT categories account for lesser number of consumers, their connected load can be more than LT categories. To address this variance, category wise weightages can be derived. These weightages can be average of two parameters - sales per customer and load per customer.

Table 53 Suggested Embedded Cost approach for calculating category wise CoS

	Particulars	For supply constrained states	For supply un-constrained states
Functionalization	Generation	PP & Gen/ fuel cost	PP & Gen/ fuel cost
	Transmission	Trans. related costs	Trans. related costs
	Distribution	Dist. related costs	Dist. related costs
Classification	Generation	Energy Related	Demand Related Energy Related
	Transmission	Demand Related	Demand Related
	Distribution	Demand related Customer related	Demand related Customer related
Allocation	Demand	Based on share in system peak demand	Based on share in system peak demand
	Energy	Based on energy sales to each consumer category	Based on energy sales to each consumer category
	Customer	Based on number of consumers/load factor	Based on number of consumers/load factor

6.2.2. Data requirement for Embedded Cost Approach

Embedded Cost approach requires the following data for calculation of category wise CoS –

1. Power Purchase Details
2. Transmission cost details
3. Distribution cost details
4. Voltage wise / Category wise data:
 - Voltage wise assets (including line lengths, Voltage wise transformer cost, Voltage wise sub-Station cost)
 - Number of consumers
 - Energy sales
 - Connected load
 - Weightage factors for allocation of customer related costs
5. Voltage wise Loss levels
6. Load research data of sample feeders

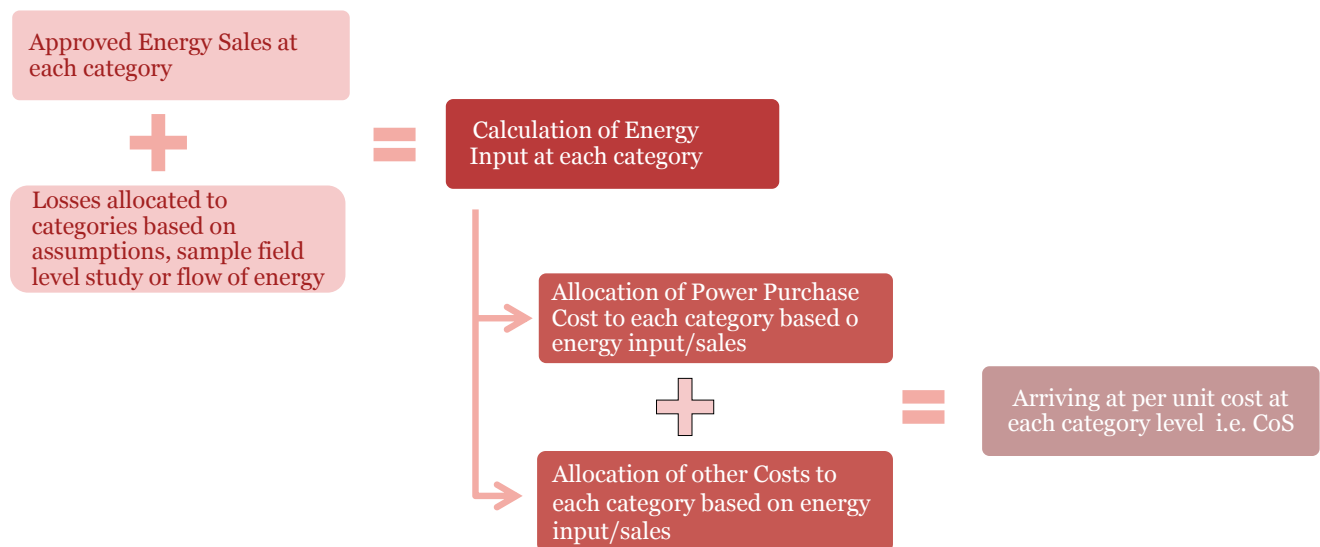
7. Consumer indexation

States which do not have detailed data as mentioned above can opt for a '**simplified approach**' in order to calculate voltage/category wise CoS.

6.3. Simplified approach

Taking into account the difficulties faced by the state commissions, the APTEL has suggested²⁴ that in absence of adequate data, it would be adequate to determine the voltage-wise cost of supply taking into account the major cost element which would be applicable to all the categories of consumers connected to the same voltage level. Different SERCs using different factors and assumptions carried out the exercise of calculating the cost of supply using this simplified approach. The figure below shows broadly the steps involved in calculation of category wise CoS using this approach.

Figure 22 Simplified approach for calculating category wise CoS



In this method the power purchase costs and other costs (such as network costs, wheeling costs etc.) are allocated to various consumer categories basis energy input or energy sales as decided by the Appropriate Commission. The table below summarises the difference between approaches followed by SERCs of Delhi, Bihar and Madhya Pradesh.

²⁴ Judgement in Appeal Nos. 102 of 2010 in the matter of Tata Steel Ltd. Vs. Orissa Electricity Regulatory Commission & Another, 2011

Table 54 Factors used for simplified approach in Delhi, Bihar and Madhya Pradesh

State/ Particulars	Energy Sales at each voltage level	Loss (Technical +Commercial)	Energy Input (EI) at each voltage level	Allocation of Power Purchase Cost (PPC) per unit	Other Costs Network Cost (NC)/ Wheeling Cost etc.	Per Unit CoS at each voltage level
Delhi	Approved gross sales in MU have been allocated to various voltage levels in the proportion of energy sales to these voltage levels by Discoms	Fixed by Commission voltage wise / As per Energy Audit report by DISCOMS	EI= Energy Sales+ Technical Loss+ Commercial Loss calculated in MU	Retail ARR includes both PPC and NC which has been proportioned based on the ratio of EI at each voltage level. Per unit cost is arrived based on sales at each voltage level	Wheeling ARR allocated to categories based on % of network cost at the given voltage level. Per unit wheeling cost calculated considering use of network by consumers upto to the voltage level under consideration.	CoS = Retail ARR (per unit)+ Wheeling Charge (per unit)
Bihar	Approved voltage wise sales by Commission	Voltage wise submitted by DISCOMS and approved by commission	EI= Energy Sales+ Technical Loss+ Commercial Loss calculated in MU	Cost of power per unit sale of Energy= (Energy Input * Unit Power Purchase Cost approved by commission)/ (Energy Sales)	Other costs excluding PPC are allocated based on voltage wise sales	CoS= PPC(per unit)+NC (per unit)
Madhya Pradesh	Approved sales figure for above 33 KV, 33 KV System and 11KV to 33KV System used	Total loss submitted at various voltage levels by DISCOMS	EI= Energy Sales+ Approved Technical loss+ Commercial loss	Allocated based on voltage wise energy input. 50% of commercial loss allocated on 11 KV and below. Remaining 50% allocated to all categories	Other costs excluding PPC are allocated basis voltage wise sales	CoS= {Total PPC+ Other Costs- Other income+Past Recovery}/ Energy Sales

6.3.1. Suggested simplified approach for calculation of category wise CoS

Table 55 Suggested Simplified approach for calculating category wise CoS

Energy Sales at each voltage level	Loss (Technical +Commercial)	Energy Input (EI) at each voltage level	Allocation of Retail Supply ARR/Power Purchase Cost (PPC) per unit	Other costs/ Network Cost (NC)/ Wheeling costs etc.	Per Unit CoS at each voltage level
Approved gross sales in MU is allocated to various voltage levels in the proportion of energy sales to these voltage levels by Discoms	Voltage wise loss is to be fixed by Commission taking into account Energy Audit report by DISCOMS	EI= Energy Sales+ Technical Loss+ Commercial Loss calculated in MU	Retail supply ARR/PPC apportioned based on the ratio of EI at each voltage level. Per unit cost is arrived based on sales at each voltage level	Wheeling ARR allocated to categories based on % of network cost at the given voltage level. Per unit wheeling cost calculated considering use of network by consumers upto the voltage level under consideration.	CoS = Retail ARR (per unit)+ Wheeling Charge (per unit)

6.3.2. Data requirement for simplified approach

Simplified approach requires the following data for calculation of voltage wise CoS –

1. Voltage wise energy sales
2. Voltage wise approved T&D losses
3. Total commercial losses
4. Power Purchase Cost
5. Network costs

This approach would therefore also require the utility to accurately estimate the voltage wise energy sales and commercial and technical losses. A clear understanding of the energy flow in the system would also improve the accuracy with which costs can be allocated to the different consumer categories. The SERCs need to gradually move towards setting tariffs based on voltage/category wise CoS instead of ACoS. This can be achieved through two methods discussed above – Embedded Cost approach or Simplified approach. Based on the data availability the states can choose the appropriate method as described in the matrix below –

Figure 23 Matrix for selecting appropriate CoS approach

Sales related data availability ↓	Costs related → data availability	
	Power Purchase Cost + Network cost	Generation, Transmission & Distribution
Voltage wise sales & losses	Simplified Approach (Bihar/MP/Delhi model)	
Voltage wise <ul style="list-style-type: none"> • sales & losses • load research data • Consumer indexation • connected load • no. of consumers 	-	Embedded Cost Approach (Punjab/AP/Assam model)

6.4. Need for undertaking detailed cost of supply studies

There is a need to move from ACoS to category-wise CoS to measure the cross subsidy coverage as mandated by the EA 2003. However only a few states in India calculate category wise or voltage wise cost of supply. Out of 29 states²⁵ in India only 11 states do this exercise.

As and when the retail supply market is thrown open to competition, the first segment to avail the benefits of competition would be large consumers with load 1 MW or above. If these consumers move away to other retail suppliers, the distribution network operator (which would continue supplying power to other consumer categories) would suffer a loss, because significant cross subsidies would get eroded. Therefore, in order to assess the true impact of cross subsidy erosion and to take remedial measures, the first step towards addressing the cross subsidy issue is to determine voltage wise and/or category wise cost of supply for all states.

Several issues need to be taken into account while allocating costs to different category of consumers which need to be studied in detail by SERCs:

- The data used for cost of supply calculations is based on annual reports of Discoms, data submitted by the Discoms or on the basis of assumptions made by the State Commissions. Detailed studies need to be carried out to verify these data.
- Measurement of voltage wise losses is done based on sample assessments or in some cases is not being done at all. It is important to have a proper record of voltage level wise technical and commercial losses.
- Most of the states like Delhi, Madhya Pradesh, Bihar and Himachal Pradesh calculate broad voltage based cost of supply. Due to un-availability of clear mapping of consumers of various categories at each voltage level, it becomes difficult to calculate consumer categories wise cost of supply.
- The electricity supply in most of the cases is restricted by the supply constraints rather than the demand. Peak demands are not naturally occurring due to various measures like load shedding and supply for limited time shifts. Therefore use of peak demand to allocate costs between consumer categories may give a distorted picture due to regulatory measures.
- Since generation cost forms a major part of cost of supply, for energy deficit states, the marginal cost of power purchase plays an important part for calculating category wise cost of supply. Faster growing consumer categories put higher requirement to purchase expensive power through spot or bilateral agreements. This difference between power purchase costs for various consumer categories cannot be observed in average cost of supply. Also the method of allocating power purchase cost to consumer categories based on their consumption or peak demands is not accurate as categories like agriculture which get regulated power supply end up being penalized due to higher purchase price of power used for servicing urban areas during peak hours.
- Methodology for suitably adjusting the cost of supply to reflect variations in quality of supply need to be devised so as to not burden on consumers who get poor cost of supply.
- States like Bihar and Madhya Pradesh, which have multiple Discoms, calculate voltage wise cost of supply for the entire state. Since the cost of supply in one region can differ from other, assuming a same CoS for the entire state can mask inter regional cross subsidy, existing between the consumers of different Discoms.

²⁵ including Delhi and excluding Telangana

7. Reduction of cross subsidies

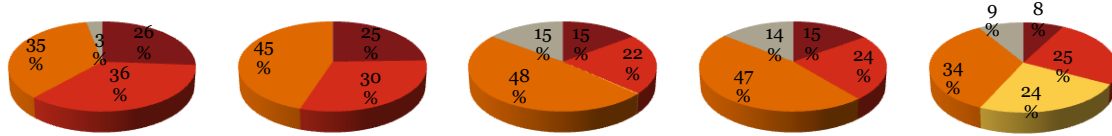
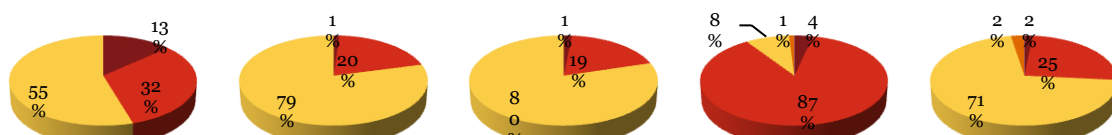
In the previous sections we have seen that high level of cross subsidies exist in most of the Indian States. Also we discussed that in order to accurately measure these cross subsidies, utilities need to move from Average Cost of Supply (ACoS) to Category wise/voltage wise Cost of supply, using either Embedded Cost Approach or Simplified approach, depending upon the data availability. In this section we discuss various strategies that can be employed to reduce these cross subsidies in order to make retail tariffs cost reflective.

