## **MINUTES OF THE FORTY SEVENTH MEETING**

#### <u>OF</u>

### FORUM OF REGULATORS (FOR) HELD AT NEW DELHI

Date	:	06 <sup>th</sup> April, 2015
List of Participants	:	At Annexure-I (enclosed). Chairpersons of APERC, J&KSERC, JERC for M & M, MERC, NERC, SSERC, TERC and WBERC did not attend.

The meeting was chaired by Shri Gireesh B. Pradhan, Chairperson, Central Electricity Regulatory Commission (CERC) and Forum of Regulators (FOR). He extended a warm welcome to all members of the Forum.

#### **Business Session - I**

The FOR thereafter took agenda items for consideration.

# Agenda Item No. 1 :Confirmation of the Minutes of the 46<sup>th</sup> Meeting of<br/>Forum of Regulators (FOR) held on 17<sup>th</sup> February,<br/>2015 at CSOI, New Delhi.

The Forum noted and endorsed the minutes of the 46<sup>th</sup> Meeting of FOR held at New Delhi on 17<sup>th</sup> February, 2015.

#### Agenda Item No. 2(i): To consider and discuss the proposed budget of "FOR" for the FY 2015-16.

The budget for the year 2015-16 as circulated was discussed in detail. Salient features of the proposed budget as reflected in the income and expenditure statement (contained in Annexure-I of the Agenda Note) were explained.

It was also informed that in the light of the decision taken in the 44<sup>th</sup> FOR meeting held at New Delhi, the Secretariat of the Forum worked out the expenditure on account of additional manpower required to enhance the effectiveness of the Forum through periodical newsletters, creation and updation of internal databases, carrying out in-house research activities etc. It was also informed that the expenditure on account of capacity building and commissioning of studies is also estimated to be on the higher side in view of the reduced Plan Assistance from the Ministry of Power on these counts. Therefore, an increase in the subscription fee of Members from the current level of Rs.3.00 lakhs to Rs.6.00 lakhs per annum has been proposed.

The Forum noted the above and after deliberations, the proposed budget along with the proposal for hike in the subscription fee of Member to Rs.6.00 lakhs per annum from the current FY 2015-16, was approved.

## Agenda Item No. 2(ii): Proposed Studies and Training Programmes during the FY 2015-16.

It was informed that the proposal for commissioning the studies and conducting the training programmes during the financial year 2015-16 was evolved keeping in view the need for detailed analysis of the emerging issues facing the sector and also with due regard to the need for capacity building for Regulators and regulatory staff. Some other suggestions for studies were also made. It was decided that the following studies and capacity building programmes would be undertaken during the financial year 2015-16 :-

2

#### Studies –

- 1. Study on National Level RPO Registry.
- 2. Study on Feasibility and Desirability of Competitive Bidding in Renewable Energy.
- 3. Study to evolve principles for price cap regulation for determination of tariff ceiling when two or more distribution licensees operate in the same scenario.
- 4. Study on assignment for formulating pricing methodology for intra-state transmission and wheeling

Any other Study as may be decided by FOR/FOR Chairperson subject to availability of budgetary provision. The Forum also decided that *inter se* prioritisation of studies/programmes would be left to the Chairperson FOR.

#### **Training Programmes –**

- 1. Orientation Programme for Chairpersons and Members of SERCs at IIMA (including international component).
- 2. Capacity Building Training Programme for Officers of SERCs at IIT Kanpur (including international component).
- 3. Training on Legal Aspect of Regulation.
- 4. Training Programme on Consumer Protection and Consumer Interest

#### **Business Session - II**

#### Agenda Item No. 3 : Presentation & Discussion on "Draft Model Regulations on Smart Grid".

A presentation (copy **enclosed** at <u>Annexure-II</u>) was made by Shri Pankaj Batra, Chief Engineer, CEA on "Draft Model Regulations on Smart Grid". During the presentation, the issues relating to objective and scope of model regulations, investment in smart grid projects, tariff design, safety and standards related to smart grid, customer engagement and smart grid, smart grid cell and nodal officer, assessment of performance of smart grid projects and programmes and other miscellaneous provisions of the model regulations, were discussed. The following specific issues emerged in course of discussion :-

- The Forum observed that the term "Smart Meter" should be defined and incorporated appropriately.
- The rationale and need for the consumers to switch over from the existing conventional meter to a smart meter need be further examined and brought out suitably in the Regulations.
- Impact of cost of smart meters (single-phase & three-phase meters with and without additional features, if any) on the consumers and the cost benefit analysis of installation of smart meters needs to be further examined.

After discussion, the Forum decided to constitute a Working Group which could go into the proposed draft regulations in detail and submit a report to the Forum for final decision. Chairperson, CERC/FOR was authorized to constitute the Working Group (which may also include representatives of CEA, SMTF, MoP etc.) at the earliest.

#### **Business Session - III**

## Agenda Item No. 4: Study Report on "Road Map for Reduction of Cross Subsidy".

Dr. Sushanta K. Chatterjee informed the Forum about the study initiated on "Road Map for Reduction of Cross Subsidy", in pursuance to the decision of the Forum during the 40<sup>th</sup> Meeting of the Forum of Regulators. A presentation was made by the representatives of M/s. PwC, Gurgaon (Haryana) (copy **enclosed** at <u>Annexure – III</u>) on the draft report of the study, which inter alia included the following:-

- 1. Review of "Average Cost of Service" across all states of India.
- 2. Detailed study in respect of ten states i.e. Madhya Pradesh, Maharashtra, Delhi, Punjab, Himachal Pradesh, Bihar, Andhra Pradesh, Meghalaya, Rajasthan and Kerala.
- 3. The detailed review included cross subsidy coverage, cross subsidy level, movement/trend of coverage of average cost of supply, road map for reduction of cross subsidy.
- 4. Detailed review of methodologies followed for determination of cost of supply in India, i.e., embedded cost approach and simplified approach.
- 5. Other issues involved in determination of cost of supply, including,
  - a. Requirement of proper record of voltage level-wise technical and commercial losses
  - b. Requirement of clear energy flow structure
  - c. Distorted picture due to usage of peak demand to allocate costs between consumer categories
  - d. The impact of marginal cost of power purchase
  - e. Suitable adjustment of the cost of supply to reflect variations in quality of supply.
- 6. International experience , including the methods adopted for reduction of cross subsidies in Philippines, Thailand, Brazil & Australia.
- 7. Strategies for reduction of cross subsidy, including
  - a. Application / levy of a Universal Charge (UC) on all consumers. This UC would be an identical charge imposed on per-unit basis on sales to all consumers of incumbent distribution companies and collection of UC would go towards a state-wide/national fund to reduce the extent of cross subsidy in retail supply.
  - b. Dealing with cross subsidies under retail supply model. In this method the tariff of any category is designed to cover the

energy and customer related costs and the Cross subsidy is passed on to Wheeling charges. In order to adopt this method, cost of supply studies and unbundling of costs into Demand, Energy and Customer related costs and estimation of wheeling cost is a necessary pre-requisite.

- 8. Recommendations & suggested way forward specify that :
  - a. All SERCs must calculate category wise cost of supply. In the absence of detailed cost of supply studies, SERCs can use the simplified approach (based on voltage wise cost of supply) and decide upon a fixed time frame to move on to an embedded cost approach.
  - b. A roadmap should be defined with fixed time period in order to align tariffs to consumer's cost of supply.
  - c. Way Forward based on the current level of cross subsidies and method used for tariff determination the way forward for states is suggested as follows
    - i. The states where the ACoS of consumer categories is lying outside  $\pm/-20\%$  range should aim to move into the range of  $\pm/-20\%$ .
    - ii. As a next step the states should aim to measure Cost of Supply using simplified approach and align Retail Supply tariffs to this Cost of Supply of respective consumer category.
    - iii. Subsequently, the states which have already achieved the objective of National Tariff Policy and EA 2003, should move to Embedded Cost Approach for measuring Cost of Supply and continue to maintain the category wise cost coverage through year on year tariff rationalisation.
  - d. Cross subsidy enjoyed by a consumer should be shown as a separate item in customer billing statements
  - e. KYC norms can be introduced for electricity consumers, linked to their PAN/Aadhar card, which in future, can be used to transfer subsidy directly to the consumer's bank account.

The Forum endorsed the need for reduction of cross subsidies in a progressive manner and after discussion, the report was approved.

#### **Business Session - IV**

The Chairperson, CERC and FOR welcomed Shri P.K. Sinha, Secretary, Ministry of Power, who joined the proceedings of the Forum. Smt. Jyoti Arora, Joint Secretary (R&R), MoP, Smt. Varsha Joshi, Joint Secretary, MNRE and Shri Gyanesh Bharti, Director (R&R) also attended.

# Agenda Item No. 5 :Presentation & Discussion on proposed<br/>amendments to the Tariff Policy – Reference from<br/>Ministry of Power.

A presentation on "Amendments to the Tariff Policy" was made by the Director (R&R), MoP, highlighting inter alia updated status on the proposed amendments to the Tariff Policy. A copy of the presentation is **attached** as **Annexure–IV**. Various issues were discussed. After discussion, the Forum felt that the following aspects related to the proposed amendments to the Tariff Policy need to be further examined by the Ministry of Power.

# 1. Para 6.4 (1) on incentive to distribution utilities and revised solar RPO level:

The Forum felt that while promotion of solar energy is welcome, the feasibility and cost implication of 8% threshold level for minimum purchase of solar power should be examined and suitably accounted for.

#### 2. Para 6.4 (5) on Renewable Generation Obligation:

The Forum, while agreeing with the proposal for bundling of the renewable energy with thermal generation for the purpose of tariff determination, observed that such bundling should be stipulated for payment purposes and not for scheduling of power generated from the respective sources of generation. The responsibility of monitoring compliance of RGO should be with the Appropriate Commission.

#### 3. Para 6.4 (6) on levy of inter-state transmission charges:

The Forum, while agreeing with the proposal of exempting renewable energy from payment of inter-state transmission charges, observed that the cost implication of such a dispensation should be assessed and duly factored in. Further, the right to determine the time period for such dispensation should be left with the Central Electricity Regulatory Commission. Pertinently, the CERC has already extended such dispensation to solar till 2017.

# 4. Insertion of new provision under Para 6.2 (1) regarding deemed generation:

The Forum, while agreeing with the concern regarding unrequisitioned surplus generating capacity, strongly objected to the proposition of 'deemed generation' benefit to the generators for the purpose of incentive. Any attempt at extending incentive without actual generation (that is the concept of deemed generation) would be against the interests of consumers. There are other ways of compensating the generators for un-requisitioned power, for instance, allocation to other beneficiaries of the same plant; option for sale of such surplus power in the open market and enabling sharing of gains between the generator and the original beneficiary, utilization of such surplus power in the ancillary market etc. This provision should, therefore, be modified accordingly.