7.1. International experiences of electricity sector reforms and cross subsidy reduction

In this section we evaluate methodologies adopted in various countries around the world to reduce cross subsidies as a part of their electricity sector reforms and find out relevant learnings for Indian power sector. Energy sector reforms in four countries i.e. Philippines, Australia, Thailand and Brazil are studied in detail in this section. The international case study gives us some important insights which can be applied to Indian scenario. The table below gives the timelines for energy sector reforms and prevailing conditions in each of the countries at important junctures. The following sections discuss the major energy reforms in these four countries along with provisions for cross subsidy.

Table 56 Review of international experiences

	Philippines	Australia	Thailand	Brazil
Timeline of energy reforms				
Time Period	1 st Phase: 1987 – 2000 2 nd Phase: 2001 onwards	1 st Phase: 1991 – 2010 2 nd Phase: 2011 onwards	1992 onwards	1 st Phase: 1995 – 2003 2 nd Phase: 2004 onwards
Major Reforms	1 st Phase: Private sector participation 2 nd Phase: Elimination of cross subsidy, unbundling of utilities and setting up of regulatory commission	1 st Phase: unbundling of utilities, setting up of wholesale retail market and estb. of regulator 2 nd Phase: package of clean energy proposals	Allowing private sector participation. Setting up of Power Development Fund to support rural electrification and protect rural consumers	1 st Phase: privatization of state utilities, wholesale power market and open access 2 nd Phase: better regulatory environment, balance between thermal and hydro power

	Philippines	Australia	Thailand	Brazil	India
Pre-Reforms					
Distribution losses²⁶	13%	15%	6%	17%	33% ²⁷
Per capita electricity consumption²⁸	525 kWh	10,036 kWh	1,715 kWh	1,956 kWh	592 kWh ²⁹
Access to electricity	89.1% ³⁰	100% ³¹	97% ³²	87.8% ³³	55.8% ³⁴
Consumer mix³⁵	 <p>■ Commercial ■ Residential ■ Agricultural ■ Industrial ■ Others</p>				
Generation by fuel type³⁶	 <p>■ Renewable ■ Hydro ■ Fossil ■ Nuclear</p>				
Fuel Shortage³⁷	Imports: Oil – 14% Coal – 34%	Imports: Oil – 4% Coal – 0%	Imports: Oil – 35% Coal – 4%	Imports: Oil – 16% Coal – 72%	Imports: Oil – 74% Coal – 6%

²⁶ U.S. Energy Information Administration (EIA)

²⁷ CEA annual report 2004-05

²⁸ Worldbank

²⁹ CEA highlights of power sector

³⁰ Economic Report, October 2006, Senate Economic Planning Office Philippines

³¹ Electric Power and Asia and Pacific 1999 and 2000, united nations

³² Institutional Reforms and Electricity Access, by Ram M. Shrestha (% of households)

³³ IBGE social indicators

³⁴ Census of India, Source of lighting 2001

³⁵ Annexure 8.5

³⁶ U.S. Energy Information Administration (EIA)

³⁷ U.S. Energy Information Administration (EIA)

	Philippines	Australia	Thailand	Brazil	India																																				
Recent information																																									
Distribution losses³⁸	12%	6%	1%	17%	25% ³⁹																																				
Per capita electricity consumption⁴⁰	647 kWh	10,712 kWh	2,316 kWh	2,438 kWh	918 kWh ⁴¹																																				
Access to electricity⁴²	99.5%	100%	99% ⁴³	94.8% ⁴⁴	67.2% ⁴⁵																																				
Consumer mix⁴⁶	<table border="1"> <caption>Consumer Mix Data</caption> <thead> <tr> <th>Country</th> <th>Commercial</th> <th>Residential</th> <th>Agricultural</th> <th>Industrial</th> <th>Others</th> </tr> </thead> <tbody> <tr> <td>Philippines</td> <td>30%</td> <td>33%</td> <td>3%</td> <td>34%</td> <td>0%</td> </tr> <tr> <td>Australia</td> <td>34%</td> <td>33%</td> <td>0%</td> <td>33%</td> <td>0%</td> </tr> <tr> <td>Thailand</td> <td>19%</td> <td>23%</td> <td>0%</td> <td>44%</td> <td>14%</td> </tr> <tr> <td>Brazil</td> <td>18%</td> <td>27%</td> <td>0%</td> <td>40%</td> <td>15%</td> </tr> <tr> <td>India</td> <td>22%</td> <td>18%</td> <td>0%</td> <td>45%</td> <td>15%</td> </tr> </tbody> </table>					Country	Commercial	Residential	Agricultural	Industrial	Others	Philippines	30%	33%	3%	34%	0%	Australia	34%	33%	0%	33%	0%	Thailand	19%	23%	0%	44%	14%	Brazil	18%	27%	0%	40%	15%	India	22%	18%	0%	45%	15%
Country	Commercial	Residential	Agricultural	Industrial	Others																																				
Philippines	30%	33%	3%	34%	0%																																				
Australia	34%	33%	0%	33%	0%																																				
Thailand	19%	23%	0%	44%	14%																																				
Brazil	18%	27%	0%	40%	15%																																				
India	22%	18%	0%	45%	15%																																				
Generation by fuel type⁴⁷	<table border="1"> <caption>Generation by Fuel Type Data</caption> <thead> <tr> <th>Country</th> <th>Renewable</th> <th>Hydro</th> <th>Fossil</th> <th>Nuclear</th> </tr> </thead> <tbody> <tr> <td>Philippines</td> <td>12%</td> <td>22%</td> <td>66%</td> <td>0%</td> </tr> <tr> <td>Australia</td> <td>7%</td> <td>13%</td> <td>80%</td> <td>0%</td> </tr> <tr> <td>Thailand</td> <td>2%</td> <td>7%</td> <td>91%</td> <td>0%</td> </tr> <tr> <td>Brazil</td> <td>2%</td> <td>10%</td> <td>19%</td> <td>69%</td> </tr> <tr> <td>India</td> <td>2%</td> <td>12%</td> <td>68%</td> <td>18%</td> </tr> </tbody> </table>					Country	Renewable	Hydro	Fossil	Nuclear	Philippines	12%	22%	66%	0%	Australia	7%	13%	80%	0%	Thailand	2%	7%	91%	0%	Brazil	2%	10%	19%	69%	India	2%	12%	68%	18%						
Country	Renewable	Hydro	Fossil	Nuclear																																					
Philippines	12%	22%	66%	0%																																					
Australia	7%	13%	80%	0%																																					
Thailand	2%	7%	91%	0%																																					
Brazil	2%	10%	19%	69%																																					
India	2%	12%	68%	18%																																					
Fuel Shortage⁴⁸	Imports: Oil – 75% Coal – 48%	Imports: Oil – 36% Coal – 0%	Imports: Oil – 5% Coal – 48%	Imports: Oil – 17% Coal – 73%	Imports: Oil – 83% Coal – 13%																																				

³⁸ U.S. Energy Information Administration (EIA)

³⁹ MOSPI, energy statistics 2013

⁴⁰ Worldbank

⁴¹ CEA power sector executive summary, October 2014

⁴² World Energy Outlook, 2014

⁴³ Rural Electrification in Thailand, Reungvith Vechasart 2014

⁴⁴ IBGE social indicators

⁴⁵ Census of India, Source of lighting 2011

⁴⁶ Annexure 8.5

⁴⁷ U.S. Energy Information Administration (EIA)

⁴⁸ U.S. Energy Information Administration (EIA)

7.1.1. Philippines

Philippines is an island country consisting of several islands that are categorized under three main divisions: Luzon, Visayas and Mindanao. The Philippine power system consists of three major island grids, aligned to these geographical divisions. The Luzon grid is the largest, accounting for 72% of total generation.

The National Power Corporation (NPC) was established in 1936 to construct, operate and maintain facilities for the production of electricity. Before the energy reforms National Power Corporation (NPC) was the sole producer and distributor of electricity in Philippines. However by 1986, NPC had accumulated high level of debts and due to low efficiency the distribution losses were as high as 21%.

First Phase of Reforms (1987 – 2000)

In order to deal with growing financial debts of NPC, the energy sector reforms in Philippines began in 1987 with passing of Executive Order 215, permitting private sector participation in power generation. Between 1987 and 1993, USD 6 billion were infused to build IPPs. NPC entered into ‘take-or-pay’ guarantees with these IPPs to protect investor confidence. However NPC continued to wallow in debt and these ‘take-or pay’ guarantees formed a burden of USD 10.42 billion by 2001.

Second Phase of Reforms (2001 onwards)

The second phase of energy reforms began in 2001 with the passing of Electric Power Industry Reform Act (EPIRA). The main thrust areas of EPIRA were -

1. The deregulation of the generation sector;
2. Creation of a new government-owned transmission company (National Transmission Company) and the eventual privatization of the operation of the transmission system;
3. Unbundling of supply activities (unregulated) from the regulated distribution sector;
4. Elimination of cross subsidies within and among various grids, and among various classes of consumers;
5. Creation of an independent regulatory body (Energy Regulatory Commission) and a Joint Congressional Power Commission to oversee implementation of the law.
6. Privatization and sale of NPC assets and contracts with Independent Power Producers (IPPs) through Power Sector Assets and Liabilities Management Corporation (PSALM). This would give government the cash flows needed to pay off NPC’s debts.
7. Creation of a wholesale electricity spot market (WESM) for the trading of energy, by which competitive market forces would establish generation tariffs and make costs more transparent; and
8. Implementation of retail competition and open access (RCOS).

Elimination of Cross Subsidies

Before the beginning of the Second Phase of reforms there were 3 kinds of cross subsidies in Philippines:

- Inter-Grid i.e. amount charged to consumers located in a viable regional grid in order to reduce the electricity rates in a less viable regional grid
- Intra-Grid i.e. amount charged to distribution utilities and non-utilities with higher load factor and/or delivery voltage in order to reduce the electricity rates charged to distribution utilities with lower load factor and/or delivery voltage located in the same regional grid

- Inter-Class i.e. price cross subsidies between various consumer categories of a utility. The major consumer categories were Industrial, Non-Industrial, Residential and Lifeline Users.

Section 74 of EPIRA mandated that all types of cross subsidies should be phased out within 3 years of establishing a Universal Charge (UC).

The **Universal Charge** is a non-by passable charge collected through PSALM, from all end-users (except lifeline consumers) based on the approval of the ERC. EPIRA allowed for the collection of UC for the following purposes:

- Missionary electrification
- Payment for stranded debts and stranded contract costs
- An environmental charge for watershed rehabilitation and management
- Equalization of taxes and royalties applied to indigenous or renewable sources of energy vis-à-vis imported energy fuels
- To account for all forms of cross-subsidies

The existing cross subsidies were removed by firstly unbundling the tariff rates and systematically reducing the cross subsidy in phases.

Unbundling of NPC rates was achieved in March 2002 and unbundling of distribution utility rates was achieved in June 2003. Pending the complete removal of cross subsidies, each cross subsidy rate level was shown as a separate item in customer billing statements. Figure 24 is an example of such an itemised bill for a residential consumer which along with unbundled rates for generation, transmission and distribution shows separate amounts for interclass subsidy and lifeline subsidy.

The inter-regional grid cross subsidy was Fully phased-out by the ERC unbundling decision of NPC on 26 June 2002 (Po.07/kWh). Intra-regional grid cross subsidy was removed in three phases in October 2003, October 2004 and October 2005.