- 5. The Forum felt that the proposition of making tariff policy mandatory is a case of excessive delegation and arrogates to the Central Government powers that override even the provisions of the Act. The Forum felt that the existing provision of the Act, providing that the Central Commission and State Commissions, shall be "*guided by*" the National Electricity Policy, the National Electricity Plan and the Tariff Policy, is adequate and in line with the spirit of distancing Government and extending desired flexibility and freedom to the Regulators in discharge of its statutory functions. These provisions, therefore, the Forum felt, do not require any change.
- 6. The Forum agreed that the Appropriate Regulatory Commissions should necessarily determine feed-in-tariff for the energy generated from waste.

Shri P.K. Sinha, Secretary, Ministry of Power, expressed satisfaction and appreciation for the valuable insight provided by the Forum on such an important issue on power sector reforms.

A vote of thanks was extended by Dr. Sushanta K. Chatterjee, Joint Chief (RA), CERC. He conveyed her sincere thanks to all the dignitaries present in the meeting. He also thanked the staff of "FOR" Secretariat for their arduous efforts at organizing the meeting.

The meeting ended with a vote of thanks to the Chair.

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### LIST OF PARTICIPANTS ATTENDED THE FORTY SEVENTH MEETING OF

### FORUM OF REGULATORS ( FOR )

### HELD ON 06<sup>TH</sup> APRIL, 2015 AT NEW DELHI

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Chairperson	16.	Shri I.A. Khan	TSERC
		Chairperson	

17.	Shri Subhash Kumar Chairperson	UERC
18.	Shri Desh Deepak Verma Chairperson	UPERC
19.	Shri M.S. Puri Member	HERC
20.	Shri H.D. Arun Kumar Member	KERC
21.	Shri Alok Gupta Member	MPERC
22.	Shri Gurinder Jit Singh Member	PSERC
23.	Dr. Sushanta K. Chatterjee Joint Chief (RA)	CERC
	SPECIAL INVITER	2S
24.	Shri A.K. Singhal Member	CERC
25.	Shri A.S. Bakshi Member	CERC
26.	Shri P.K. Sinha Secretary	МОР
27.	Smt. Jyoti Arora Joint Secretary (R&R)	MOP
28.	Smt. Varsha Joshi Joint Secretary	MNRE
29.	Shri Gyanesh Bharti Director	МОР
30.	Shri A.K. Saxena Chief (Engg.)	CERC
31.	Shri T. Rout	CERC



# Smart Grid Concept, Features & Benefits



"A smart grid is an electrical grid with automation, communication and IT systems that uses two way digital communication technology which can monitor power flows from points of generation to points of consumption (even down to the appliances level) and control the power flow or curtail the load to match generation in real time"

# Smart Grid-Concept







# Smart Grid-Key features



Principal Characteristics	Today's Grid	Smart Grid
Self Healing	Needs human Intervention	Automatically detects and responds
Motivated and Participative consumer	Un-informed and Non- Participative Consumers	Consumer/Prosumer Engagement
Resists Attack	Vulnerable to Attacks & Natural disasters	Resilient & Rapid Restoration Capabilities

# Smart Grid-Key features



Principal Characteristics	Today's Grid	Smart Grid
Generation & Storage Options	Negligible Storage and Decentralized Generation	Integrating DDG, Renewable Energy Sources and Storage.
Quality Power	Focus on outages rather than power quality	Quality power to Customers.
Asset Optimization	Poor Asset Management; Time based maintenance	Real time Monitoring & Condition based Maintenance.

# Smart Grid-functionalities

electricity they add to the grid

AMI enables metering, billing, energy auditing, and advanced features of demand response.

Designed to provide effective power management,

and includes a portfolio of demand response options

Peak Load Management

Microgrid

AMI

To achieve specific local goals, such as reliability, diversification of energy sources, and cost reduction,

Energy **Storage**  Devices that store energy to perform useful processes at a later time for Grid Management













# Smart Grid-functionalities

Real-time monitoring & control system operation for State-of the art distribution management

Outage Management

SCADA/DMS

system restoration and efficient crew management Address Voltage flickering (Sags/Swells), unbalanced and harmonic distorted supply etc.

**Power Quality** Management

Renewable Integration

Enhancing grid flexibility and increasing the value of renewable energy

PHEV

Plug-in Hybrid Electric Vehicle for Balancing the aggregate demand required for charging









# **Benefits of Smart Grid Deployment**

DILLY



Asset Optimization
 Reduction of T&D losses
 Improved Collection eff.
 Peak load management
 Reduced Power Cost
 Increased grid visibility

- ✓ Self-healing grid
- ✓ Renewable integration

✓ Higher Accessibility

- ✓ Improved Power reliability
- ✓ Backup requirement redn.
- ✓ Quality Power
- ✓ User friendly
  - Transparent interface
- CC SA ✓ ToU tariff, DR programs ✓ Net metering etc.

- ✓ Satisfied customers
- ✓ Financially sound utilities

REGULATOR

- ✓ Tariff neutral system modernization
- Reduction in emission intensity



**GRID** – Energy Utilities and Mining

# Road Map for Reduction in Cross Subsidy Final Presentation

Strictly Private and Confidential 6 April 2015



# pwc

## Agenda

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## Agenda

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# Section 1 Approach and methodology

# Phased approach

## Phase 1

- 1. What are cross subsidies?
- 2. Review of legal and regulatory framework
- 3. Review of Status of cross subsidies across states in India

### Phase 2

- 1. Review of the performance of select states
- 2. Study cost of supply methodology followed across states

### Phase 4

Recommendations and way forward

## Phase 3

Review of cross subsidies, structure and procedure used for reduction of cross subsidy in the international context

# Section 2 *Review of ACoS coverage across all states*

## Category wise average tariffs – a review

			AB	R			ACoS coverage					
State	FY	Domestic	Agricultural	Industrial	Commercial	ACoS	Domestic	Agricultural	Industrial	Commercial		
North												
Jammu & Kashmir	FY15	2.13	2.57	3.87	3.54	5.69	37%	45%	68%	62%		
Himachal Pradesh	FY15	4.28	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	-				i							
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%		

## Category wise average tariffs – a review (contd.)

		ABR AQ						ACoS co	ACoS coverage			
State	FY	Domestic	Agricultural	Industrial	Commercial	ACoS	Domestic	Agricultural	Industrial	Commercia		
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	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%		

In most of the states, Domestic and Agricultural categories continue to get cross subsidised beyond the 80% range

## Categorization of states according to cross-subsidy levels

Industry &	-	Maharashtra	Delhi
Comm >120%		MP	Chhattisgarh
ACoS coverage		Andhra	Tamil Nadu
Industry or Comm <120% ACoS coverage	-	-	Kerala
Industry & Comm <=120% ACoS coverage	Punjab HP Assam	Rajasthan / Bihar {	Uttarakhand Uttar Pradesh Goa, Meghalaya Jharkhand Gujarat
	Agri & Domestic	Agri or Domestic	Agri & Domestic
	>=80% ACoS	<80% ACoS	<80% ACoS
	coverage	coverage	coverage

# States with all categories below 100% ACoS coverage:

- 1. J&K
- 2. Arunachal
- 3. Manipur
- 4. Nagaland
- 5. Mizoram

These states continue to subsidise domestic and agricultural categories beyond the 80% limit while reducing the tariffs for subsidising categories

Subsidising categories (+)

Subsidised categories (-)

# Section 3 Selection of states for detailed study

## Selection of states for detailed study



### Selection criterion -

- **1. Region:** states have been chosen from each of the 4 regions i.e. north, south, east and west
- **2. Data availability:** states which have published ACoS coverage data in their tariff orders have been given preference
- **3.** ACoS coverage: from each region, states which show large deviation from the  $\pm 20\%$  limit of ACoS coverage have further been selected to study reasons behind higher cross subsidies
- **4. 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

# Section 4 *Review of cross subsidy in selected states*

# Detailed review of 10 Indian States

In this section we have studied the tariff orders issued by relevant state commissions in last 5 years. Based on the data mentioned below we've done the following analysis -



targeted cross subsidy levels as per the roadmap.

the movement of category wise ACoS coverage and established whether their tariffs are moving towards or away from their ACoS.

## Madhya Pradesh



### **Cross subsidy movement**

- ACoS coverage is high for Domestic and Agriculture category
- Sharp increase in absolute levels of cross-subsidy to Agriculture over the last five years due to increase in energy sales
- ACoS coverage for HT and LT consumers outside the prescribed limits
- Rs. 1750 crore would be required to remove cross subsidy for subsidizing categories without any tariff hike for subsidized categories
- MPERC calculated voltage wise cost of supply in FY2014-15 using a simplified approach based on method given by APTEL in judgment no. 102 in 2010

#### **Tariff hike required** to bring the category to ACoS:

**Cross subsidy in Rupee Terms** 

LT Agriculture – 29% LT Domestic - NA

#### **FY13** Trend\* **FY11 FY11 FY12 FY14** FY15 **FY12 FY13 FY14 FY15 FY11 Category within** LT Road Actual ACoS coverage ±20% map Domestic (136) (182)(129)(159)39 97% Т Domestic 100% 95% 95% 98% 100% Non Domestic 228 290 363 436 437 Category below 20% Industrial 88 119 133 77 135 Agriculture (0-300) 73% Agriculture (805)(929)(1,156)(1, 425)(1,715)77% Т 75% 73% 77% 75% Agriculture (above 300) 80% нт Category above 20% Industrial 380 423 505 610 688 Non Domestic 120% 139% 140% 136% 140% 136% U Non-Industrial 108 76 146 171 160 LT Industry 120% 124% 123% 123% 122% 122% Т Irrigation, PWW and (7) (4)(45)(22)(35)А HT Industrial 120% 121% 119% 121% 120% 123% other than Agriculture

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#### \*T – Towards ACoS, U – Uneven trend, A – Away from ACoS

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## Maharashtra

Method of CS calculationACoS coverageCS roadmapFY2012-13 to FY2015-16	CS measurement	Since FY2002-03
<b>CS roadmap</b> FY2012-13 to FY2015-16	Method of CS calculation	ACoS coverage
	CS roadmap	FY2012-13 to FY2015-16
91538 10,628 7,610 5,216 Total Energy Sales (MU) 100% 75% 26% 30% 29% 50% 41% 36% 51% 00% 25% 55% 51% 20% 37% Commercial 0% 00% 00% 00% 00% 00% 00% 00% 00% 00%	91538 10,628 100% 75% - 26% 30% 50% - 41% 25% - 5% 51% 19%	7,6105,216Total Energy Sales (MU)14% 29% 29% 36%51%Others Agricultural Industrial S7%36% 20%37%Commercial Domestic