Figure 24 Philippines sample of itemized bill

ELECTRIC BILL		Page: 1 of 1
e Address AMETHYST ST ORTIGAS COMMERCIAL CENTER SAN ANTONIO PASIG CITY METRO M		
d	Due Date 21 JAN 2004	Current Amount Due P 4,956.95
RATE: Residential		
Generation Charge	710 X 3.4029	2,416.06
Transmission Charge	710 X 0.9605	681.96
System Loss Charge	710 X 0.5493	390.00
Distribution Charge	710 X 1.7168	1,218.93
Supply Charge	710 X 0.5897	418.69
METERING CHARGE		
Retail Customer Charge	5 X 1 mo	5.00
Metering System Charge	710 X 0.2497	177.29
Lifeline Rate Subsidy	710 X 0.0761	54.03
Interclass Subsidy	710 X -0.6438	-457.10
PowerAct Redn	710 X -0.3000	-213.00
CERA	1218.93 X 11.02%	134.53
FRANCHISE TAX		
National	4826.19 X 2%	96.52
ENERGY TAX		
First	60 X 0.10	6.00
UNIVERSAL CHARGES		
Missionary	710 X 0.0373	26.48
Environmental Fund	710 X 0.0025	1.78

Table 57 Philippines - Intra regional grid cross subsidies removal

Customer Classification	Original Subsidy (P/KWh)	Revised Subsidy (P/KWh)	Oct 2005 (P/KWh)
Small utilities	0.5009	0.3339	0
Other utilities	0.5009	0.3339	0
Non utilities	0.5009	0.3339	0
MERALCO	0.5033	0.3355	0
Steel Industries	0.3629	0.2419	0
Government Agencies	0.3627	0.24	0

Source: Department of Energy, report on 'The Philippine power sector: the three years of reform', Oct 2004

ERC implemented the plan to remove the inter class cross subsidies on residential, commercial and industrial electricity customers in the year 2004. The removal took effect through realignment of tariffs in two phases:

- 40% of the subsidies were removed in Oct 2004
- 60% of the remaining subsidies were removed in Oct 2005

Table 58 Philippines - Status of Inter-Class Cross Subsidies before reduction in Oct 2004

Consumer Category	Cross Subsidy (p/kWh)
Industrial Extra Large	0.6306
Industrial Very Large	0.5139
Industrial Large	0.2738
Industrial Medium	0.0892
Commercial Very Large	0.7822
Commercial Large	0.6958
Commercial Medium	0.5780
Commercial Small	0.3165
Residential	(0.7130)

Source: Department of Energy, report on 'The Philippine power sector: the three years of reform', Oct 2004

In order to reduce the impact of removal of cross subsidies, Section 73 of EPIRA provides for a subsidized lifeline rate to apply to marginalized end-users. The lifeline rate provides a lower electricity rate for grid connected end-use customers with a low electricity consumption. This lifeline subsidy was exempt from the cross subsidy phase out for a period of 10 years. For example, Meralco customers consuming less than 50 kwh, 51-70 kwh and 71-100 kwh got 50 percent, 35 percent and 20-percent discounts (on generation, transmission, distribution, supply, metering and systems loss) respectively.

ERC allowed MERALCO to collect a per kWh charge in order to compensate the under-recoveries due to elimination of cross subsidies.

MERALCO implemented the inter-class cross subsidy removal for the period June 2003 to October 2006 and lifeline subsidized rates from June 2003 to December 2007. In 2007, MERALCO filed an application with ERC stating that the tariff decided by commission which was implemented in two phases to eliminate inter class cross subsidy was resulting in under-recoveries. The under recoveries were estimated at 1.05 Billion PhP due to interclass subsidy and 0.86 Billion PhP due to lifeline subsidy rates⁴⁹.

To recover this inter-class cross subsidy under-recoveries and lifeline subsidy rates under-recoveries, the ERC allowed MERALCO to levy a separate of PhP 0.0103/kWh and PhP 0.0068/kWh charge on all consumers until such time that the under recoveries shall be fully recovered.

7.1.2. Australia

Australia consists of six states (New South Wales, Queensland, Victoria, South Australia, Western Australia and Northern Australia), Australian Capital Region and the island Tasmania. Economic activity is focused on Australia's eastern seaboard in the states of New South Wales, Queensland and Victoria where most of the population lives.

⁴⁹ ERC case no 2007-157 RC

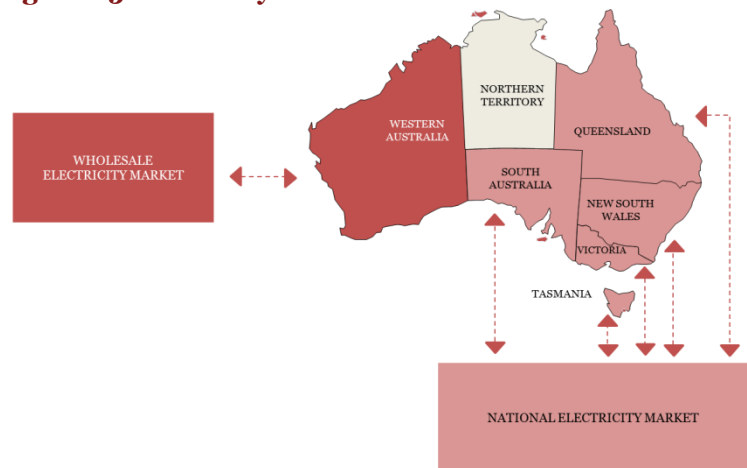
Electricity Sector Reforms

Reforms of the electricity sector began in 1991 with the disaggregation of state owned utilities into separate generation, transmission, distribution and retail supply entities. The later reforms measures, upto 2010 broadly consisted of:

- Privatization of electricity businesses in some States
- Formalization of electricity industry regulation
- Introduction of retail competition

Post reforms, across the states and territories, the ownership profile of generation assets varies: in Victoria and South Australia, generating capacity assets tend to be privately owned while in New South Wales and Queensland the state owns a majority of capacity. Private generation in the Western Australia accounts for over half of total electricity generating capacity within the state. Eastern and Southern Australia have an integrated wholesale electricity market – National Electricity Market (NEM). Western Australia has a stand-alone market arrangement known as the Wholesale Electricity Market (WEM).

Figure 25 Electricity market structure in Australia



Electricity Tariff Equalization Fund (ETEF) in New South Wales

New South Wales (NSW) introduced full retail competition in 2002. There are currently three state owned retailers and at least seven other privately owned retailers in NSW. In the initial years the retail market was segmented into two tiers for pricing purposes:

- Consumers of less than 160 MWh per annum were ‘small retail customers’. They were eligible for a regulated tariff to be provided by state owned retailers who were also the Retailers of the Last Resort.
- Consumers of over 160 MWh per annum were large retail customers who negotiate contracts with any retailer.

NSW used a transitional mechanism, Electricity Tariff Equalization Fund (ETEF), to provide protection to state distributors who were obliged to serve consumers with regulated tariffs however faced a wholesale power generation market that was entirely competitive. ETEF commenced operation on 1 January 2001.

The ETEF mechanism was designed so that distributors supplying customers at regulated rates contributed to the fund when spot market prices fell below the regulated price and were compensated by the fund when spot market prices rose above it. In case the fund lacked sufficient reserves to compensate distributors, additions were made to the ETEF by publicly owned generators. Each generator’s mandatory contribution to the fund was proportional to its benefit from high spot market prices. ETEF was an entity of the NSW treasury and the ETEF support was available only to state retailers.

- **Western Power:** responsible for operating, maintaining and expanding the electrical transmission and distribution network in the SWIS.

Uniform tariff policy applies to all residential and small business electricity customers supplied by Synergy (South West Interconnected System consumers) and Horizon Power (Regional consumers). The electricity tariffs for consumers of Horizon Power, in regional Western Australia, are at a level similar to the tariffs applicable in the SWIS. However, the cost of providing power in these remote systems is considerably higher than the revenue that can be collected from consumers paying the uniform tariff.

Uniform tariffs are maintained across Western Australia by inter-utility transfers via the Tariff Equalisation Fund. The tariff equalisation fund provides financial support to Horizon Power to cover the difference between:

- the efficient cost of supply of electricity to consumers in areas outside of the SWIS; and
- the revenue available to Horizon Power from supplying electricity to persons in areas outside of the SWIS at the uniform retail tariff.

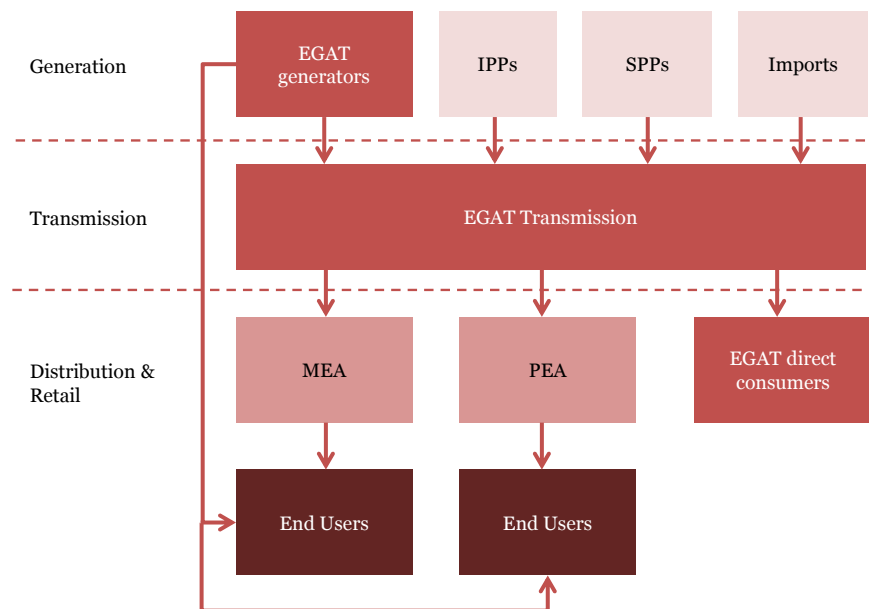
The TEF is funded through Tariff Equalisation Contribution (TEC) payments made by Western Power to Horizon Power. The cost of these payments is funded by an additional charge collected by Western Power as part of the distribution network tariffs in the South West Interconnected System (i.e., tariffs in the SWIS are set at economic cost plus the TEC).

Therefore, the customers connected to the distribution system in the South West Interconnected System cross-subsidise customers outside of the South West Interconnected System customers to ensure Uniform Retail Tariff across Western Australia.

7.1.3. Thailand

Thailand is one of the fastest growing electricity markets in ASEAN region. In Thailand electricity is supplied by three main bodies (i) Metropolitan Electricity Authority (MEA) which supplies electricity to majorly Bangkok and surrounding areas (ii) Provincial Electricity Authority (PEA) which supplies electricity to rest of the areas and (iii) Electricity Generating Authority of Thailand (EGAT) Directly to some consumers. Electricity Generating Authority of Thailand (EGAT) was established in 1968 as the main generator of electricity which supplies electricity to PEA and MEA.

Figure 26 Thailand - power industry structure



Energy reforms

In 1992 the government amended the Electricity Generating Authority of Thailand Act, allowing private power producers to produce and sell electricity into the power grid. The government arranged Power Purchasing

Agreements with these IPPs and compensated the IPPs for the effects of baht devaluation with the primary motivation of maintaining investor's confidence. This created excess production capacities.

In 2003, plan was prepared to privatize the EGAT so as to get sufficient investment capital for expansion of power production capacity and electricity system. Civil society groups then started a movement against EGAT privatization, and against the increased burden of electricity tariff. Following legal battle, the Supreme Administrative Court cancelled the royal decree and EGAT again became state owned in 2006⁵¹. EGAT therefore to this date remains the largest producer of electricity in Thailand.

Cross Subsidy Provision

In order to protect poor consumers two types of cross subsidies still exist in Thailand:

- EGAT sells power at lower price to PEA than to MEA. This acts as a direct subsidy from the rich capital and industrial area to the rural areas. EGAT charged PEA 30% lower than it charged MEA.
- The tariff structure is based on cross subsidies between customer categories. People with less than 150 Kwh usage per month enjoy a minimal tariff (almost free). Customers with usage between 150 Kwh to 400 Kwh per month have to pay a tariff considerably lower than that for usage above 400 Kwh. However, electricity tariff for each customer category is kept same all over the country.

Thailand provides free electricity to poor consumers. A temporary electricity tariff reduction for the poor was in place since 2008 which became permanent in July 2011, when the energy regulatory commission (ERC) decided to provide free electricity to residential consumers using less than 90 kilowatt hours (kWh) per month (Pusayanawin, 2012a). In 2011, 8.8 million electricity users benefited from the scheme. Eligibility for the scheme was reduced in 2012 to those consuming less than 50 kWh per month (Ruangrong, 2012).

Power development fund

The Power Development Fund was set up under the Office of the Energy Regulatory Commission (OERC) pursuant to the Energy Industry Act, B.E. 2550 (2007), with the following objectives:

- to be used as a capital to enhance extensive electrification to various localities
- to decentralize development to provincial areas
- to develop or rehabilitate localities affected by power plant operation
- to promote the use of renewable energy and technologies for electricity industry operation that have minimal impact on the environment, with due consideration on the balance of natural resources
- to create fairness for power consumers

The sources of fund comprise the following:

1. Contributions from electricity industry licensees in accordance with the announcements issued by the ERC under the policy framework
2. Fines collected from electricity industry licensees who violate or fail to comply with the ERC orders
3. Donated money or assets
4. Interest or any benefit incurred from the money or assets of the Fund

7.1.4. Brazil

Brazil is the largest country in Latin America and one of the fastest growing economies in the world. The Brazilian government created Eletrosul, Furnas, Chesf, and Eletronorte to generate and transmit electricity for,

⁵¹ Research pare on Regulatory framework of Thai Electricity Sector, University of New South Wales, November 2010

respectively, the southern, south-eastern / mid-western, north-eastern and northern regions of the country, putting all of these entities under the control of a holding company called Eletrobras. By 1995, 90% of the demand was being supplied by state owned distribution companies. Financial crises in the 1990s forced Brazilian Government to implement several energy reforms. The objective of these reforms was to create a competitive power sector with increased private participation.

First phase of Energy Reforms (1995-2003)

During the first phase many state owned companies were privatized. Generation, transmission and distribution businesses were unbundled. Network business was regulated. A wholesale power market was established. Also open access to grid was allowed wherein large consumers above 10 MW and later in 2000 above 3 MW were allowed to contract independently with generators. ANEEL (Brazil's National Electricity Regulatory Agency), a quasi-independent regulatory body in charge of overseeing the electricity sector was formed in 1996.