### **Cross subsidy movement**

- Cross subsidies outside the +/- 20% range for almost all categories
- High level of cross subsidy to agriculture consumers
- Cross-subsidies to domestic consumers have increased substantially in the last few years
- BPL consumers pay only around 20 % of CoS
- MERC in its tariff orders does not calculate category wise or voltage wise CoS. Average Cost of Supply is used to measure cross subsidy.
- Rs. 8033 crore would be required to remove cross subsidy for subsidizing categories without any tariff hike for subsidized categories

#### Tariff hike required to bring the category to ACoS:

LT Agriculture (unmetered) – 127% LT Domestic - 14%

### **Cross subsidy in Rupee Terms**

	FY11	FY12	FY13	FY14	FY15	FY16	Actual	Trond*		FY09	FY10	FY11	FY12	FY13
LT Category	Traje	ctory for	cross sub	osidies in	the Road	dmap	FY13	menu	LT Catagomy					Ŭ
BPL	20%	21%	23%	25%	27%	29%	21%	-				(0.4)	(01)	(o <b>-</b> )
Domestic	64%	70%	76%	83%	90%	98%	88%	А	brL	-	-	(24)	(91)	(95)
Non Domestic	149%	142%	135%	120%	118%	118%	176%	А	Domestic	174	(204)	(900)	(1080)	(1,015)
Agriculture	51%	56%	61%	66%	72%	78%	/		Non-Domestic	564	640	870	1,231	1,670
unmotorod	5170	3070	01/0	0070	/2/0	/0/0	44%	Т	Agriculture unmetered	(2,874)	-	-	(3490)	(3,321)
	0/	0/	0/	0 (	0 /	0/	0/		Agriculture metered	(1,676)	(1,485)	(1,677)	(3,169)	(3,443)
Agriculture metered	37%	40%	43%	47%	51%	55%	42%	Т	Industrial	240	(6)	<b>5</b> 91	581	666
Industrial	117%	117%	117%	117%	110%	110%	129%	Α		249	(0)	321	501	000
HT Category									HT Category					
Industrial	124%	124%	120%	119%	116%	111%	135%	А	Industrial	2,076	2,078	2,720	4,384	5,488
Commercial	184%	150%	145%	131%	120%	120%	201%	А	Commercial	-	307	609	983	1,207
Agriculture	54%	58%	63%	60%	75%	82%	56%	T	Agriculture	(106)	(121)	(99)	(156)	(159)
	07/0	00/0	-0/0	\$970	/0/0	01/0	00/0	-						

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\*T – Towards ACoS, U – Uneven trend, A – Away from ACoS 12

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# Delhi



### Cross subsidy movement

**Small Industrial Producers** 

Large Industrial Producers

Commercial up to 10 kW

Commercial >100 kW

Commercial 10 to 100 kW

Industrial up to 10 kW

Industrial 10-100 kW

Industrial >100 kW

HT - Commercial

Agriculture

Domestic

**TPDDL** 

- Cross subsidies calculated separately for each discom
- Domestic category is the major recipient of cross-subsidies
- Domestic tariff not able to keep pace with ACoS Rs 7.56/unit
- Cross-subsidies for industrial, commercial consumers have been decreased
- Rs. 2,288 crore would be required to remove cross subsidy for subsidizing categories without any tariff hike for subsidized categories
- Voltage wise CoS is calculated for in MYT order of 2008, using a simplified approach based on method given by APTEL in judgment no. 102 in 2010

### Tariff hike required to bring the category to ACoS:

<u>TPDDL</u>	<u>BRPL</u>	BYPL	
Agriculture – 132%	Agriculture – 133%	Agriculture – 163%	
Domestic - 39%	Domestic - 29%	Domestic - 37%	

### **Cross subsidy in Rupee Terms**

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

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**FY12** 

105%

121%

35%

67%

**FY13** 

149%

131%

159%

120%

150%

154%

148%

172%

49%

87%

-

**FY14** 

143%

134%

160%

118%

148%

151%

153%

173%

51%

82%

-

FY15

122%

129%

121%

144%

106%

131%

134%

136%

156%

43%

72%

Tren

-

Т

U

U

Т

Т

U

U

U

U

Α
# Delhi

### Cross subsidy movement

BRPL	FY12	FY13	FY14	FY15	Trend*
Small Industrial Producers	_	-	-	129%	-
Industrial up to 10 kW		-	131%	125%	Т
Industrial 10-100 kW	101%	134%	136%	128%	U
Industrial >100 kW		160%	163%	152%	U
Large Industrial Producers	-	119%	121%	113%	U
HT – Commercial	_	139%	142%	132%	U
Commercial up to 10 kW	10.0%	147%	140%	139%	Т
Commercial 10 to 100 kW	120%	147%	152%	140%	U
Commercial >100 kW	-	171%	175%	161%	U
Agriculture	32%	48%	48%	43%	A
Domestic	69%	87%	101%	77%	U

### **Cross subsidy in Rupee Terms**

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

### **Cross subsidy movement**

BYPL	FY12	FY13	FY14	FY15	Trend*
Small Industrial Producers		-	-	130%	-
Industrial up to 10 kW		122%	129%	129%	А
Industrial 10-100 kW	99%	-	130%	130%	-
Industrial >100 kW		145%	147%	150%	А
Large Industrial Producers		110%	116%	116%	А
HT – Commercial		133%	137%	132%	U
Commercial up to 10 kW		139%	143%	139%	U
Commercial 10 to 100 kW	111%	142%	148%	145%	U
Commercial >100 kW		159%	164%	161%	U
Agriculture	30%	44%	-	38%	A
Domestic	62%	79%	79%	73%	А

### **Cross subsidy in Rupee Terms**

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

# Punjab

CS measurement	Since FY2002-03				
Method of CS calculation	ACoS coverage + CS in Rs crore				
CS roadmap	NA				
<ul> <li>Domestic</li> <li>Commercial</li> <li>Industrial</li> <li>Agricultural</li> <li>Others</li> </ul>	3% 30% 8%				

- All categories are within +/- 20% of ACOS. Cost supply to agriculture consumers paid for by State Govt.
- Cross-subsidies alignment has been achieved due to higher tariff hikes for domestic and agriculture consumers as compared to industry
- Cross subsidy for domestic consumers is on the rise
- Rs. 1,478 crore would be required to remove cross subsidy for subsidizing categories without any tariff hike for subsidized categories
- Category wise cost of supply is calculated using embedded cost approach in FY2013-14. The methodology is discussed in later slides.

### Tariff hike required to bring the category to ACoS:

Agriculture – 25% Domestic (up to 100 units) – 22%

### Cross subsidy movement

### Cross subsidy in Rupee Terms

Category	Slab	FY11	FY12	FY13	FY14	FY15	Trend*	Category	Slab	FY11	FY12	FY13	FY14	FY15
Domestic	Upto 100	78%	81%	84%	85%	82%	Т	Domestic	Upto 100	(271)	(433)	(444)	(491)	(680)
	101-300	111%	111%	110%	110%	109%	Т		101-300	143	135	158	185	181
	> 300	117%	117%	116%	117%	116%	Т		> 300	136	105	133	169	164
NRS	Upto 100	1069/	1069/	100%	117%	116%	Т	NRS	Upto 100	272	316	305	116	115
	>100	120%	120%	120%	120%	116%	А		>100				235	197
Industrial	SP	102%	102%	103%	105%	104%	А	Industrial	SP	6	10	13	29	24
	MP	112%	113%	112%	114%	113%	А		MP	80	104	119	160	154
	LP	114%	116%	116%	118%	116%	A		LP	558	716	692	1,064	970
Agricultural	Pumpset	79%	80%	83%	77%	80%	A	Agricultural	Pumpset	(942)	(994)	(994)	(1,490)	(1,143)

Direct subsidy from state government

# Himachal Pradesh

CS measurement	FY2005-06
Method of CS calculation	ACoS coverage
CS roadmap	NA
<ul> <li>7%</li> <li>Domestic</li> <li>Commercial</li> <li>Industrial</li> <li>Agricultural</li> <li>Others</li> </ul>	4% 23% 6%

- As on FY2014-15, all consumer categories are within the +/- 20% range of ACoS coverage.
- The ACoS did not increase substantially between FY2010-11 and FY2014-15 (4% CAGR growth). Therefore the commission was able to realign its tariff in this five year period.
- Category wise Cost of Supply is calculated using a simplified approach based on method given by APTEL in judgment no. 102 in 2010
- Rs. 223 crore would be required to remove cross subsidy for subsidizing categories without any tariff hike for subsidized categories

#### Tariff hike required to bring the category to ACoS:

Agriculture – NA Domestic - 11%

### Cross subsidy movement

### **Cross-subsidy in Rupee Terms**

	FY11	FY12	FY13	FY 14	FY15	Trend*		FY11	FY12	FY 13	FY 14	FY 15
Industrial Power	90%	102%	104%	106%	105%	А	Industrial	(165)	36	82	157	138
Domestic	66%	80%	80%	82%	82%	Т	Domestic	(172)	(103)	(129)	(196)	(217)
Irrigation and	<b>-</b> 90/	06%	07%	10.90/	105%	^	Irrigation and	(40)	(7)	(6)		(6)
Drinking water	/070	90%	97%	100%	105%	A	Drinking water	(42)	(/)	(0)	(/)	(0)
Commercial	118%	125%	114%	114%	108%	Т	Commercial	24	40	25	35	20
NDNC	115%	123%	114%	114%	103%	Т	NDNC	5	9	7	8	2

Direct subsidy from state government

# Bihar

CS measur	ement	FY2011-12				
Method of	CS calculation	ACoS and C	oS			
CS roadma	p	NA				
100% 75% - 50% - 25% - 0%	3,515 17% 4% 18% 12% 50% NBPDCL	5,378 13% 8% 32% 12% 35% SBPDCL	<ul> <li>Total energy sales (MU)</li> <li>Others</li> <li>Agricultural</li> <li>Industrial</li> <li>Commercial</li> <li>Domestic</li> </ul>			

### Cross subsidy movement

	FY11	FY12	FY13	FY14	FY15		Tre	nd*
					North	South	Ν	S
Kutir Jyoti	39%	40%	29%	47%	100%	100%	Т	Т
Domestic – I	20%	32%	34%	52%	100%	100%	Т	Т
Domestic –II	54%	57%	65%	78%	64%	56%	Т	U
Non-Domestic – I	42%	42%	42%	69%	100%	100%	Т	Т
Non-Domestic – II	113%	116%	132%	107%	113%	105%	Т	Т
Non-Domestic –III	57%	62%	62%	65%	75%	65%	Т	Т
Irrigation – I	22%	0.00/	21%	18%	100%	100%	U	U
Irrigation – II	92%	26%	102%	81%	66%	86%	Α	Α
LT Industrial – I	100%	93%	108%	93%	97%	94%	U	Т
LT Industrial – II	104%	103%	122%	97%	97%	90%	Т	Т
HT Industrial – I	102%	94%	119%	106%	112%	107%	А	Α
HT Industrial – II	100%	91%	111%	107%	117%	107%	Α	А
HT Industrial – III	98%	87%	105%	94%	101%	92%	U	U
HTSS	71%	64%	69%	85%	124%	76%	Т	Т

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Direct subsidy from state government

- Voltage wise Cost of Supply is calculated using a simplified approach based on method given by APTEL in judgment no. 102 in 2010.
- Kutir Jyoti, Domestic-I, Non Domestic-I and IAS-1 Categories show 100% ACoS coverage as the revenue gap between ABR and ACoS is funded via subsidy support from State Government
- In FY15, categories like HTSS and HTS-III which are subsidizing in NBPDCL, are subsidized categories in SBPDCL.
- Rs. 2106 cr and Rs. 5283 cr for NBPDCL and SBPDCL resp. would be required to remove cross subsidy for subsidizing categories without increasing the tariff for subsidized category

#### Tariff hike required to bring the category to ACoS:

Irrigation and Agricultural I– NA Domestic I - NA

#### **FY11 FY12 FY13 FY14 FY15** North South (698)Kutir Jvoti (936)(1787)(1482)0 0 Domestic – I (3539)(3579) (3794)(2150)0 0 Domestic -II (4016) (3660)(2722)(2614)(1868)(4123) Non-Domestic – I (58)(99)(70)(38)0 0 Non-Domestic – II 378 535 1013 365. 307 210 (7) Non-Domestic -III (25)(16)(37)(7) (2)Irrigation - I (1386) (1784)(2562)0 0 (1684) Irrigation - II (29)(238)(238)(88)35 LT Industrial – I 0 (84)143 (81) (16)(47)LT Industrial - II 15 15 234 (21)(10)(60)HT Industrial – I (317)2143 299 200 267 55 HT Industrial - II 86 (159)600 0 103 72HT Industrial - III (14)(85)(79)2 (91) 119 HTSS (1010)(1999)(373)(507)127 (874)

### **Cross-subsidy in Rupee Terms**

\*T – Towards ACoS, U – Uneven trend, A – Away from ACoS 17

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# Andhra Pradesh

CS measurement	NA
Method of CS calculation	NA
CS roadmap	NA



### <u>Cross subsidy movement</u>

	FY11	FY12	FY13	FY14	Trend*
LT					
Domestic	103%	105%	100%	87%	Т
Non Domestic	185%	175%	159%	169%	Т
Industrial	136%	139%	137%	113%	Т
Agricultural	39%	42%	42%	48%	Т
НТ					
Industrial- General	114%	114%	122%	128%	А
Industry - Other	168%	168%	165%	168%	Т
Irrigation & Agriculture	102%	77%	74%	102%	U

Direct subsidy from state government

- Category wise Cost of Supply is calculated using embedded cost approach. Calculated from FY2000-01 tariff order.
- Category wise revenue based on Full Cost Recovery Tariff (FCRT) which results in zero revenue gap. Thus ACoS coverage is inclusive of direct subsidy from government.
- As on FY2014-15, subsidizing categories of LT Non Domestic and HT Industry show ACoS coverage outside 120% limit. Most consumer categories show cross subsidy coverage movement towards ACoS.
- Rs. 6137 cr would be required to remove cross subsidy for subsidizing categories without increasing the tariff for subsidized category

#### Tariff hike required to bring the category to ACoS:

LT Agriculture – 107% LT Domestic - 14%

### **Cross-subsidy in Rupee Terms**

	FY11	FY12	FY13	FY14
LT				
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				
Industrial- General	886	1,070	2,283	3,378
Industry - Other	573	658	886	1,075
Irrigation & Agriculture	6	(553)	(126)	12

# Meghalaya

CS measurement	FY2010-11
Method of CS calculation	ACoS coverage
CS roadmap	Broad voltage wise



- Voltage wise or category wise CoS is not calculated in the tariff orders
- The Commission in FY11 tariff order published ACoS coverage for broad voltage categories of EHT, HT, LT Non Domestic and LT Domestic along with a roadmap for cross subsidy reduction
- In FY2014-15, ACoS coverage for subsidising consumer categories are within the +/- 20% range but they show a trend of moving away from ACoS.
- In FY2014-15, the subsidised categories show a trend of cross subsidy coverage moving towards ACoS however currently they are outside the +/- 20% range.
- Rs. 557 cr would be required to remove cross subsidy for subsidizing categories without increasing the tariff for subsidized category

#### Tariff hike required to bring the category to ACOS:

LT Agriculture – 81% LT Domestic - 33%

### Cross subsidy movement

	FY11	FY12	FY13	FY14	FY15	Trend*
LT						
Domestic	72%	69%	72%	73%	76%	Т
Kutir Jyoti	116%	78%	69%	32%	56%	U
Commercial	116%	109%	115%	115%	118%	А
Agriculture	38%	38%	40%	46%	55%	Т
HT						
Industrial	111%	105%	111%	115%	115%	А
Commercial	111%	104%	111%	111%	117%	U
EHT						
Industrial	106%	97%	104%	106%	108%	A

### **Cross-subsidy in Rupee Terms**

	FY11	FY12	FY13	FY14	FY15
LT					
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)
НТ					
Industrial	15	62	315	263	219
Commercial	1	3	16	20	24
EHT					
Industrial	5	(41)	187	126	89

# Rajasthan



### Cross subsidy movement

JVVNL	FY10	FY11	FY12	FY13	FY14	Trend*
Domestic	78%	80%	85%	92%	93%	Т
Non-Domestic	111%	114%	123%	125%	122%	А
Agriculture (Metered)	26%	27%	29%	42%	71%	Т
Agriculture (Flat)	25%	26%	28%	42%	72%	Т
Small Industry	87%	90%	104%	102%	99%	Т
Medium Industry	91%	95%	107%	106%	104%	Т
Large Industry	91%	94%	100%	102%	101%	Т

- Voltage wise or category wise CoS is not calculated in the tariff orders
- As on FY2013-14, except Agriculture category all other consumer categories are within the +/- 20% range of ACoS coverage
- Agricultural consumers underwent significant tariff hikes in FY13 and FY14. This has led to increase in ACoS coverage to approx. 70% in all discoms
- ACoS coverage calculations are inclusive of government subsidy
- Rs. 1017 cr, Rs. 1021 cr and Rs. 1362 cr for JVVNL, AVVNL and JdVVNL respectively would be required to remove cross subsidy for subsidizing categories without increasing the tariff for subsidized category

#### Tariff hike required to bring the category to ACOS:

JVVNL	AVVNL	JdVVNL
Agriculture – 39%	Agriculture – 45%	Agriculture – 8%
Domestic - 8%	Domestic - 11%	Domestic - 42%

#### **Cross-subsidy in Rupee Terms**

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

Direct subsidy from state government

# Rajasthan

### Cross subsidy movement

#### **Cross-subsidy in Rupee Terms**

AVVNL	FY10	FY11	FY12	FY13	FY14	Trend*	AVVNL	FY10	FY11	FY12	FY13	FY14
Domestic	79%	76%	86%	87%	90%	Т	Domestic	(165)	(224)	(158)	(193)	(169)
Non-Domestic	109%	104%	125%	122%	115%	А	Non-Domestic	20	11	66	74	79
Agriculture (Metered)	25%	24%	28%	39%	68%	Т	Agriculture (Metered)	(804)	(985)	(969)	(978)	(576)
Agriculture (Flat)	23%	23%	28%	40%	69%	Т	Agriculture (Flat)	(426)	(346)	(472)	(433)	(248)
Small Industry	84%	81%	97%	97%	95%	Т	Small Industry	(17)	(21)	(4)	(6)	(7)
Medium Industry	85%	82%	99%	99%	95%	Т	Medium Industry	(39)	(53)	(4)	(4)	(21)
Large Industry	86%	83%	107%	106%	100%	Т	Large Industry	(150)	(204)	83	90	1

### Cross subsidy movement

### **Cross-subsidy in Rupee Terms**

JdVVNL	FY10	FY11	FY12	FY13	FY14	Trend*	JdVVNL	FY10	FY11	FY12	FY13	FY14
Domestic	85%	83%	89%	87%	93%	Т	Domestic	(109)	(146)	(115)	(176)	(110)
Non-Domestic	115%	112%	127%	120%	116%	А	Non-Domestic	32	30	70	69	83
Agriculture (Metered)	25%	25%	28%	39%	68%	Т	Agriculture (Metered)	(977)	(1,213)	(1,951)	(1,805)	(1,021)
Agriculture (Flat)	25%	24%	28%	40%	70%	Т	Agriculture (Flat)	(378)	(302)	(531)	(485)	(225)
Small Industry	89%	87%	100%	95%	97%	Т	Small Industry	(11)	(14)	0	(7)	(4)
Medium Industry	95%	92%	111%	101%	99%	А	Medium Industry	(10)	(17)	25	2	(2)
Large Industry	94%	92%	107%	102%	114%	А	Large Industry	(27)	(44)	40	13	80

Direct subsidy from state government

# Kerala

CS measurement	Since FY2013-14
Method of CS calculation	ACoS coverage
CS roadmap	NA



- Voltage wise or category wise Cost of Supply is not calculated in the tariff orders of KSEB. ACoS is used as the basis for tariff determination.
- As of FY2014-15, most of the categories have ACoS coverage outside the +/- 20% range and show a trend of moving away from ACoS.
- Tariffs were revised in FY2013-14 and FY2014-15 in order to reduce the revenue gap which in turn led to increase in ACoS coverage of all categories
- Rs. 15121 cr would be required to remove cross subsidy for subsidizing categories without increasing the tariff for subsidized category

#### Tariff hike required to bring the category to ACOS:

LT Agriculture – 121%

LT Domestic - 40%

### Cross subsidy movement

### **Cross-subsidy in Rupee Terms**

Category	FY11	FY12	FY13	FY14	FY15	Trend*	Category	FY11	FY12	FY13	FY14	FY15
LT Domestic	48%	49%	43%	61%	71%	Т	LT Domestic	(14657)	(14787)	(21426)	(20106)	(14200)
LT Industrial	98%	102%	87%	111%	113%	А	LT Industrial	(118)	87	(662)	79	794
LT Agricultural	23%	23%	20%	37%	45%	Т	LT Agricultural	(772)	(784)	(919)	(1052)	(921)
LT Non- Domestic	-	-	149%	151%	186%	А	LT Non- Domestic	-	-	1321	1592	2891
LT Commercial	175%	180%	158%	162%	171%	А	LT Commercial	5643	6639	4314	4923	6776
HT Industrial	-	-	89%	113%	117%	А	HT Industrial	-	-	(808)	245	1593
HT Agriculture	-	-	67%	93%	104%	Т	HT Agriculture	-	-	(12)	(4)	2
HT Commercial	-	-	106%	167%	183%	А	HT Commercial	-	-	272	2873	2736

# Section 5 *Cost of Supply methodologies – review of select states*

# Review of methodologies followed for cost of supply in India



Two kinds of approach followed by states in India to calculate CoS

Embedded cost approach

Embedded cost approach required detailed technical studies and is followed by Punjab, Haryana, AP and TN

# Simplified approach

Other states have followed a simplified approach of allocating costs among various consumer categories.