National Interconnected System (SIN) was formed which interconnects 4 other sub-systems in the country. Private players were allowed in distribution sector. To encourage private sector participation the mandate of uniform national tariff was removed in 1993 allowing distribution companies to set their own tariffs.

In order to promote private participation in the power sector, in 2001 a Comitê de Revitalização⁵² i.e. a committee to give suggestion to revitalize the electricity sector, was setup. Several Relatório de Proogresso were issued by this committee out of which Relatório de Proogresso No. 2 expressed tariff realignment and cross subsidy as main concerns. These are discussed in detail in the section of cross subsidy provisions below.

Second phase of Energy Reforms (2004 onwards)

The second round of reforms in Brazil started since 2004 with following objectives:

- To build a stable regulatory environment in Brazil's electricity sector.
- To ensure adequate supply through reduction of risk perception while allowing a fair return on investment.
- To ensure reasonable tariff.
- To strengthen contractual obligations between various parties.
- To reintroduce planning to cope with demand growth.

In order to fulfil these objectives following measures were taken:

- Regulated Contracting Environment (ACR) was introduced according to which distribution companies are required to ensure long term contract for 100% of demand forecast for five years for their captive consumers.
- Thermal and hydro power mix contracting by distribution utilities was initiated to balance reliable supply and cost.
- New institutions were created and roles for existing institutions were modified to ensure regulation and security of supply.
- Free Contracting Environment (ACL) was introduced so that large consumers were free to contract directly with generators.
- Energy Research Enterprise is involved in setting up an auction market for the generators based on demand forecast of distribution companies for their captive consumers, wherein the distribution companies buy at average bid price from the pool. In case of shortage, distribution companies buy electricity from short term market.

⁵² 'Cross-Subsidies: The economic impact of the "tariff realignment" in Brazil' by Michael B. Rosenzweig, Sarah Potts Voll and Carlos Pabon-Agudelo

Criterion to award concessions for hydro generation was altered in 2003 to the bidder offering the lowest price for its output to customers in the regulated market.

Cross subsidy provisions

The 1973 'Conta de Consumo de Combustíveis' policy introduced cross subsidies to equalize national electricity prices. Profitable power utilities were regulated to share their profits with the unprofitable ones. The tariff was made uniform at the national level. Tariff equalization was aimed at incentivizing industrial development in less developed states. In order to remove constraints for privatization and encourage investments, in 1993 the distribution companies were authorized to set their own tariffs.

However the Industrial consumers continued to enjoy regulated tariffs. Unlike in India where industrial consumers are subsidizing consumers in order to cross subsidize the domestic or agricultural consumers, in Brazil the large industrial consumers were the subsidized consumers. This reduced their incentive to shift on open access.

In June 2001, Comitê de Revitalização was established to recommend proposals for improvement of electricity sector. Three Relatório de Progreso (report of progress) were issued. The Relatório de Progreso No. 2 expressed two concerns regarding the distribution tariffs –

- i) The need for unbundling of tariffs, without which it was difficult to encourage development of competitive retail market.
- ii) The tariffs did not reflect the costs of supply, which gives uneconomic signals to market participants. The reason behind Brazilian electric market not producing accurate and transparent price signals were as follows:
 1. The Brazilian generation system is heavily relied on hydro power, where the marginal cost of production is zero.
 2. Numerous *encargos* or regulatory charges were introduced over time in order to support activities like rural electrification and establish special rates for low-income households.

The Relatório de Progreso No. 2 proposed the following steps to eliminate cross subsidies –

- i) To undertake studies to determine amount of cross subsidies and their impact on distribution tariffs
- ii) To eliminate these cross subsidies in next 5 years, subject to a schedule set by ANEEL.
- iii) Unbundling of tariffs so that the potential customers of open access can understand and compare the costs of being captive versus the costs of being free.

However the Relatório de Progreso No. 3 expressed concern over elimination of cross subsidies citing that the competitiveness of industries will be affected if special measures were not taken to reduce tariff shock. It justified the establishment of a price mechanism with implicit cross subsidy to industrial consumers. Therefore the two papers (Relatório de Progreso No. 2 and No.3) of Comitê de Revitalização were not consistent.

In the year 2004, Law number 10.848 was passed which allowed distributors to freely buy energy to be resold with a price limit set by ANEEL. Some of the main characteristics of the regulation:

- Universal access to services
- Fair remuneration of the investments, defined in the concession agreements, authorization or permissions
- Public bidding to expand generation / transmission
- Bilateral energy contracting
- Centralized accountability and liquidation of contracts
- Permanent monitoring of the attending
- Systematic operation of the transmission network and centralized request to generate
- Regulated mechanisms to evaluate and inspect

Regulatory Charges

1. **EER:** The Encargo de Energia de Reserva (“EER”) is a regulatory charge designed to raise funds for energy reserves which will be used to increase the safety of the energy supply in the Interconnected Power System.
2. **RGR Fund:** The purpose of RGR fund was to reassure investors that they would not have any stranded assets at the time their concession expired. However between 1994 and 1998, proceeds from this fund were also used for several energy efficiency projects.
3. **CDE Account:** In order to reduce dependence on hydro power generation, thermal generation was promoted through subsidies by this CDE fund.
4. **UBP Fund:** IPPs are required to make contributions to UBP Fund (Uso de Bem Público) for using a public asset, according to the rules of the corresponding public bidding process for the granting of concessions.
5. **CCC Account:** The CCC Account was created in 1973 as a subsidy to enable fuel to reach generators in electrically isolated parts of the country. In the past this fund was used to promote thermal generation.

7.2. Strategies for reducing cross subsidies

Due to high level of existing cross subsidies in most of the Indian states, significant tariff hikes would be required for reducing cross subsidies across consumer categories. In order to facilitate the cross subsidy reductions, we have suggested two approaches. The first approach, of the Universal Charge (UC) Model, aims at bringing about transparency in calculation of cross subsidies and reducing the same.

The second approach acknowledges the imminent separation of ‘content and carriage’ businesses and introduction of retail supply competition. This approach discusses how residual cross subsidies can be taken care of in the changed market structure.

7.2.1. Universal Charge for cross subsidies

A Universal Charge (UC) model is suggested for bringing about transparency and facilitating the cross subsidies reductions as per trajectories determined by the states. The UC, similar to the one levied in Philippines, would be an identical charge imposed on per-unit basis on sales to all consumers of incumbent distribution companies. Collection of UC would go towards a state-wide/national fund to reduce the extent of cross subsidy in retail supply and any revenue gap created in doing so.

The UC fund is proposed to cover any revenue gap created due to tariff realignments as per cross subsidies reduction trajectory. The duration of levy of this UC would be subject to the time period till the cross subsidies are eliminated with 100% cost coverage for all consumer categories, and may be continued for as long as deemed to be required by the appropriate regulatory commission.

An illustration using cost of supply data from Punjab shows a simplified working model presenting the proposed mode of levying Universal Charge (UC) and its subsequent utilization towards reducing cross subsidies. The following assumptions are taken for the purpose of this illustration –

- Figures for category wise sales and CoS are taken from report by TERI on ‘Voltage wise-Category wise Cost of Supply’ in Punjab with base year of FY2012-13
- The current category wise sales figures are projected based on last 10 year CAGR
- Category wise CoS is projected based on a 5% y-o-y increase
- The assumed losses are maintained at current level throughout the time period of this model. Any improvement in efficiency may lead to a scenario where the increase in CoS is lower than expected, leading to lower tariff hikes.

- The illustration looks at a five-year time period. Cross subsidies (in this illustration) are entirely removed within this time period. SERCs may be extended this model to further years and/or modify the model accordingly once a timeframe is decided for elimination of cross-subsidies.

There are three stages in the proposed UC model –

STAGE 1 – *Tariff hikes required to maintain the current cost coverage*

Category wise tariffs are increased by the same percentage as the increase in their respective Cost of Supply. For instance if the CoS of a category XYZ increase by 5%, then the tariff for that category is also increased by 5%. This stage will only ensure that the current cost coverage is maintained for all consumer categories.

STAGE 2 – *Tariff hikes required to reach the targeted cost coverage*

Category wise cost coverages for subsidising/subsidised categories are decreased/increased respectively in a uniform fashion so as to reach 100% cost coverage by the end of next 5 years. These targeted category wise cost coverage values are multiplied with their respective CoS to get the required tariff from each consumer category. This stage therefore gives us the tariff hikes required for achieving 100% cost coverage in 5 years period. The table below shows the targeted category wise cost coverage trajectory for the state of Punjab.

Table 59 Targeted category wise cost coverage trajectory for UC model illustration of Punjab

Consumer Categories	BASE YEAR	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Industrial - 66 kV	116%	113%	110%	107%	103%	100%
Industry LS	109%	107%	106%	104%	102%	100%
Domestic – 11 kV	119%	115%	111%	107%	104%	100%
Commercial - 11 kV	118%	115%	111%	107%	104%	100%
Bulk	113%	111%	108%	105%	103%	100%
Industry MS	91%	93%	95%	96%	98%	100%
Industry SP	78%	82%	87%	91%	96%	100%
Domestic (0-100)	74%	79%	84%	90%	95%	100%
Domestic (101-300)	99%	100%	100%	100%	100%	100%
Domestic (above 300)	105%	104%	103%	102%	101%	100%
Agriculture	78%	83%	87%	91%	96%	100%
Commercial	102%	101%	101%	101%	100%	100%
Public Lighting	107%	106%	104%	103%	101%	100%

Source: PwC analysis

STAGE 3 – *UC Charge calculation to meet the revenue gap generated*

Due to imbalance between tariff and cost of supply in current scenario, gap exists between the revenue generated (category wise tariff multiplied by energy sales) and revenue required (category wise CoS multiplied by energy sales). The Universal Charge is collected from all consumer categories in order to compensate for this revenue gap. As the tariffs are increased/decreased year on year as per the calculation in Stage 2, this revenue gap decreases and so does the amount of Universal Charge.

The tables below present the illustration for a UC Fund based reduction in cross subsidy over a period of five years.

	BASE YEAR			YEAR 1		STAGE 1		STAGE 2		STAGE 3					
						Tariff after CS Neutral Hike		Increase due to targeted CoS coverage		Increase due to cost/revenue mismatch					
Consumer Categories	CoS	Tariff	CoS coverage	Sales	CoS	Tariff	CoS coverage	Tariff	CoS coverage	Revenue from stage 2 tariff (A)	ARR (B)	Gap to be filled by UC (A - B)	Tariff + UC	Revenue generated from UC	Additional fund required from govt.
Industrial - 66 kV	4.82	5.61	116%	2,426	5.06	5.89	116%	5.72	113%	1,389	1,228	(161)	6.22	121	-
Industry LS	5.13	5.61	109%	5,100	5.39	5.89	109%	5.79	107%	2,953	2,747	(206)	6.29	255	-
Domestic – 11 kV	4.90	5.81	119%	80	5.15	6.10	119%	5.91	115%	47	41	(6)	6.41	4	-
Commercial - 11 kV	5.09	6.03	118%	622	5.34	6.33	118%	6.13	115%	381	332	(49)	6.63	31	-
Bulk	4.94	5.59	113%	293	5.19	5.87	113%	5.73	111%	168	152	(16)	6.23	15	-
Industry MS	6.17	5.61	91%	1,861	6.48	5.89	91%	6.01	93%	1,118	1,206	88	6.51	93	93
Industry SP	6.57	5.10	78%	904	6.90	5.36	78%	5.66	82%	512	623	112	6.16	45	45
Domestic (0-100)	5.52	4.09	74%	5,440	5.80	4.29	74%	4.59	79%	2,499	3,153	653	5.09	272	272
Domestic (101-300)	5.52	5.49	99%	3,193	5.80	5.76	99%	5.77	100%	1,843	1,851	8	6.27	160	160
Domestic (above 300)	5.52	5.81	105%	1,550	5.80	6.10	105%	6.04	104%	936	898	(38)	6.54	77	-
Agriculture	5.33	4.18	78%	11,772	5.60	4.39	78%	4.63	83%	5,451	6,588	1,137	5.13	589	589
Commercial	5.92	6.03	102%	2,469	6.22	6.33	102%	6.31	101%	1,557	1,535	(23)	6.81	123	-
Public Lighting	5.62	6.03	107%	140	5.90	6.33	107%	6.25	106%	88	83	(5)	6.75	7	-
Total				37,035						19,554	20,957	1,404		1,852	1,174