### **Embedded Cost approach**

		For supply constrained states	For supply un- constrained states	
ation	Generation	PP & Gen/ fuel cost	PP & Gen/ fuel cost	
ionaliza	Transmission	Trans. related costs	Trans. related costs	Distribution system is designed to meet the system peak demand, therefore the contribution of
Funct	Distribution	Dist. related costs	Dist. related costs	demand <i>can be used as allocation</i> <i>factor</i> . System peak methods
n	Generation	Energy Related	Demand Related Energy Related	<ul> <li>Tannual peak</li> <li>Average of 12 monthly peaks</li> <li>Seasonal peaks</li> </ul>
ificatio	Transmission	Demand Related	Demand Related	/
Class	Distribution	Demand related Customer related	Demand related Customer related	While HT categories account for lesser
	Demand	Based on share in system peak demand	Based on share in system peak demand	<ul> <li>no. of consumers, their connected</li> <li>load can be more than LT categories.</li> <li>To address this variance, category</li> </ul>
Allocation	Energy	Based on energy sales to each consumer category	Based on energy sales to each consumer category	wise weightages can be derived . These weightages can be average of two parameters - sales per customer and load per customer.
ł	Customer	Based on number of consumers/load factor	Based on number of consumers/load factor	6 April 2015 25

# Data required for carrying out CoS calculation using embedded approach

Used for classification of costs into demand / energy / customer related costs

Used as factors for allocation of costs to various voltage / consumer categories

Used for allocating energy related charges across consumer categories

Used for allocating demand related charges across consumer categories

- 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
- 5. Voltage wise Loss levels
- 6. Load research data of sample feeders



- Depreciation
- Interest & Finance
- Capitalised expenses

<u>Appendix</u> —

### Simplified approach

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 Cost etc.	Per Unit CoS at each voltage level
Approved gross sales in MU have been allocated to various voltage levels in the proportion of energy sales to these voltage levels by Discoms	Voltage wise loss 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 to the voltage level under consideration.	CoS = Retail ARR (per unit)+ Wheeling Charge (per unit)

# Data required for carrying out CoS calculation using simplified cost approach



### Selection of CoS method based on data availability

Costs related —	>
data availability	

↓ Sales related ✔ data availability	Power Purchase Cost + Network cost	Generation, Transmission & Distribution
Voltage wise sales & losses	Simplified Approach (Bihar/MP/Delhi model)	
<ul> <li>Voltage wise</li> <li>sales &amp; losses</li> <li>load research data</li> <li>Consumer indexatio</li> <li>connected load</li> <li>no. of consumers</li> </ul>	n	Embedded Cost Approach (Punjab/AP/Assam model)

\*Based on the availability of data the states should select the appropriate method for CoS study

Section 5 - Cost of Supply methodologies -review of select states



## Issues in determination of cost of supply

- 1. Proper record of voltage level wise technical and commercial losses is required: Measurement of voltage wise losses is done based on sample assessments/assumptions.
- 2. Clear energy flow structure is required: Due to non-availability of clear energy flow structures it becomes difficult to allocate costs to various voltage levels / consumer categories.
- 3. Use of peak demand to allocate costs between consumer categories may give a distorted picture: The electricity supply in most of the states is restricted. Peak demands are therefore not naturally occurring due to various measures like load shedding and supply for limited time shifts.
- 4. Marginal cost of power purchase: Faster growing consumer categories put higher requirement to purchase expensive power. This difference between power purchase costs cannot be observed in ACoS.
- 5. Methodology for suitably adjusting the cost of supply to reflect variations in quality of supply need to be devised: consumers who get poor quality of supply should not be burdened. Categories like agriculture which get regulated power supply end up being penalized for servicing urban areas during peak hours.
- 6. Assuming a same CoS for the entire state : In states with multiple Discoms, calculating overall voltage wise cost of supply for the entire state, can mask inter regional cross subsidies.

# Section 6 Strategies for reduction of cross subsidies

Section 6 - Strategies for reduction of cross subsidies

# <u>Philippines</u>

*EPIRA 2001 mandated that all types of cross subsidies should be phased out within 3 years of establishing a Universal Charge (UC).* 

Phases in removal of cross subsidy:

- 1. Unbundling of electricity tariff
- 2. Removal of Inter-Grid and Intra-Grid subsidies
- 3. Removal of Inter-Class subsidy in two phases of 40% and 60% reduction each

# <u>Brazil</u>

- Unlike India, in Brazil the large industrial consumers were subsidized consumers. This reduced their incentive to shift on open access.
- In June 2001, Comitê de Revitalização was established. It recommended following -
  - undertake studies to determine amount of cross subsidies
  - eliminate these cross subsidies in next 5 years
  - Unbundling of tariffs
- Between 2004 and 2006 cross-subsidy was eliminated through re-alignment of tariffs

# <u>Australia</u>

In 1999, National Electricity Market (NEM) was created, linking six states of eastern and southern Australia In 2002, full retail competition was introduced in New South Wales Electricity Tariff Equalisation Fund (ETEF) was formed so that distributors supplying customers at

formed so that distributors supplying customers at regulated rates must contribute to the fund when spot market prices fall below reference price and are compen-sated by the fund when spot market prices rise above it.

# <u>Thailand</u>

Power Development Fund was set up under Office of the Energy Regulatory Commission (OERC) for development or rehabilitation of localities affected by power plant operation. Electricity Generators contribute to this fund.

Inter-regional subsidy - EGAT sells power at lower price to PEA than to MEA.

People with less than 150 Kwh usage per month enjoy a minimal tariff (almost free).



Section 6 – Strategies for reduction of cross subsidies

### Strategy 1 - Universal Charge Model

### Learning From - Philippines/Thailand/Australia

A Universal Charge (UC) may be imposed on all consumers. This UC would be an identical charge imposed on per-unit basis on sales to all consumers of incumbent distribution companies and collection of UC would go towards a state-wide/national fund to reduce the extent of cross subsidy in retail supply

Illustration:

- The illustration shows a simplified working model showing the proposed mode of levying Universal Charge (UC) and its subsequent utilization towards reducing cross-subsidies.
- The illustration uses cost of supply data from Punjab to estimate working of UC
- The illustration looks at a five-year time period. Cross subsidies (in this illustration) are entirely removed within this time period.
- In other states model may be extended to further years and/or modified accordingly once a timeframe is decided for elimination of cross-subsidies



# Strategy 2 - Dealing with cross subsides under retail supply model

		Domestic	Agricultural	Industrial	Commercial
CoS	Cost of Supply	6	9	2	4
W	Wheeling	2	4	0.5	2
Е	Energy	2	2	1	1
С	Customer	2	3	0.5	1
т	Tariff	4	5	5	7
E+C	Minimum Tariff payable	4	5	1.5	2
T-CoS	Subsidy Enjoyed (T-CoS)	(2)	(4)	3	3
	Loss to wheeling company	2	4	(1.5)	(1)

All figures in Rs. per unit. For representation purpose only.

- The tariff of any category must cover the energy and customer related costs.
- Cross subsidy is passed on to Wheeling charges.
- Cost of supply studies and unbundling of costs into Demand, Energy and Customer related costs and estimation of wheeling cost is a necessary pre-requisite for rolling out such a scheme

# Section 7 Way Forward and Key Recommendations

# Key Recommendations (1/3)

- 1. Roadmap for calculation of Cost of Supply All SERCs must calculate category wise cost of supply. In absence of detailed cost of supply studies, SERCs can use the simplified approach and decide upon a fixed time frame to move on to an embedded cost approach.
- 2. Roadmap for reduction of cross subsidies A roadmap should be defined with fixed time period in order to align tariffs to consumer's cost of supply.

<u>Click here</u> for a representative trajectory for select states.

3. Cross Subsidy - Subsidy amount can be set considering factors like number of units consumed (like in case of Delhi), the capacity of consumer to pay, alternate sources of fuel available to consumer etc.

# Key Recommendations (2/3)

- 4. Way Forward based on the current level of cross subsidies and method used for tariff determination the way forward for states is suggested as follows -
  - Block I All major categories outside +/-20% range

Way Forward - Such states should first aim to first move into Block II by getting major consumer categories into +/-20% range.

• <u>Block II – All major categories within +/-20% range</u>

Way Forward - Such states should aim to measure Cost of Supply using simplified approach and align Retail Supply tariffs to this Cost of Supply of respective consumer category.

• <u>Block III – All major categories within +/-20% range + use simplified approach</u>

Way Forward - Such states have already achieved the objective of National Tariff Policy and EA 2003. They should move to Embedded Cost Approach for measuring Cost of Supply and continue to maintain the category wise cost coverage through year on year tariff rationalisation.

## Key Recommendations (3/3)

- 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:
  - i. Cost of Supply to the respective consumer category
  - ii. Tariff charged from consumer
  - iii. Source and amount of cross subsidy (Difference between the CoS and tariff)
- 6. **KYC** 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.

Strive to achieve the best!

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# Appendix 1 Heat Maps of cross subsidy comparison across states

### Comparison of broad consumer categories



As seen in previous slide, while in absolute terms for most of the states the domestic category is below 80% ACoS coverage, when compared with each other most of the states have similar range of ACoS coverage States with high agricultural activity like UP, Uttarakhand, Maharashtra, Jharkhand, Gujrat continue to have even less than 50% of ACoS coverage

### Comparison of broad consumer categories

### INDUSTRIAL CATEGORY

# **COMMERCIAL CATEGORY** 117 142.5 100

Western and Southern states of Maharashtra, Madhya Pradesh, Andhra Pradesh and Tamil Nadu continue to charge high tariff in order to support agricultural consumers.

# Appendix 2 Selection of states for detailed study



# North Region

States	Max ACoS coverage > 120%	Min ACoS Coverage < 80%	Major category by sales	ACoS coverage published	Major subsidizing category	Major subsidized category
Delhi	$\checkmark$	$\checkmark$	Domestic	$\checkmark$	Commercial	Domestic
Haryana	NA	NA	Industrial	NA	NA	NA
Himachal	-	-	Industrial	$\checkmark$	Industrial	Domestic
J&K	NA	NA	Domestic	NA	NA	NA
Punjab	-	-	Industrial	$\checkmark$	Industrial	Agricultural
Rajasthan	$\checkmark$	$\checkmark$	Agricultural	$\checkmark$	Industrial	Agricultural
Uttar Pradesh		$\checkmark$	Domestic		Industrial	Domestic
Uttarakhand		-	Industrial	$\checkmark$	Industrial	Domestic

• Himachal Pradesh has been chosen to represent hilly states.

- Delhi has been chosen as unlike other states, in Delhi, commercial category is the subsidizing category.
- Punjab has been chosen as it has majority of sales in Agricultural category, while having all categories within +/-20% ACoS coverage
- Rajasthan has been chosen as the state has very small deviation from  $\pm 20\%$  limit of ACoS coverage



# South Region

States	Max ACoS coverage > 120%	Min ACoS Coverage < 80%	Major category by sales	ACoS coverage published	Major subsidizing category	Major subsidized category
Andhra	NA	NA	Agriculture	NA	NA	NA
Karnataka	NA	NA	Agriculture	NA	NA	NA
Kerala	-	$\checkmark$	Domestic	$\checkmark$	Commercial	Domestic
Tamil Nadu	$\checkmark$	$\checkmark$	Domestic	$\checkmark$	Industrial	Domestic

- 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 Region

States	Max ACoS coverage > 120%	Min ACoS Coverage < 80%	Major category by sales	ACoS coverage published	Major subsidizing category	Major subsidized category
Arunachal	NA	NA	Industrial	NA	NA	NA
Assam	-	-	Domestic	$\checkmark$	Industrial	Domestic
Bihar	$\checkmark$	$\checkmark$	Domestic	$\checkmark$	Industrial	Domestic
Jharkhand	NA	NA	Domestic	NA	NA	NA
Manipur	NA	NA	Domestic	NA	NA	NA
Meghalaya	-	$\checkmark$	Industrial	$\checkmark$	Industrial	Domestic
Mizoram	NA	NA	Domestic	NA	NA	NA
Nagaland	NA	NA	Domestic	NA	NA	NA
Odisha	NA	NA	NA	$\sqrt{\text{(voltage-wise)}}$	NA	NA
Sikkim	NA	NA	Industrial	NA	NA	NA
Tripura	NA	NA	Domestic	NA	NA	NA

- From the north east region, Meghalaya which regularly publishes ACOS coverage information, has been chosen.
- Also we choose Bihar as subject of further study, because the energy consumption in this state is highly skewed towards Industrial and Domestic categories.



## West Region

States	Max ACoS coverage > 120%	Min ACoS Coverage < 80%	Major category by sales	ACoS coverage published	Major subsidizing category	Major subsidized category
Goa	$\checkmark$	$\checkmark$	Industrial	$\checkmark$	Industrial	Domestic
Gujarat	NA	NA	Industrial	NA	NA	NA
Chhattisgarh	$\checkmark$	$\checkmark$	Industrial	$\checkmark$	Industrial	Domestic
Maharashtra	$\checkmark$	$\checkmark$	Industrial	$\checkmark$	Industrial	Domestic
Madhya Pradesh	$\checkmark$	$\checkmark$	Agricultural	$\checkmark$	Industrial	Agricultural

• From the west region of India, we chose 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 reduce cross subsidy by the FY2015-16.

# Appendix 3 *Cost of supply*
# FOIR Study- Estimation of cost of supply

## Step 1

## Functionalisation –

The total cost was classified into Generation, Transmission and Distribution function Costs

Step 2					
Classification –					
Cost Function	<b>Cost Classification</b>				
Power Purchase &	Demand Related				
Generation	<b>Energy Related</b>				
Transmission	Demand Related				
Distribution	Demand Related				
	<b>Energy Related</b>				
	<b>Customer Related</b>				

## Step 3

## Allocation –

The D, E and C costs are then further allocated to consumer categories based on factors like peak demand or connected load

Cost Function	Factor for Allocation of Costs
Demand Related	Coincident peak demand
Generation - Energy Related	On the basis of 'block growth approach'
Transmission & Distribution -	Share as per energy sales
Energy Related	
Customer Related	Number of consumers

# FOIR Study- Estimation of cost of supply

## Block growth approach

- Identify base year. Consumption and losses in base year Base Block
- Identify current year. Consumption and losses in current year, over and above the base Growth Block
- Stack stations in merit order of purchase
- Identify stations that will serve the Base Block. Calculate cost of Base Block (X1). Remaining stations will serve as Growth Block. Calculate cost of Growth Block (X2)
- Variable cost of a category =
- Base year cost = X1\* base year consumption
- Growth cost = X2\*incremental consumption

# FOIR Study- Estimation of cost of supply

## CAGR of sales growth in last 4/5 years in various states

	Kerela	AP	Bihar	MP	Maharash tra	Rajasthan	Punjab	HP
Domestic	6%	7%	3%	16%	8%	11%	8%	11%
Agricultural	6%	5%	5%	17%	13%	10%	0%	4%
Industrial	19%	-9%	4%	8%	3%	4%	3%	5%
Commercial	5%	7%	11%	10%	11%	14%	7%	10%
Agriculture - Highest growth	14%	2%	6%	0%	о%	4%	8%	6%

The methodology suggested in FOIR would lead to increase in cost of supply of agriculture when supply to agriculture is indeed growing quickly. Penalises rural consumers for late electrification.

# Assam - Estimation of cost of supply

## Step 1

## Functionalisation –

The total cost of AERC was classified into Generation, Transmission and Distribution function Costs

### Step 2

**Classification** –

Cost Function	<b>Cost Classification</b>
Power Purchase &	Demand Related
Generation	<b>Energy Related</b>
Transmission	Demand Related
Distribution	<b>Demand Related</b>
	<b>Customer Related</b>

## Step 3

## Allocation –

The D, E and C costs are then further allocated to consumer categories based on factors like peak demand or connected load

Cost Function	Allocation of Costs
Generation – Demand Related	Share as per % peak causation by various categories
Energy and Wheeling	Share as per energy sales
Distribution- Demand Related	Share as per percentage peak causation
Distribution- Customer Related	Share as per % off-peak causation by categories

Appendix 3 – Cost of supply

# Punjab - Estimation of cost of supply

PSPCL had engaged TERI for carrying out study of cost of supply in Punjab . TERI calculated the cost of supply using two methodologies -

	Methodology 1	Methodology 2
Functionalization		
	Total utility costs divided into:	Total utility costs divided into:
	1. Generation	1. Generation
	2. Transmission	2. Transmission
	3. Distribution	3. Distribution
Classification		
Generation	1. Demand	1 Enormy
	2. Energy	1. Energy
Transmission	1. Demand	1. Energy
	1. Demand	1. Demand
Distribution	2. Energy	2. Energy
	3. Customer	3. Customer
<b>Factors Allocation</b>		
Demand	Peak Demand	Effective connected load
Energy	Energy sales + Losses	Energy sales + Losses
Customor	Normalised Number of	Enormy color
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# Punjab - Comparison of results from two methodologies

Voltage	Consumer Category	Tariff(Rs/ kWh)	ACOS	COS1	COS2	ACOS coverage	Cost Coverage Method 1	Cost Coverage Method2	
132KV	Industrial	5.61	5.37	3.49	3.97	104%	161%	141%	COSof
	Traction	6.03	5.37	3.36	3.95	112%	179%	153%	categories
66KV	Industrial	5.61	5.37	4.73	4.82	104%	119%	116%	getting
33KV	Industrial	5.61	5.37	4.62	4.93	104%	121%	114%	hours of
11KV	Industry	5.61	5.37	4.54	5.13	104%	124%	109%	supply
	Domestic	5.81	5.37	5.02	4.9	108%	116%	119%	Increases
	Commercial	6.03	5.37	4.27	5.09	112%	141%	118%	COS of
	Bulk	5.59	5.37	4.6	4.94	104%	122%	113%	categories
LT	Industry	5.61	5.37	6.38	6.39	104%	88%	89%	getting
	Domestic (above 300)	5.81	5.37	5.74	5.52	108%	101%	105%	hours of supply
	Agriculture	4.18	5.37	5.56	5.33	78%	75%	78%	decreases
	Commercial	6.03	5.37	6.00	5.92	112%	101%	102%	

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# Andhra Pradesh - Estimation of cost of supply

## Step 1

## Functionalisation –

All investment and operating cost are separated into following cost functions:

- 1. Production
- 2. Transmission
- 3. Distribution
- 4. Customer related facilities

## Step 3

## Allocation -

The D, E and C costs are then further allocated to consumer categories based on factors like energy sales or number of customers. Technical losses and commercial losses are allocated on basis of sales and energy audit respectively.

Cost Function	Allocation of Costs
Demand Component	Category Input (Coincident peak demand +Losses)
Energy Component	Category Input (Sales+Losses)
Customer Component	Number of Customers in the category

## Step 2

### **Classification** –

<b>Cost Function</b>	<b>Cost Classification</b>
Power Purchase &	Demand Related
Generation	Energy Related
Transmission	Demand Related
Distribution	Demand Related
	Customer Related

### ← <u>Back to PPT</u>

Appendix 3 – Cost of supply

### Comparative analysis of approaches adopted in Delhi, Bihar, MP

Partic ulars _ ↓ State	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)
MP	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

## Bihar - Estimation of cost of supply

Category	Tariff	٨٢٩٩	ACoS	605	CoS
	(Rs./kWh)	ACUS	coverage	003	coverage
Domestic					
Kutir Jyoti	3.03	6.46	47%	6.46	47%
Domestic - I	3.34	6.46	52%	6.46	52%
Domestic -II	5.06	6.46	78%	7.15	71%
Domestic - III	4.70	6.46	73%	6.46	73%
Commercial					
Non-Domestic – I	4.45	6.46	69%	7.15	62%
Non-Domestic - II	6.88	6.46	107%	7.15	96%
Non-Domestic -III	4.23	6.46	65%	7.15	59%
Irrigation					
IAS – I	1.15	6.46	18%	6.46	18%
IAS – II	5.24	6.46	81%	7.15	73%
Industrial LT					
LTIS – I	5.99	6.46	93%	7.15	84%
LTIS – II	6.28	6.46	97%	7.15	88%
Industrial HT					
HTS – I	6.86	6.46	106%	6.77	101%
HTS – II	6.93	6.46	107%	6.46	107%
HTS – III	6.05	6.46	94%	6.22	97%
HTSS	5.49	6.46	85%	6.46	85%

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Source: BERC FY2013-14 tariff order