UC Charge	0.50
UC Fund at start	0.00
UC Fund at end	448

	YEAR 2		STAGE 1		STAGE 2		STAGE 3					
			Tariff after CS Neutral Hike		Increase due to targeted CoS coverage		Increase due to cost/revenue mismatch					
Consumer Categories	Sales	CoS	Tariff	CoS coverage	Tariff	CoS coverage	Revenue from stage 2 tariff (A)	ARR (B)	Gap to be filled by UC (A - B)	Tariff + UC	Revenue generated from UC	Additional fund required from govt.
Industrial - 66 kV	2,453	5.31	6.19	116%	5.84	110%	1,431	1,303	(128)	6.14	74	-
Industry LS	5,139	5.66	6.19	109%	5.97	106%	3,070	2,906	(163)	6.27	154	-
Domestic - 11 kV	85	5.40	6.41	119%	6.00	111%	51	46	(5)	6.30	3	-
Commercial - 11 kV	677	5.61	6.65	118%	6.23	111%	422	380	(42)	6.53	20	-
Bulk	301	5.45	6.16	113%	5.88	108%	177	164	(13)	6.18	9	-
Industry MS	1,908	6.80	6.19	91%	6.43	95%	1,227	1,298	71	6.73	57	57
Industry SP	916	7.24	5.62	78%	6.27	87%	575	664	89	6.57	27	27
Domestic (0-100)	5,766	6.09	4.51	74%	5.14	84%	2,964	3,509	545	5.44	173	173
Domestic (101-300)	3,458	6.09	6.05	99%	6.07	100%	2,097	2,104	7	6.37	104	104
Domestic (above 300)	1,616	6.09	6.41	105%	6.28	103%	1,015	983	(31)	6.58	48	-
Agriculture	12,594	5.88	4.61	78%	5.12	87%	6,443	7,401	958	5.42	378	378
Commercial	2,688	6.53	6.65	102%	6.60	101%	1,774	1,755	(20)	6.90	81	-
Public Lighting	146	6.20	6.65	107%	6.47	104%	94	90	(4)	6.77	4	-
Total	38,974						21,982	23,169	1,187		1,169	748

UC Charge	0.30
UC Fund at start	448
UC Fund at end	430

	YEAR 3		STAGE 1		STAGE 2		STAGE 3					
			Tariff after CS Neutral Hike		Increase due to targeted CoS coverage		Increase due to cost/revenue mismatch					
Consumer Categories	Sales	CoS	Tariff	CoS coverage	Tariff	CoS coverage	Revenue from stage 2 tariff (A)	ARR (B)	Gap to be filled by UC (A - B)	Tariff + UC	Revenue generated from UC	Additional fund required from govt.
Industrial - 66 kV	2,479	5.58	6.49	116%	5.95	107%	1,474	1,383	(91)	6.20	62	-
Industry LS	5,178	5.94	6.49	109%	6.16	104%	3,190	3,075	(115)	6.41	129	-
Domestic - 11 kV	90	5.67	6.73	119%	6.09	107%	55	51	(4)	6.34	2	-
Commercial - 11 kV	737	5.89	6.98	118%	6.33	107%	467	435	(32)	6.58	18	-
Bulk	309	5.72	6.47	113%	6.02	105%	186	177	(9)	6.27	8	-
Industry MS	1,956	7.14	6.49	91%	6.88	96%	1,347	1,397	51	7.13	49	49
Industry SP	929	7.61	5.90	78%	6.92	91%	643	707	63	7.17	23	23
Domestic (0-100)	6,112	6.39	4.73	74%	5.73	90%	3,501	3,906	405	5.98	153	153
Domestic (101-300)	3,744	6.39	6.36	99%	6.38	100%	2,387	2,392	5	6.63	94	94
Domestic (above 300)	1,685	6.39	6.73	105%	6.52	102%	1,100	1,077	(23)	6.77	42	-
Agriculture	13,474	6.17	4.84	78%	5.64	91%	7,596	8,314	717	5.89	337	337
Commercial	2,928	6.85	6.98	102%	6.90	101%	2,021	2,006	(15)	7.15	73	-
Public Lighting	152	6.51	6.98	107%	6.70	103%	102	99	(3)	6.95	4	-
Total	41,047						24,741	25,633	892		1,026	663

UC Charge	0.25
UC Fund at start	430
UC Fund at end	565

	YEAR 4		STAGE 1		STAGE 2		STAGE 3					
			Tariff after CS Neutral Hike		Increase due to targeted CoS coverage		Increase due to cost/revenue mismatch					
Consumer Categories	Sales	CoS	Tariff	CoS coverage	Tariff	CoS coverage	Revenue from stage 2 tariff (A)	ARR (B)	Gap to be filled by UC (A - B)	Tariff + UC	Revenue generated from UC	Additional fund required from govt.
Industrial - 66 kV	2,506	5.86	6.82	116%	6.05	103%	1,517	1,468	(48)	6.15	25	-
Industry LS	5,217	6.24	6.82	109%	6.35	102%	3,314	3,253	(61)	6.45	52	-
Domestic - 11 kV	96	5.96	7.06	119%	6.18	104%	59	57	(2)	6.28	1	-
Commercial - 11 kV	803	6.19	7.33	118%	6.42	104%	515	497	(18)	6.52	8	-
Bulk	317	6.00	6.79	113%	6.16	103%	196	191	(5)	6.26	3	-
Industry MS	2,006	7.50	6.82	91%	7.36	98%	1,477	1,504	27	7.46	20	20
Industry SP	942	7.99	6.20	78%	7.63	96%	719	752	34	7.73	9	9
Domestic (0-100)	6,479	6.71	4.97	74%	6.36	95%	4,122	4,347	225	6.46	65	65
Domestic (101-300)	4,054	6.71	6.67	99%	6.70	100%	2,717	2,720	3	6.80	41	41
Domestic (above 300)	1,757	6.71	7.06	105%	6.78	101%	1,192	1,179	(12)	6.88	18	-
Agriculture	14,415	6.48	5.08	78%	6.20	96%	8,936	9,339	403	6.30	144	144
Commercial	3,188	7.20	7.33	102%	7.22	100%	2,303	2,294	(9)	7.32	32	-
Public Lighting	158	6.83	7.33	107%	6.93	101%	109	108	(2)	7.03	2	-
Total	43,264						27,879	28,381	502		433	282

UC Charge	0.10
UC Fund at start	565
UC Fund at end	496

	YEAR 5		STAGE 1		STAGE 2		STAGE 3					
			Increase due to rise in CoS		Increase due to targeted CoS coverage		Increase due to cost/revenue mismatch					
Consumer Categories	Sales	CoS	Tariff	CoS coverage	Tariff	CoS coverage	Revenue from stage 2 tariff (A)	ARR (B)	Gap to be filled by UC (A - B)	Tariff + UC	Revenue generated from UC	Additional fund required from govt.
Industrial - 66 kV	2,534	6.15	7.16	116%	6.15	100%	1,559	1,559	-	6.15	-	-
Industry LS	5,256	6.55	7.16	109%	6.55	100%	3,441	3,441	-	6.55	-	-
Domestic - 11 kV	102	6.25	7.42	119%	6.25	100%	64	64	-	6.25	-	-
Commercial - 11 kV	875	6.50	7.70	118%	6.50	100%	568	568	-	6.50	-	-
Bulk	326	6.30	7.13	113%	6.30	100%	205	205	-	6.30	-	-
Industry MS	2,056	7.87	7.16	91%	7.87	100%	1,619	1,619	-	7.87	-	-
Industry SP	956	8.39	6.51	78%	8.39	100%	801	801	-	8.39	-	-
Domestic (0-100)	6,867	7.05	5.22	74%	7.05	100%	4,838	4,838	-	7.05	-	-
Domestic (101-300)	4,390	7.05	7.01	99%	7.05	100%	3,093	3,093	-	7.05	-	-
Domestic (above 300)	1,833	7.05	7.42	105%	7.05	100%	1,291	1,291	-	7.05	-	-
Agriculture	15,422	6.80	5.33	78%	6.80	100%	10,491	10,491	-	6.80	-	-
Commercial	3,472	7.56	7.70	102%	7.56	100%	2,623	2,623	-	7.56	-	-
Public Lighting	164	7.17	7.70	107%	7.17	100%	118	118	-	7.17	-	-
Total	45,636						31,446	31,446	-		-	-

UC Charge	0.00
UC Fund at start	496
UC Fund at end	496

From the above discussed model we can observe that the year on year tariff hikes for subsidised categories due to tariff rationalisation can be very high leading to tariff shocks. These tariff hikes are further increased due to UC charge on all consumer categories. In order to protect subsidised categories from these tariff shocks, the state government can contribute to the UC Fund for the initial years on behalf of subsidised categories. The additional funds required from state government in the illustration of UC Model in Punjab, would be as follows:

Table 60 Additional fund requirement from state government based on UC model illustration of Punjab

(in Rs. Crore)	YEAR1	YEAR2	YEAR3	YEAR4	YEAR5
Industry MS	93	57	49	20	-
Industry SP	45	27	23	9	-
Domestic (0-100)	272	173	153	65	-
Domestic (101-300)	160	104	94	41	-
Agriculture	589	378	337	144	-
Total	1,174	748	663	282	-

Source: PwC analysis

7.2.2. Dealing with cross subsidies under retail supply competition

Elimination of cross subsidies is important to allow for level playing field between various supply licensees under retail supply competition. However given the current situation, cross subsidies are likely to continue in the near future even after the content carriage segregation. Two basic principles may be adopted for dealing with residual cross subsidies in a retail supply competition scenario:

- Cross subsidies should be located in the wires component of the distribution tariff. Since wires are a monopolistic regulated industry and, therefore, are not subject to competition, market signals, though distorted, would not explicitly affect competition.
- It is possible, however, that the size of the some customer categories subsidy is too great to be captured in the wires tariff alone. In that case, the proper solution would be for the subsidy to be paid directly by government to the affected category.

Illustration -

For the purpose of illustrating this strategy, we have assumed there are four consumer categories with cost of supply and tariffs as given in the table below. The cost of supply is further broken down into wheeling charge, energy charge and customer charge.

After the advent of retail supply competition, the tariffs must be cost reflective, i.e. the tariff of any category must cover the energy and customer related costs.

If retail supply competition is to be introduced then cross subsidies need to be either eliminated or located within the wires business only. Therefore the maximum possible cross subsidy for domestic consumer can be equal to the wheeling charges paid by them i.e. Rs 0.80/kWh. Under retail supply competition, either the tariff for domestic consumers must rise to at least 90% of CoS or the State Government will have to bear the cost of subsidization.

Table 61: Illustration for cross subsidies under retail supply competition (all figures in Rs/kWh)

		Domestic	Agricultural	Industrial	Commercial
CoS	Cost of Supply	6	9	2	4
W	Wheeling	2	4	0.5	2
E	Energy	2	2	1	1
C	Customer	2	3	0.5	1
T	Tariff	4	5	5	7
T-CoS	Existing cross subsidy	(2)	(4)	3	3
E+C	Min Tariff payable	4	5	-	-
W/CoS	Max cross subsidy possible	33%	44%	-	-

Source: PwC analysis

8. Way forward and recommendations

Based on our review of existing level of cross subsidies in Indian states and suggested strategies to reduce these levels of cross subsidies, we give the following key recommendations –

1. Roadmap for calculation of Cost of Supply

Going forward states need to adopt category wise Cost of Supply (CoS) instead of Average Cost of Supply (ACoS) for the purpose of tariff determination and cross subsidy measurement. The state regulators can choose the appropriate method of calculating category wise or voltage wise cost of supply between Embedded Cost approach or Simplified approach, based on the availability of data.

2. Roadmap for reduction of cross subsidies

In majority of the states, most of the consumer categories are outside the +/-20% range of ACoS coverage. Only states of Punjab, Himachal Pradesh and Assam have been able to reduce cross subsidies (after subsuming direct State Government subsidies) within the +/-20% range of ACoS coverage. Therefore the state regulators need to implement the guidelines of the Tariff Policy on gradual reduction of cross subsidies⁵³. A roadmap should be defined with fixed time period in order to align tariffs to consumer's cost of supply

3. Factors for determining cross subsidy

The state regulators can set the cross subsidy amount considering factors like number of units consumed (like in case of Delhi), alternate sources of fuel available to consumer etc.

4. Way forward for states based on their current cross subsidy level and method of cost of supply calculation

Three blocks have been defined in which states can be placed as per their current level of cross subsidies and method for cost of supply calculation. Also the way forward for each of these blocks is discussed.

Block I – States where *all major consumer categories are outside +/-20% ACoS range*

- States where both subsidised and subsidising categories are outside +/- 20% ACoS should aim to move into Block II by achieving +/-20% ACoS coverage for all consumer categories within next five years
- Given the sales mix these states are unlikely to reach parity without tariff shocks and may require government assistance
- In order to achieve this the state governments may need to fund agriculture category, with the minimum subsidy per unit corresponding to cost of at least 80% of ACoS

Block II – States where *all major consumer categories are within +/-20% ACoS range*

- Such states have already achieved the objective of National Tariff Policy. They should aim to move into Block III by moving from ACoS base tariff determination to category wise CoS.
- Such states should keep on aligning tariffs to remain within +/- 20% of category wise cost of supply. These states may begin by using simplified method for calculating Cost of Supply, based on data availability.

Block III – States where *all major consumer categories are within +/-20% ACoS range and use simplified method for calculating Cost of Supply*

- Such states should carry out detailed technical studies for calculating Cost of Supply using Embedded Methodology.