# Appendix 4 International Review – Contextual comparison



Philippines Australia		Thailand	Brazil				
Timeline of Energy Reforms							
<u>1<sup>st</sup> Phase:</u> (1987 - 2000) private sector participation	<u>1<sup>st</sup> Phase:</u> (1991 – 2010) unbundling of utilities, setting up of wholesale retail market and estb. of regulator, cross subsidy reduction	<u>1<sup>st</sup> Phase:</u> (1992-2003) Allowing private sector participation and IPPs	<u>1<sup>st</sup> Phase:</u> (1991 – 2003) privatization of state utilities, wholesale power market and open access				
<u>2<sup>nd</sup> Phase:</u> (2001 - ) cross subsidy reduction, unbundling of utilities & setting of regulatory commission	<u>2<sup>nd</sup> Phase:</u> (2011 - ) package of clean energy proposals	<u>2<sup>nd</sup> Phase</u> : (2003 - ) Regulatory reforms, setting up of Power Development Fund for rural electrification	<u>2<sup>nd</sup> Phase:</u> (2004 - ) better regulatory environment, balance between thermal and hydro power, cross subsidy reduction				



#### Appendix 4 – International Review – Contextual comparison

	Philippines	Australia	Thailand	Brazil	India		
Pre-Reforms							
Distribution losses	13%	15%	6%	17%	33%		
Per capita electricity consumption	525 kWh	10,036 kWh	10,036 kWh 1,715 kWh		036 kWh 1,715 kWh 1,956 kWh		592 kWh
Access to electricity	89.1%	100%	97%	87.8%	55.8%		
Consumer mix	3 35 % 35 % 36 %		15 15 22 % $%$ $%48$ 0 % %		9.8 % % 34 % 24 %		
Generation by fuel type	13 % 32 % 55 %	1% 20 % 79 % • Renewable	<ul> <li>Hydro</li> </ul>	8 1 4 % % 87 %	2 25 % % % 71 %		
Fuel Shortage	Oil Imports – 14% Coal Imports – 34%	Oil Imports – 4% Coal Imports – 0%	Oil Imports – 35% Coal Imports – 4%	Oil Imports – 16% Coal Imports – 72%	Oil Imports – 74% Coal Imports – 6%		



#### Appendix 4 – International Review – Contextual comparison

	Philippines	Australia	Thailand	Brazil	India
Recent informatio	n				
Distribution losses	12%	6%	1%	17%	25%
Per capita electricity consumption	647 kWh	10,712 kWh	2,316 kWh	2,438 kWh	918 kWh
Access to electricity	99.5%	100%	99%	94.8%	67.2%
Consumer mix	30 30 % 30 % 30 % 30 % %	33 % 33 33 % 34 % mmercial • Residenti	14 19 % 44 % %	15 18 % 27 % 40 % 1Industrial Others	7 % 45 % 45 %
Generation by fuel type	$\begin{array}{c} 12\\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	7 13 % % 80 % • Renewable	2 7 % % 91 % • Hydro • Fossi	19 2 10 % % 69 %	$2^{2}$ $3^{2$
Fuel Shortage	Oil Imports – 75% Coal Imports – 48%	Oil Imports – 36% Coal Imports – 0%	Oil Imports – 5% Coal Imports – 48%	Oil Imports – 17% Coal Imports – 73%	Oil Imports – 83% Coal Imports – 13%

# Appendix 5 International Review – Philippines



Appendix 5 – International Review – Philippines

# Philippines

Thre are 3 main geographical 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.

#### **Energy Reforms and current industry structure**

<u>In 2001</u>, Electric Power Industry Reform Act (EPIRA) was enacted. Its main thrust areas were -

- Privatization and sale of NPC assets and contracts with IPPs
- Unbundling of supply activities
- Creation of a wholesale electricity spot market (WESM)
- Elimination of cross-subsidies
- Creation of independent Electricity Regulatory Commission
- Implementation of retail competition and open access (RCOS) <u>– achieved in 2013</u>



#### **Removal of Cross Subsidies**

There were 3 kinds of cross subsides in Philippines:

- **1. Inter-Grid** amount charged to consumers located in a viable regional grid in order to reduce the electricity rates in a less viable regional grid
- 2. Intra-Grid amount charged to distribution utilities and nonutilities 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
- **3.** Inter-Class price cross-subsidies between various consumer categories of a utility.

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

#### Phases in removal of cross subsidy:

- **1. Unbundling** Unbundling of NPC rates was achieved in Mar 2002 and distribution utility rates in June 2003. Pending removal of cross subsidies, each cross subsidy rate level was shown as a separate item in customer bills
- **2. Removal of Inter-Grid subsidy** The inter-regional grid cross subsidy was fully phased-out by the ERC unbundling decision of NPC on 26 June 2002.
- **3.** Removal of Intra-Grid subsidy Intra-regional grid cross subsidy was removed in three phases in October 2003, October 2004 and October 2005.
- **4. Removal of Inter-Class subsidy -** removal took effect in two phases:
  - 40% of the subsidies were removed in Oct 2004
  - + 60% of the subsidies were removed in Oct 2005



# Philippines

The <i>Universal Charge</i> is a non-by passable charge collected from all end-users (except lifeline consumers) for the following	Cross-subsidy to Lifelines consumers
purposes: • Missionary electrification	• The lifeline rate provides a lower electricity rate for grid connected end-use customers with a low electricity consumption.
<ul> <li>Payment for stranded debts and stranded contract costs</li> <li>An environmental charge for watershed rehabilitation and management</li> </ul>	<ul> <li>This lifeline subsidy was exempt from the cross subsidy phase out</li> <li>Meralco customers consuming less than 50 kwh, 51-70 kwh</li> </ul>
<ul> <li>Equalization of taxes and royalties applied to indigenous or renewable sources of energy vis-à-vis imported energy fuels</li> <li>To account for all forms of cross-subsidies</li> </ul>	and 71-100 kwh got 50 percent, 35 percent and 20-percent discounts (on generation, transmission, distribution, supply, metering and systems loss), respectively
	systems respectively

- 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 rates.
- 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.

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Appendix 5 – International Review – Philippines

## Liberalisation and Evolution of Electricity Sector



# Republic Act No. 9136 OR Electric Power Industry Reform Act of 2001 (EPIRA)

- Deregulation of Generation Sector
- Creation of new Government owned transmission company and eventual privatization of transmission system.
- Unbundling of supply activities (unregulated) from regulated distribution sector.
- Elimination of cross- subsidies.
- Creation of an independent regulatory body(Energy Regulatory Commission) and Joint Congressional Power Commission

# EPIRA Thrust Areas

- Privatization and sale of NPC assets and contracts with Independent Power Producers (IPPs)
- Creation of Wholesale Electricity Sport Market for trading of energy
- Implementation of retail competition and open access.

# Most Revolutionary changes introduced by EPIRA



## **Pre - EPIRA Industry Structure**





## **Regulatory Framework**

Department of Energy (DoE) The Department is mandated by RA 7638 (Department of Energy Act of 1992) to prepare, integrate, coordinate, supervise and control all plans, programs, projects and activities of the Government relative to energy exploration, development, utilization, distribution and conservation.

EPIRA, 2001 mandated creation of Electricity Regulatory Commission. ERC focuses on two primary responsibilities - to ensure consumer education and protection, and to promote the competitive operations in the electricity market. ERC endeavours to create a regulatory environment that is democratic and transparent, and one that equitably balances the interests of both the consumers and the utility investors.

Electricity Regulatory Commission

## National Electrification Administration

The National Electrification Administration (NEA) was created on August, 1969 by virtue of Republic Act 6038 that boldly declared as a national policy objective the total electrification of the Philippines on an area coverage basis.

# Appendix 6 International Review - Australia



# Australia

Economic activity is focused on Australia's eastern seaboard, where most of the population lives. 100% of population has access to electricity.

#### **Energy Reforms**

<u>In 1991</u>, State owned utilities were disaggregated into separate generation, transmission, distribution and retail supply entities.

<u>In 1999</u>, National Electricity Market (NEM) was created, linking six states of eastern and southern Australia In 2006 Australian Energy Regulator (AER) and Australian Energy Market Commission (AEMC) were established for overseeing and regulating the energy markets and networks

In 2006, stand-alone market arrangement known as the Wholesale Electricity Market (WEM) was established in Western Australia, operating in the South-West Interconnected System (SWIS)

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#### **Industry Structure**

**Generation** - in Victoria, South Australia, New South Wales and Queensland have privatised some or all of their electricity supply



**Distribution** - 16 major electricity distribution networks, of which 13 are located in the NEM. Full retail competition at the consumer level has been introduced in Victoria, New South Wales (NSW), Australian Capital Territory, South Australia and Queensland.



# Australia

# Electricity Tariff Equalization Fund (ETEF) in New South Wales

- NSW introduced full retail competition in 2002
- There are three state owned retailers and at least seven other privately owned retailers
- In the initial years the retail market was segmented into two tiers for pricing purposes.
  - Consumers of less than 160 MWh pa are small retail customers. They are eligible for a regulated tariff, but may negotiate a contract with any retailer.
  - Consumers of over 160 MWh pa are large retail customers who negotiate contracts with any retailer
- The ETEF mechanism was designed so that distributors supplying customers at regulated rates must contribute to the fund when spot market prices fall below this reference price and are compen-sated by the fund when spot market prices rise 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 previous benefit from high spot market prices.
- ETEF was an entity of the NSW treasury. ETEF support was available only to state retailers

Phasing out of ETEF: ETEF was a cross subsidy which funded uniform tariffs across Western Australia. Under a 2006 plan, the phasing out of ETEF was to begin in September 2008, and would be gone completely after June 2010. There were five phases of 20% decreases in the amount of regulated load covered. The ETEF ceased operations on 30 June 2011 and was abolished on 14 June 2012. Road Map for Reduction in Cross Subsidy • Final Presentation 6 April 2015 PwC 72





## Australia

#### **Tariff Equalization Fund (TEF) in Western Australia**

- Distribution of electricity in state of Western Australia, Australia, is carried out though two main systems: South West and the North West Interconnected System. The South West Interconnected System ("SWIS") is connected to over 840,000 retail customers while the North West Interconnected System ("NWIS") focuses on regional customers that are outside the SWIS.
- Reforms were initiated in 2003 with disaggregation of the state electricity utility which led to the creation of four independent, government owned electricity utilities:
  - **Synergy**: responsible for the sale of electricity within the South West Interconnected System (SWIS);
  - **Horizon Power**: the regional business responsible for the generation, transport and sale of electricity in areas outside of the SWIS;
  - Verve Energy: responsible for power generation within the SWIS; and
  - **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) even though the cost of supply to Horizon consumers is higher
- Uniform tariffs are maintained across Western Australia by inter-utility transfers via the Tariff Equalisation Fund (TEF)
- **TEF** is funded through **Tariff Equalisation Contribution (TEC)** payments made by Western Power to Horizon Power.