⁵³ A trajectory of ACoS coverage is formulated for the 10 states under review, in order to bring all consumer categories at 100% ACoS coverage in the next 5 years. These trajectories are shown in Annexures of this report.

-
- Such states should continue to maintain the category wise cost coverage and move towards linking retail tariffs to category wise cost of supply through year on year tariff rationalisation.

5. Bill segregation

Cross subsidy enjoyed by a consumer should be shown as a separate item in customer billing statements (like in case of Philippines). The consumer's bill should clearly show the following:

- Cost of Supply to the respective consumer category
- Tariff charged from consumer
- Source and amount of cross subsidy (Difference between the CoS and tariff)

6. Introduction of KYC norms

KYC norms can be introduced for electricity consumers, linked to their PAN/Aadhar card. In the future this information can then be used to transfer subsidy directly to the consumer's bank account.

9. Concluding note

Electricity tariffs in India are pegged to consumers' capacity-to-pay, keeping in mind socio-economic considerations. This explains why commercial and industrial consumers pay tariffs upto 40% higher than the average cost of supply, although the cost to serve these consumers is lower than the average cost of supply, on account of lower technical and commercial losses. On the other hand domestic and agricultural consumers in some states pay tariffs that cover only about 50% of the average cost.

Such cross subsidies in tariff are common and can be sizable. For example, in Andhra Pradesh, industrial sector consumes just 38% of power but accounts for 50% of revenue of the utility. Agricultural consumers who account for 25% of total sales contribute just 13% to the total revenue. In Delhi, a relatively affluent residential consumer (consuming upto 1500 per month) is also charged a tariff lower than the average cost of supply.

On the policy front, there are adequate guidelines that emphasize the need for winding down cross-subsidies. The EA 2003 prescribed that tariff must progressively reflect cost of supply. This was reinforced by directives in the National Electricity Policy and Tariff Policy to bring tariffs of all categories of consumers to within +/- 20% of the average cost of supply by FY2010-11. However in spite of the legislative mandate, the state electricity regulators have not been successful in re-aligning electricity tariffs. Some states like Punjab and Himachal Pradesh have rationalized tariff structures (with government support). Other states have not been so successful.

High level of cross-subsidy results in wastage of economic resources. In the subsidized sectors it encourages electricity consumption to a point where the value attached to incremental consumption is lower than the cost of supply. Utilities are reluctant to provide connections and regular supply to agricultural and residential consumers, where they incur losses on every unit of electricity sold. On the other hand, subsidizing consumers are driven to cut down their consumption. Higher cost of electricity increases their cost of manufacturing and feeds into higher product costs. It may also lead to revenue loss to state utilities as industries switch to 'captive power generation'.

Cross-subsidies also obstruct competition in retail supply of electricity. Under open access regulations, consumers with load more than 1 MW are not bound to purchase electricity from the distribution licensee and can source power from any generator. However industrial users cannot switch to an alternate, cheaper source due to levy of high cross-subsidy surcharge - a cess payable by open access consumers to the licensee. The surcharge varies by state: it is 15% of retail tariff in Gujarat, 32% in Karnataka, 41% in Delhi, and 52% in West Bengal. Countries such as the Philippines successfully introduced competition in electricity distribution only after eliminating cross-subsidies.

In India though, removing cross-subsidies has proven difficult. The review of performance of the states in this report shows that SERCs were unable to adhere to the Tariff Policy guidelines to bring down cross subsidies to within +/- 20% of ACoS by FY2010-11. Even in states where cross subsidies, measured by ACoS coverage, have declined, the absolute levels of cross subsidies continue to increase on account of higher sales growth to subsidised categories. In fact the sales-mix of the state is closely related to its ability to affect a reduction in cross subsidies. It is therefore necessary to analyse the impact of rural electrification and 24X7 supply schemes on cross subsidies and financial health of the discoms.

There is also a need to move from ACoS to category-wise CoS to measure the cross subsidy coverage as mandated by the EA 2003. Only a few states in India calculate category wise or voltage wise cost of supply. Out of 29 states⁵⁴ in India, only 11 states do this exercise. When the retail supply market is thrown open to competition, the first segment to avail the benefits of competition would be large consumers with load 1 MW or above. If these consumers move away to other retail suppliers, the distribution network operator (which would continue supplying power to other consumer categories) would suffer a loss, because significant cross subsidies would get eroded. Therefore, in order to assess the true impact of cross subsidy erosion and to take remedial

⁵⁴ including Delhi and excluding Telangana

measures, the first step towards addressing the cross subsidy issue is to determine voltage wise and/or category wise cost of supply for all states.

Going forward, it is suggested that greater transparency be introduced in the methodology for publishing cross subsidies. The Universal Charge Model is suggested to implement winding down of cross subsidies and to make up for any shortfalls in revenue that it may impose upon the utilities. Such shortfalls may need to be funded by the government. It is likely that cross subsidies may not be entirely eliminated before implementation of retail supply competition. However in order to ensure that cross subsidies do not distort consumer choice it is necessary that cross subsidies be limited to the wires business only.

10. Annexures

10.1. Cost of supply calculation based on APTEL judgement in Appeal Nos. 102 of 2010

Embedded cost approach requires a detailed database of information regarding voltage of supply, power factor, load factor, time of use of electricity, quantity of electricity consumed AT & C losses etc. Most of this above mentioned information was not readily available in the states of Bihar, Madhya Pradesh, Himachal Pradesh and Delhi. Taking into account the difficulties faced by the state commissions, the APTEL has suggested⁵⁵ that in absence of adequate data, it would be adequate to determine the voltage-wise cost of supply taking into account the major cost element which would be applicable to all the categories of consumers connected to the same voltage level. The APTEL gave detailed guidelines for calculation of voltage wise cost of supply on an approximate basis, as follows –

1. Ideally, the network costs can be split into the partial costs of the different voltage level and the cost of supply at a particular voltage level is the cost at that voltage level and upstream network. However, in the absence of segregated network costs, it would be prudent to work out the voltage-wise cost of supply taking into account the distribution losses at different voltage levels as a first major step in the right direction.
2. As power purchase cost is a major component of the tariff, apportioning the power purchase cost at different voltage levels taking into account the distribution losses at the relevant voltage level and the upstream system will facilitate determination of voltage wise cost of supply, though not very accurate, but a simple and practical method to reflect the actual cost of supply.
3. The technical distribution system losses in the distribution network can be assessed by carrying out system studies based on the available load data. Some difficulty might be faced in reflecting the entire distribution system at 11 KV and 0.4 KV due to vastness of data. This could be simplified by carrying out field studies with representative feeders of the various consumer mix prevailing in the distribution system.
4. However, the actual distribution losses allowed in the ARR which include the commercial losses will be more than the technical losses determined by the system studies. Therefore, the difference between the losses allowed in the ARR and that determined by the system studies may have to be apportioned to different voltage levels in proportion to the annual gross energy consumption at the respective voltage level. The annual gross energy consumption at a voltage level will be the sum of energy consumption of all consumer categories connected at that voltage plus the technical distribution losses corresponding to that voltage level as worked out by system studies. In this manner, the total losses allowed in the ARR can be apportioned to different voltage levels including the EHT consumers directly connected to the transmission system of GRIDCO. The cost of supply of the appellant's category who are connected to the 220/132 KV voltage may have zero technical losses but will have a component of apportioned distribution losses due to difference between the loss level allowed in ARR (which includes commercial losses) and the technical losses determined by the system studies, which they have to bear as consumers of the distribution licensee.
5. Therefore Power Purchase Cost which is the major component of tariff can be segregated for different voltage levels taking into account the transmission and distribution losses, both commercial and technical, for the relevant voltage level and upstream system. As segregated network costs are not available, all the other costs such as Return on Equity, Interest on Loan, depreciation, interest on working capital and O&M costs can be pooled and apportioned equitably, on pro-rata basis, to all the voltage levels including the appellant's category to determine the cost of supply. Segregating Power Purchase cost taking into account voltage-wise transmission and distribution losses will be a major step in the right direction for determining the actual cost of supply to various consumer categories. All consumer categories connected to the same voltage will have the same cost of supply. Further, refinements in formulation for cost of supply can be done gradually when more data is available.

⁵⁵ Judgement in Appeal Nos. 102 of 2010 in the matter of Tata Steel Ltd. Vs. Orissa Electricity Regulatory Commission & Another, 2011

Based on this approach described by APTEL, different state commissions using different factors and assumptions carried out the exercise of calculating the cost of supply.

Case Study - Delhi

DERC has been regularly publishing tariff orders since the unbundling in 2002. Before FY2010-11, no data regarding the levels of cross subsidy was published by the State Commission. During this period, though category wise sales figures were published, neither category wise CoS nor was ACoS data published by the State Commission.

In the Multi Year Tariff (MYT) order of 2008, voltage wise CoS for all the three DISCOMs was calculated. The approved ARR of the Wheeling and Retail Supply business (excluding supply margin) was allocated to different voltage levels and the same had been considered along with the energy sales to the respective voltage level to arrive at the Paisa per unit Wheeling charge and Retail Supply Charge. The following steps are explained in section A5 of MYT order of 2008, to calculate the voltage wise CoS -

'5.41 The Commission has considered the Gross energy sales (MU) approved for Discom for the year was allocated to different voltage levels in the proportion of energy sales (MU) to these voltages to total sales in that year as submitted by respective Discom.'

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

'5.44 Next, the Commission has allocated the approved GFA of the DISCOMs to different voltage levels. For this, the Commission had directed the DISCOMs to submit their estimates of allocation of GFA to different voltage levels. NDPL vide letter no NDPL\DERC\MYT\2007-08 dated 21 February, 2008 has submitted the estimates as per their cost records. The BSES companies, however, has submitted vide letter dated 21 February, 2008 that the voltage wise allocation of assets has not been carried out by the companies in the past and that in the absence of the voltage wise details of GFA the same may be apportioned in ratio of sales for EHT, HT and LT.'

'5.45 Based on the voltage wise assets allocation submitted, the Commission has allocated the Wheeling ARR to the assets at respective voltage levels.....'

'5.48 The Wheeling cost apportioned above to a particular assets category is thereby reallocated to different voltage levels in proportion of their contribution to the energy input at that level...'

Table 62 DERC - Voltage wise Cost of Supply (Rs./unit)

	FYo8	FYo9	FY10	FY12	FY13	FY14	FY15
BRPL							
> 66 kV	2.86	2.90	-	-	-	-	-
33/66 kV	3.08	3.11	2.89	4.44	4.66	5.48	6.37
11 kV	3.71	3.73	3.18	4.60	4.80	5.61	6.52
LT level	4.65	4.60	4.30	6.00	6.32	6.41	7.37
ACoS	4.42	4.38	4.05	5.75	6.04	6.20	7.14
BYPL							
> 66 kV	2.38	2.72	-	-	-	-	-
33/66 kV	2.57	2.93	2.75	4.41	4.74	5.59	6.28

	FYo8	FYo9	FY10	FY12	FY13	FY14	FY15
11 kV	3.15	3.58	3.00	4.56	4.88	5.71	6.40
LT level	4.46	4.91	4.49	6.19	6.68	6.69	7.45
ACoS	4.25	4.68	4.26	6.00	6.46	6.54	7.24
NDPL/TPDDL							
> 66 kV	3.18	2.96	2.92	4.34	4.46	5.58	6.72
33/66 kV	3.37	3.15	3.08	4.53	4.67	5.65	6.81
11 kV	4.17	3.87	3.50	5.03	5.16	5.88	7.09
LT level	4.86	4.58	4.51	5.77	6.05	6.40	7.68
ACoS	4.68	4.40	4.28	5.62	5.89	6.31	7.56

Source: DERC Tariff orders

The above table shows that the LT voltage level has higher cost of supply than the average cost of supply. Since generally it is observed that domestic and small consumers form a major part of LT voltage supply and the tariff for such customers is lower than other consumer categories, this may signify presence of cross subsidy between various voltage levels.

Case Study - Madhya Pradesh

The Madhya Pradesh Electricity Regulatory Commission was constituted by Government of Madhya Pradesh vide Gazette Notification dated 20th August, 1998. The first Tariff Order was passed on 26th September 2001. Since the first tariff order in FY2001-02, there has been variation in both the methodology used by the regulator to publish cost of supply and cross subsidy data in the state. The Commission does not publish ACoS or ACoS coverage numbers separately for the three Discoms. Therefore there could be inter-regional cross subsidy which is not measured currently.

Till FY2004-05 i.e. before the unbundling of generation, transmission and distribution companies, MPERC published ACoS along with voltage wise CoS calculated starting from the EHV level and going down to the LT level. The cost of supply for various consumer categories was then calculated based on the voltage level supply to that category.

In its tariff orders of FY2006-07 till FY2013-14, MPERC published only the ACoS data. On 25th October 2013 vide letter no. MPERC/RE/2013/2780, MPERC directed Discoms to determine the voltage wise CoS for compliance of the directives given in the judgment passed by Hon'ble Appellate Tribunal for Electricity (APTEL). Cost of supply breakup for each consumer category requires detailed technical study for determination of voltage-wise losses of the Distribution network. In FY2014-15 tariff order, the Discoms have indicated that since the detailed study was not available, an illustrative calculation for voltage wise cost of supply is done.

Section 7.5 of FY2014-15 tariff order states -

'Petitioners have submitted that the Tariff Regulations do not provide segregation of normative losses for the Distribution Licensees into voltage wise normative losses in respect of technical and commercial losses. Petitioners have further submitted that determination of voltage-wise losses would require detailed technical studies of the Distribution network. Therefore, for the purposes of illustrative computation of voltage-wise cost of supply, the petitioners have assumed voltage-wise losses; the data therein is not duly verified and so, should not be relied upon.'

Illustrative computation of voltage wise cost of supply was done in the FY2014-15 tariff order of MPERC

Section 7.8 of FY2014-15 tariff order, explains the methodology for calculating voltage wise Cost of Supply.

- 1) Voltage wise cost of supply has been computed for above 33 kV and below 33 kV and 11 kV (inclusive of LT) categories only.

- 2) Sales as admitted by the State Commission for above 33 kV and below 33 kV and 11 kV (inclusive of LT) categories have been considered.
- 3) Total technical and commercial losses of the petitioners have been considered the same as specified in the Tariff Regulations for FY 2014-15.
- 4) Total losses as admitted by the State Commission have been segregated voltage wise for above 33 kV, 33 kV and 11 kV (inclusive of LT) in the same proportion as submitted by the Discoms.
- 5) Power purchase costs at the Discom periphery for above 33 kV, below 33 kV and 11 kV (inclusive of LT) based on the voltage-wise input energy have been considered. All other costs of the Discom are allocated based on the sales to each voltage-level.
- 6) Voltage wise total cost derived has been divided by voltage wise sales for working out the voltage wise cost of supply

Table 63 MPERC - Computation of voltage-wise cost of supply in FY2014-15

State	Units	EHT System (400 kV, 220 kV, 132 kV & 66 kV)	33 kV system	11 kV+ LT system	Total
Sales	MU	5234	5877	34389	45501
Technical and Commercial losses submitted	%	3.97%	4.50%	20.67%	23.06%
Energy input submitted	MU	5451	6409	47279	59139
Energy input admitted	MU	5447	6399	47213	59058
Energy lost admitted (technical up to 33 kV and 11 kV + LT – technical and commercial)	MU	212	522	12824	13557
Commercial loss assumed as 50% of 11 kV and LT overall losses	MU	-	-	6412	6412
Balance 50% commercial losses for all voltage in proportion to sales	MU	738	828	4846	6412
Net energy input for computing VCoS	MU	6184	7227	45647	59058
Power Purchase Costs – allocated based on voltage wise losses	Rs. Crore	1673	1944	13710	17326
Other costs – allocated based on voltage-wise losses	Rs. Crore	520	565	3326	4410
Less: Other income – allocated based on voltage-wise sales	Rs. Crore	77	91	523	691
Recoveries of past	Rs. Crore	111	126	759	996
Total Costs (ARR requirement)	Rs. Crore	2226	2544	17271	22042
Voltage wise CoS (VCoS)	Rs./Unit	4.25	4.33	5.02	4.84
ABR	Rs./Unit	5.68	5.96	4.53	4.84
cross subsidies vis-à-vis VCoS	%	133.50%	137.79%	90.11%	100%

Source: MPERC aggregate revenue requirement and retail supply tariff order for FY 2014-15

While in the tariff order of FY2014-15, cross subsidy was calculated based on this voltage-wise cost of supply, the ACoS coverage figures were also published in order to compare the ACoS coverage from previous year tariff orders.

Case Study - Bihar

The Bihar Electricity Regulatory Commission (BERC), for calculation of cost of supply in its tariff orders of FY2013-14 and FY2014-15, followed the methodology provided by the APTEL, in its order dated 10th May, 2012. The methodology provided by the Tribunal under para 18.9 of APTEL Order and is detailed in Annexure 3. BERC computes a combined voltage wise cost of supply for both the Discoms.

The tariff order of FY2014-15 states the following steps in which voltage wise cost of supply is calculated –

‘7.2 As per the APTEL judgment, assessment of the technical loss in the distribution system network by carrying out system studies based on the available load data for 33 kV and above and field studies for representative feeders for 11 kV and 0.4 kV of the various consumer mix prevailing in the distribution system is a pre-requisite for arriving at the voltage-wise cost of supply as per methodology ordered by the APTEL’

‘7.3Due to lack of data for segregation of technical and commercial losses, the State Commission could not fix the technical and commercial loss level within the total distribution loss of 21.40% approved for FY 2014-15. In view of high loss level of 45.00% by SBPDCL and 36.50% by NBPDC, it is considered appropriate to assume technical and commercial loss levels for realistic assessment of Cost of Supply within overall T&D loss level of 24.54% allowed by the State Commission. The State Commission has approved the transmission losses at 4% for FY 2014-15. Hence, keeping the transmission losses at 4%, the remaining is adjusted among others.’

The state commission considered the following voltage-wise technical losses for FY2014-15 –

Table 64 BERC - voltage wise technical loss (%) in FY2014-15

Voltage Level	Loss (%)
220/132 kV	4.00%
33 kV	5.00%
11 kV	6.00%
LT	7.00%
Technical Losses in the system (A)	16.67%
Total Losses (distribution loss + transmission loss) (B)	24.54%
Commercial & Non-Technical Loss (B)-(A)	7.87%

Source: BERC 2014-14 tariff order

Further the tariff order states that –

‘7.5 As stated in para 33 of APTEL order dated 10.05.2012, the voltage-wise commercial losses are to be arrived at by segregating the total commercial losses in proportion to grossed up sales (Actual consumption + technical loss) voltage-wise.

In para 34 of APTEL order it is reiterated that the power purchase cost is to be segregated for different voltage levels taking into account the transmission and distribution losses, both commercial and technical, for relevant voltage level and upstream system. Thus the losses (technical) at 33 KV shall be the losses at that voltage and also at upstream 132 KV voltages.’

Based on the above methodology the technical losses are added back to the energy sales to calculate the energy input or grossed up sales. The voltage wise commercial losses are then arrived at by segregating total commercial losses in proportion of grossed up sales. These commercial losses are then added to voltage wise energy input to arrive at energy input at state periphery.

‘7.7 The power purchase cost has been allocated for different voltage levels taking into account the T&D losses, both commercial and technical, for the relevant voltage level and upstream as per methodology indicated by APTEL.’

‘7.8 Hon’ble APTEL in its order has indicted the method for allocation of network costs at different voltage levels as under:

“ all other cost such as Return on Equity , interest on loan , interest on working capital and O&M costs can be pooled and apportioned equitably, on pro-rata basis to all the voltage level to determine the cost of supply”.

The network costs have to be calculated on pro-rata basis and its appointment shall be fare and just.’

Based on method explained in section 7.7 and 7.8 of FY2014-15 tariff order, the power purchase cost is allocated between voltage levels in the proportion of energy sales at state periphery and the network costs are allocated in the proportion of approved energy sales. The table below shows us the cost of supply for each voltage category for FY2014-15.

Table 65 BERC - voltage wise cost of supply for FY2014-15

Supply Voltage	Cost of Power Purchase (Rs. per unit)	Network cost (Rs. per unit)	Cost of Supply (Rs. per unit)
220/132 kV	4.53	1.77	6.30
33 kV	4.77	1.77	6.54
11 kV	5.07	1.77	6.84
LT	5.45	1.77	7.22

Source: BERC Tariff order FY2014-15

The voltage wise cost of supply is same for both the Discoms in view of the common retail supply tariff and distribution loss percentage approved by the State Commission.

Table 66 BERC - Voltage wise Cost of Supply (Rs./unit)

	FY14	FY15
220/132 kV	6.22	6.3
33 kV	6.46	6.54
11 kV	6.77	6.84
LT level	7.15	7.22

Source: BERC Tariff orders

Case Study - Himachal Pradesh

Himachal Pradesh Electricity Regulatory Commission (HPERC) in the Tariff Order of FY2009-2010, carried out the exercise to calculate voltage wise cost to serve. However, this voltage wise cost to serve has been worked out for indicative purposes only and the state commission continues to use ACoS for the purpose of tariff determination. Section A5 of FY2009-10 tariff order explains the methodology of calculating CoS, which is an adaption of embedded cost method. The state commission for the purpose of functionalization, takes the approved generation, transmission and distribution costs.

Per unit generation cost is calculated by dividing the approved power purchase cost by total energy input (energy sales plus T&D losses). This per unit generation cost is assumed same for all three voltage categories.

The per unit transmission cost is calculated by dividing the approved transmission cost by total energy sales. The per unit transmission cost is assumed same for all three voltage categories.

For the purpose of distribution costs, the energy sales are divided into sales below 11kV (LT category) and sales above 11kV (HT category). Thereafter the approved distribution costs are divided by these energy sales to calculate the per unit distribution cost for each HT and LT voltage categories.

Table 67 HPERC - Cost allocation to generation, transmission and distribution in FY10

Cost Head	Energy (Excluding (MU) (A)	Wheeled Losses) (B)	Cost Allocation (Rs Cr) (B)	Unit Cost (Rs/Unit) (B/A*10)	Applicable Categories
Generation & Power Purchase cost	7454.97		1644.48	2.21	EHT, HT and LT
Transmission cost	6501.48		130.42	0.20	EHT, HT and LT
Distribution Cost => 11 kV	4934.08		319.48	0.65	HT and LT
Distribution Cost < 11 kV	2149.23		246.56	1.15	LT
Total			2340.94		

Source: HPERC FY2009-10 tariff order

Losses have been apportioned according to the sale and power wheeled at each voltage level. Section 5.5(b) of FY2009-10 tariff order explains -

'5.5(b) Energy flows through each voltage level to reach Low-Tension (LT) consumer. So the losses and costs at higher voltages are shared at lower voltages. It was an assumption due to lack of load flow study information and accurate power flow diagram outlining the flow of energy from one voltage to another.'

Therefore the per unit transmission losses are considered same for each voltage category and distribution losses are calculated for HT and LT category based on the energy sales at that level. The below table gives us the per unit transmission & distribution loss as calculated in FY2009-10 tariff order.

Table 68 HPERC – T&D loss allocation in FY10 tariff order

Loss	Energy Wheeled (MU)-A	Loss (MU) B	Loss (%) C (B/A)*100	Gen & PP Cost* C (Rs/unit)	Applicable Categories
Transmission Loss	6501.48	276.58	4.25%	0.09	EHT, HT and LT
Distribution Loss(=>11 kV)	4934.08	420.82	8.53%	0.19	HT and LT
Distribution Loss(<11 kV)	2149.23	256.09	11.92%	0.26	LT

Source: HPERC FY2009-10 tariff order

Bases on the above calculation the per unit CoS in FY2009-10 tariff order is calculated as follows –

Table 69 HPERC - Voltage wise CoS calculation for FY2009-10

S. No.	Particulars	Generation bus bar	EHT (>=66 kV)	HT (>=11kV)	LT (<11kV)	Total
1	Energy Input (MU)	7454.97	7454.97	5610.99	2405.32	
2	Loss (MU)		276.58	420.82	256.09	953.49
3	Sales at respective level (MU)	0.00	1567.40	2784.84	2149.23	6501.48
4	Cost at respective level (Rs Cr)	1644.48	130.42	319.48	246.56	2340.94
5	Generation and Power Purchase Cost (Rs/ unit)	2.21				
6	Cost Allocation (Rs/ unit)					
	Generation Cost		2.21	2.21	2.21	

S. No.	Particulars	Generation bus bar	EHT (>=66 kV)	HT (>=11kV)	LT (<11kV)	Total
	Transmission Cost		0.20	0.20	0.20	
	Distribution Cost (>= 11 kV)			0.65	0.65	
	Distribution Cost (< 11 kV)				1.15	
7	Loss Allocation (Rs/ unit)					
	Transmission Loss Allocation		0.09	0.09	0.09	
	Distribution Loss Allocation (>11 kV)			0.19	0.19	
	Distribution Loss Allocation (<11 kV)				0.26	
8	Cost of Supply (Rs/ unit)		2.50	3.34	4.75	3.60

Source: HPERC FY2009-10 tariff order

This methodology has been followed by the state commission in later tariff orders also to calculate the voltage wise CoS as given in the table below. From the table we can see that, distributing power at higher voltages incurs a lower cost than doing the same at a lower voltage. Also the LT voltage level generally has a higher cost of supply than the average cost of supply.

Table 70 Voltage wise Cost of supply from FY 2009-120 to FY 2014-15

	FY10	FY11	FY 12	FY 13	FY 14	FY 15
EHT (>=66kV)	2.50	2.95	3.34	3.57	3.45	3.61
HT (>=11 kV & <66kV)	3.34	4.04	3.87	4.33	4.03	4.38
LT (< 11kV)	4.75	5.88	4.74	5.63	5.07	5.06
Total⁵⁶	3.60	4.42	4.04	4.59	4.28	4.56
ACoS	3.60	4.42	4.04	4.59	5.18	5.22

Source: HPERC tariff orders

⁵⁶ In FY14 and FY15, the total cost of supply is without taking into factor past revenue gap and carrying cost. Therefore the ACoS is greater than the total cost of supply.

10.2. Trajectories required for elimination of cross subsidies (based on ACoS)

As per the classification of states as discussed in section 8.1, although movement from Block II to Block III would require detailed CoS study, states can move from Block I to Block II by year on year tariff rationalisation. In this section we have calculated the category wise tariff hike required for the 10 selected states in order to get all consumer categories to 100% ACoS coverage in next 5 years.

In some states where the ACoS coverage for subsidised categories is well below 80%, bringing all the categories to 100% ACoS coverage in a period of 5 years can lead to tariff shocks. This can be prevented with the help of additional financial support from state government for domestic or agricultural categories. However in the absence of such financial support, a second scenario is discussed below wherein the consumer categories are brought within +/- 20% ACoS coverage range instead of 100% ACoS coverage in order to prevent tariff shock.

Delhi – scenario 1

(T=FY15)	ACoS CAGR	ACoS coverage trajectory						Tariff hike required				
		T	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic	6.34%	74%	79%	84%	89%	95%	100%	14%	13%	13%	13%	12%
Agricultural		43%	54%	66%	77%	89%	100%	35%	29%	25%	22%	20%
Industrial		122%	118%	113%	109%	104%	100%	2%	2%	2%	2%	2%
Commercial		135%	128%	121%	114%	107%	100%	1%	0%	0%	0%	-1%

Delhi – scenario 2

(T=FY15)	ACoS CAGR	ACoS coverage trajectory						Tariff hike required				
		T	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic	6.34%	74%	76%	78%	80%	83%	85%	10%	10%	9%	9%	9%
Agricultural		43%	50%	58%	65%	73%	80%	25%	22%	20%	19%	17%
Industrial		122%	121%	119%	118%	116%	115%	5%	5%	5%	5%	5%
Commercial		135%	132%	129%	126%	123%	120%	4%	4%	4%	4%	4%

Himachal Pradesh – scenario 1

(T = FY15)	ACoS CAGR	ACoS coverage trajectory						Tariff hike required				
		T	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic	3.38%	78%	83%	87%	91%	96%	100%	9%	9%	8%	8%	8%
Agricultural		105%	104%	103%	102%	101%	100%	10%	2%	2%	2%	2%
Industrial		105%	104%	103%	102%	101%	100%	2%	2%	2%	2%	2%
Commercial		108%	106%	105%	103%	102%	100%	2%	2%	2%	2%	2%

*since all consumer categories are already within +/-20% ACoS coverage range, scenario 2 is not required for Himachal Pradesh

Punjab – scenario 1

(T = FY15)	ACoS CAGR	ACoS coverage trajectory						Tariff hike required				
		T	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic		95%	96%	97%	98%	99%	100%	8%	8%	8%	8%	8%
Agricultural	6.60%	80%	84%	88%	92%	96%	100%	12%	12%	11%	11%	11%
Industrial		115%	112%	109%	106%	103%	100%	4%	4%	4%	4%	4%
Commercial		116%	113%	110%	106%	103%	100%	4%	4%	4%	3%	3%

Punjab – scenario 2

(T = FY15)	ACoS CAGR	ACoS coverage trajectory						Tariff hike required				
		T	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic		95%	96%	97%	98%	99%	100%	8%	8%	8%	8%	8%
Agricultural	6.60%	80%	82%	84%	86%	88%	90%	9%	9%	9%	9%	9%
Industrial		115%	113%	111%	109%	107%	105%	5%	5%	5%	5%	5%
Commercial		116%	114%	112%	109%	107%	105%	5%	5%	5%	4%	4%

Rajasthan – scenario 1

(T = FY14)	ACoS CAGR	ACoS coverage trajectory						Tariff hike required				
		T	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic		92%	94%	95%	97%	98%	100%	6%	6%	6%	6%	6%
Agricultural	4.30%	69%	76%	82%	88%	94%	100%	14%	13%	12%	12%	11%
Industrial		101%	101%	101%	100%	100%	100%	4%	4%	4%	4%	4%
Commercial		118%	114%	111%	107%	104%	100%	1%	1%	1%	1%	1%

Rajasthan – scenario 2

(T = FY14)	ACoS CAGR	ACoS coverage trajectory						Tariff hike required				
		T	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic		92%	94%	95%	97%	98%	100%	6%	6%	6%	6%	6%
Agricultural	4.30%	69%	72%	74%	76%	78%	80%	7%	7%	7%	7%	7%
Industrial		101%	101%	101%	100%	100%	100%	4%	4%	4%	4%	4%
Commercial		118%	117%	117%	116%	116%	115%	4%	4%	4%	4%	4%

Maharashtra – scenario 1

(T = FY13)	ACoS CAGR	ACoS coverage trajectory						Tariff hike required				
		T	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic	6.33%	88%	90%	93%	95%	98%	100%	9%	9%	9%	9%	9%
Agricultural		43%	55%	66%	77%	89%	100%	34%	28%	25%	22%	20%
Industrial		135%	128%	121%	114%	107%	100%	1%	1%	0%	0%	-1%
Commercial		185%	168%	151%	134%	117%	100%	-3%	-4%	-6%	-7%	-9%

Maharashtra – scenario 2

(T = FY13)	ACoS CAGR	ACoS coverage trajectory						Tariff hike required				
		T	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic	6.33%	88%	90%	93%	95%	98%	100%	9%	9%	9%	9%	9%
Agricultural		43%	51%	58%	65%	73%	80%	24%	22%	20%	18%	17%
Industrial		135%	131%	127%	123%	119%	115%	3%	3%	3%	3%	3%
Commercial		185%	172%	159%	146%	133%	120%	-1%	-2%	-2%	-3%	-4%

Madhya Pradesh – scenario 1

(T = FY15)	ACoS CAGR	ACoS coverage trajectory						Tariff hike required				
		T	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic	2.78%	100%	100%	100%	100%	100%	100%	3%	3%	3%	3%	3%
Agricultural		77%	82%	86%	91%	95%	100%	9%	8%	8%	8%	8%
Industrial		124%	120%	115%	110%	105%	100%	-1%	-1%	-2%	-2%	-2%
Commercial		136%	129%	122%	114%	107%	100%	-3%	-3%	-3%	-4%	-4%

Madhya Pradesh – scenario 2

(T = FY15)	ACoS CAGR	ACoS coverage trajectory						Tariff hike required				
		T	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic	2.78%	100%	100%	100%	100%	100%	100%	3%	3%	3%	3%	3%
Agricultural		77%	81%	84%	88%	91%	95%	7%	7%	7%	7%	7%
Industrial		124%	122%	119%	116%	113%	110%	0%	0%	0%	0%	0%
Commercial		136%	131%	126%	120%	115%	110%	-1%	-1%	-1%	-2%	-2%

Bihar – scenario 1

(T = FY15)	ACoS CAGR	ACoS coverage trajectory						Tariff hike required				
		T	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic	5.44%	70%	76%	82%	88%	94%	100%	15%	14%	13%	13%	12%
Agricultural		92%	94%	95%	97%	98%	100%	7%	7%	7%	7%	7%
Industrial		99%	99%	99%	100%	100%	100%	6%	6%	6%	6%	6%
Commercial		107%	106%	104%	103%	101%	100%	4%	4%	4%	4%	4%

Bihar – scenario 2

(T = FY15)	ACoS CAGR	ACoS coverage trajectory						Tariff hike required				
		T	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic	5.44%	70%	73%	76%	79%	82%	85%	10%	10%	10%	10%	9%
Agricultural		92%	94%	95%	97%	98%	100%	7%	7%	7%	7%	7%
Industrial		99%	99%	99%	100%	100%	100%	6%	6%	6%	6%	6%
Commercial		107%	107%	106%	106%	105%	105%	5%	5%	5%	5%	5%

Meghalaya – scenario 1

(T = FY15)	ACoS CAGR	ACoS coverage trajectory						Tariff hike required				
		T	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic	7.14%	77%	82%	86%	91%	95%	100%	13%	13%	13%	12%	12%
Agricultural		55%	64%	73%	82%	91%	100%	24%	22%	20%	19%	18%
Industrial		112%	110%	107%	105%	102%	100%	5%	5%	5%	5%	5%
Commercial		118%	114%	111%	107%	104%	100%	4%	4%	4%	4%	4%

Meghalaya – scenario 2

(T = FY15)	ACoS CAGR	ACoS coverage trajectory						Tariff hike required				
		T	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic	7.14%	77%	80%	82%	85%	87%	90%	11%	11%	10%	10%	10%
Agricultural		55%	60%	65%	70%	75%	80%	16%	16%	15%	15%	14%
Industrial		112%	112%	111%	111%	110%	110%	7%	7%	7%	7%	7%
Commercial		118%	117%	117%	116%	116%	115%	7%	7%	7%	7%	7%

Andhra Pradesh – scenario 1

(T = FY14)	ACoS CAGR	ACoS coverage trajectory						Tariff hike required				
		T	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic	9.69%	87%	90%	92%	95%	97%	100%	13%	13%	13%	13%	13%
Agricultural		51%	61%	71%	80%	90%	100%	31%	27%	25%	23%	22%
Industrial		130%	124%	118%	112%	106%	100%	5%	4%	4%	4%	3%
Commercial		169%	156%	142%	128%	114%	100%	1%	0%	-1%	-2%	-4%

Andhra Pradesh – scenario 2

(T = FY14)	ACoS CAGR	ACoS coverage trajectory						Tariff hike required				
		T	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic	9.69%	87%	88%	88%	89%	89%	90%	10%	10%	10%	10%	10%
Agricultural		51%	57%	63%	68%	74%	80%	22%	21%	20%	19%	18%
Industrial		130%	126%	122%	118%	114%	110%	6%	6%	6%	6%	6%
Commercial		169%	156%	142%	128%	114%	100%	1%	0%	-1%	-2%	-4%

Kerala – scenario 1

(T = FY15)	ACoS CAGR	ACoS coverage trajectory						Tariff hike required				
		T	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic	5.71%	71%	77%	83%	88%	94%	100%	14%	14%	13%	13%	12%
Agricultural		47%	57%	68%	79%	89%	100%	30%	25%	22%	20%	18%
Industrial		115%	112%	109%	106%	103%	100%	3%	3%	3%	3%	3%
Commercial		174%	160%	145%	130%	115%	100%	-3%	-4%	-5%	-6%	-8%

Kerala – scenario 2

(T = FY15)	ACoS CAGR	ACoS coverage trajectory						Tariff hike required				
		T	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic	5.71%	71%	75%	79%	82%	86%	90%	11%	11%	11%	11%	10%
Agricultural		47%	53%	60%	67%	73%	80%	21%	19%	17%	16%	15%
Industrial		115%	114%	113%	112%	111%	110%	5%	5%	5%	5%	5%
Commercial		174%	164%	153%	142%	131%	120%	-1%	-1%	-2%	-2%	-3%

Assumptions –

1. 'T' refers to the ensuing year for which the latest tariff order is available.
2. 5 year CAGR for ACoS is considered for projecting cost of supply for the next 5 years.
3. ABR movement for consumer categories in next five years is calculated based on projected ACoS and required ACoS coverage.

11. About PwC

PwC firms help organisations and individuals create the value they're looking for. We're a network of firms in 158 countries with close to 169,000 people who are committed to delivering quality in assurance, tax and advisory services. Tell us what matters to you and find out more by visiting us at www.pwc.com. In India, PwC (www.pwc.com/India) offers a comprehensive portfolio of Advisory and Tax & Regulatory services; each, in turn, presents a basket of finely defined deliverables. Network firms of PwC in India also provide services in Assurance as per the relevant rules and regulations in India. Providing organisations with the advice they need, wherever they may be located, our highly qualified, experienced professionals, who have sound knowledge of the Indian business environment, listen to different points of view to help organisations solve their business issues and identify and maximise the opportunities they seek. Our industry specialisation allows us to help co-create solutions with our clients for their sector of interest.

About GRID

PwC's GRID (Government Reforms and Infrastructure Development) SBU is an industry-focussed consultancy team of 250 professionals working for governments, regulators, utilities and investors in infrastructure. Leveraging PwC global experience in these industries, this team advises on policy, regulation, institutional strengthening, performance improvement, financing and other related matters. We are located in these cities: Ahmedabad, Bangalore, Bhubaneswar, Chennai, Delhi NCR, Hyderabad, Kolkata, Mumbai and Pune.

Contacts

Kameswara Rao

Executive Director, National Leader - Power & Mining
+91 (40) 6624 6688
kameswara.rao@in.pwc.com

Sambitosh Mohapatra

Executive Director, Power & Mining
+ 91 (124) 330 6008
sambitosh.mohapatra@in.pwc.com