# Appendix 7 International Review - Thailand



Appendix 7 – International Review - Thailand

# Thailand

Thailand is the biggest and second fastest growing consumer of electricity in ASEAN region with 100% access to electricity in urban areas and 99.8% access to electricity in rural areas

#### **Industry Structure**

EGAT is the major electricity generator. Distribution is carried through Metropolitan Electricity Authority (MEA), Provincial Electricity Authority (PEA) and EGAT Directly.



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#### **Power Development Fund**

The Fund was set up under Office of the Energy Regulatory Commission (OERC) for development or rehabilitation of localities affected by power plant operation. Electricity Generators contribute to this fund.

#### **Cross Subsidy in Thailand**

- EGAT sells power at lower price to PEA than to MEA. This acts as a cross subsidy from the rich capital and industrial area to the rural areas
- The tariff structure is based on cross-subsidy 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.
- <u>In July 2011</u>, Energy Regulatory Commission (ERC) decided to provide free electricity to residential consumers using less than 90 kilowatt hours (kWh) per month. Eligibility for the scheme was reduced in 2012 to those consuming less than 50 kWh per month. Subsidies for this scheme are estimated in table below

	Residential rate (THB per kWh)	Units/ month (kWh)	Number of recipients	Subsidy per person	Total subsidy	Subsidy per year (THB million)
2011	3.4826	90	8,789,544	309	2,712	32,547
2012	3.4826	50	3,670,000	171	629	7,550

# Appendix 8 International Review - Brazil



Appendix 8 – International Review - Brazil

# Brazil

Brazil is the world's tenth largest energy consumer. hydroelectric plants account for 69% of total installed capacity. The National Interconnected System (SIN) comprises the electricity companies in the South, South-East, Center-West, North-East and part of the North region

#### **Regulatory/Industry Structure**

In Brazil, there are 49 utilities with distribution concessions and about 64% of Brazilian distribution assets are controlled by private sector companies



#### **Energy Reforms**

#### First phase (1995-2003)

- Generation, transmission and distribution businesses were unbundled.
- A wholesale power market was established. 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.

#### Second Phase (2004 onwards)

- Regulated Contracting Environment (ACR). Distribution companies were required to ensure long term contract for 100% of demand forecast for five years, for their captive consumers.
- Free Contracting Environment (ACL) was introduced so that large consumers were free to contract directly with generators.

#### **Cross Subsidy in Brazil**

- In1993 the distribution companies were authorized to set tariffs.
- Unlike India, in Brazil the large industrial consumers were 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. Its 2<sup>nd</sup> report of progress proposed the following steps to eliminate cross subsidies
  - To undertake studies to determine amount of cross subsidies
  - · To eliminate these cross subsidies in next 5 years
  - Unbundling of tariffs
- In the year 2004, Law number 10.848 allowed distributors to freely buy energy to be resold with a price limit set by ANEEL
- Between 2004 and 2006 cross-subsidy was eliminated through retariff alignment
- Some amount of subsides was retained through regulatory charges

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# **Reforms and liberalisation in Brazil electricity sector**

## First wave of Reforms: 1995 -2003

- Change in legislation
- Introduction of mandatory open access for large consumers and IPPs.
- Introduction of competition and divestment of government owned utilities.
- Govt. of Brazil stopped investing in any new power plants.

- Introduction of long term market.
- Earlier short term market was sought to be replaced by the long term market.

Second wave of Reforms: 2004 and after



## **Regulatory institutions in Brazil**

	MME	Ministry of Mines and Energy	• Central Institution that dominates the decision making in the sector.
$\vdash$	ANEEL	• Regulatory Agency	<ul> <li>In charge of both economic and technical regulation.</li> <li>Monitors concession contracts.</li> </ul>
			• Decides review and readjustments of tariffs.
$\vdash$	CNPE	Council for National Policies in Energy	• In charge of framing national policies on Energy.
$\vdash$	CMSE	Electricity Industry Monitoring Committee	• In charge of monitoring supply continuity and security.
$\vdash$	ONS	National System Operator	<ul><li>In charge of operation of national grid.</li><li>Ensures access to transmission network equitably.</li></ul>
$\vdash$	EPE	Energy Research Enterprise	<ul><li>A research body.</li><li>Planning arm of the MME.</li></ul>
	CCEE	Electric Power Trading Chamber	• Enables and manages trading of electricity



# Evolution of tariff framework

#### Stage 1: 1974 Federal Tariff setting National level Tariff

- Complex system of subsidies and compensations.
- Tariff was made uniform at the national level.
- Tariff equalisation was aimed at incentivising industrial development in less developed states.
- Tariff equalisation was done by Eletrobras, a federal company, through managing an equalisation fund.
- Complexities of the method and dependency on government subsidies led to major financial crises for distribution companies in the 1980.
- Utilities were guaranteed a rate of return.

#### Stage 2: 1993 Federal control removed, Free tariff setting by distribution company

- Distribution companies were authorised to set their own tariffs subject to approval of licensing authorities.
- Tariff set by distribution companies were required to be approved by DNAEE (Department of Waters and Electric Energy).
- Guaranteed rate of return was not assured.
- Supply contracts were introduced between generators and distributors.
- Tariff equalisation process among utilities was abolished.
- Tariff setting was done on cost of service model (cost plus methodology).

Stage 3: 1995 Price cap Regulations, Regulatory Agency approval

- Establishment of concession regime.
- Competitive bidding of all public concessions entry of private players.
- Price cap Regulations were introduced.
- Concept of controllable and uncontrollable costs.
- Large consumers and independent power producers were free to contract – nonregulated tariff.
- Creation of ANEEL, the Regulatory Agency – approval of tariff for captive consumers of the distribution companies.



# **Regulatory Charges in Brazil**

**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.

**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.

**CDE Account:** In order to reduce dependence on hydro power generation, thermal generation was promoted through subsidies by this CDE fund.

**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.

**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.

# Appendix 9 *UC Fund Model*



#### Appendix 9 – UC Fund Model

	В	ASE YE	AR	YEAI	R 1	STA	AGE 1	STAGE 2		STAGE 3					
						Tariff Neuti	after CS ral Hike	Increa targe cov	se due to ted CoS erage		Incre	ase due to cos	t/revenue m	ismatch	
Consumer Categories	CoS	Tariff	CoS coverag e	Sales	CoS	Tariff	CoS coverag e	Tariff	CoS coverag e	Revenue from step 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
<b>Domestic (above</b> <b>300)</b>	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 Charge0.50UC Fund at start0.00UC Fund at end448



#### Appendix 9 – UC Fund Model

	YEA	AR 2	ST	STAGE 1		STAGE 2		STAGE 3					
			Tariff Neut	after CS ral Hike	Increa targeted	ase due to CoS coverage		Increase due to cost/revenue mismatch					
Consumer Categories	Sales	CoS	Tariff	CoS coverage	Tariff	CoS coverage	Revenue from step 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

#### Appendix 9 – UC Fund Model

	YEA	AR 3	ST	AGE 1	STAGE 2		STAGE 3						
			Tariff Neut	fafter CS ral Hike	Increa targe cov	ase due to eted CoS verage		Increase due to cost/revenue mismatch					
Consumer Categories	Sales	CoS	Tariff	CoS coverage	Tariff	CoS coverage	Revenue from step 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
#### Appendix 9 – UC Fund Model

	YEA	AR 4	ST	AGE 1	ST	AGE 2			STA	AGE 3		
			Tariff Neut	f after CS rral Hike	Increa targe cov	ase due to eted CoS verage		Inc	rease due to cos	st/revenue m	ismatch	
Consumer Categories	Sales	CoS	Tariff	CoS coverage	Tariff	CoS coverage	Revenue from step 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

#### Appendix 9 – UC Fund Model

	YEA	AR 5	ST	AGE 1	ST	AGE 2			ST	AGE 3		
			Increase	due to rise in CoS	Incre	ase due to CoS coverage		Incr	ease due to co	ost/revenue mi	smatch	
Consumer Categories	Sales	CoS	Tariff	CoS coverage	Tariff	CoS coverage	Revenue from step 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

# Appendix 10 *Trajectories for reduction of cross subsides (based on ACoS)*



# Trajectories for reduction of cross subsides (based on ACoS)

In the following slides, we discuss the tariff hikes required in the 10 selected states, in order to –

- 1. Achieve 100% ACoS coverage for all consumer categories
- 2. Get all consumer categories within +/-20% ACoS coverage range

The trajectories of ACoS coverage, shown in the following slides are representative and may be adjusted for each state based on factors like –

- External financial support. For e.g. state governments could fund difference between ABR and ACoS for certain categories like in the states of Bihar and Punjab.
- Targeted level of cross subsidies . For e.g. state commissions may want to bring ACoS coverage within +/-20% range instead of 100%.
- Time period in which cross subsidies are to be reduced . For e.g. increasing the time period of trajectory will lead to lower tariff hikes.

Appendix 10 – Trajectories for reduction of cross subsides (based on ACoS)

# Delhi - Trajectories for reduction of cross subsides

For target of	100% AC	oS cover	age in ne	ext 5 yea	rs							
(T = FY15)	ACoS CAGR		ACoS	covera	ge traje	ectory			Tariff	hike re	quired	
		Т	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic		74%	79%	84%	89%	95%	100%	14%	13%	13%	13%	12%
Agricultural	6.34%	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%

#### For target of within +/-20% ACoS coverage in next 5 years

(T = FY15)	ACoS CAGR		ACoS	covera	ge traje	ectory			Tariff	hike re	quired	
		Т	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic		74%	76%	78%	80%	83%	85%	10%	10%	9%	9%	9%
Agricultural	6.34%	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%

- 1. 5 year CAGR for ACoS is considered for projecting cost of supply for the next 5 years
- 2. No improvement in efficiency during the trajectory period. Improvement in efficiency or reduction in losses, may lead to lower tariff hikes

Appendix 10 – Trajectories for reduction of cross subsides (based on ACoS)

# Himachal Pradesh - Trajectories for reduction of cross subsides

For target of	100% AC	oS cover	age in no	ext 5 yea	rs							
(T = FY15)	ACoS CAGR		ACoS	covera	ge traje	ectory			<b>Tariff</b>	hike re	quired	
		Т	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic		78%	83%	87%	91%	96%	100%	9%	9%	8%	8%	8%
Agricultural	3.38%	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%

For target of	within +/	-20% A	CoS cove	erage in r	next 5 ye	ars						
(T = FY15)	ACoS CAGR		ACoS	covera	ge traje	ectory			Tariff	hike re	quired	
		Т	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic												
Agricultural	3.38%					Sor	na aa ah					
Industrial						Sai	ne as au	ove				
Commercial												

- 1. 5 year CAGR for ACoS is considered for projecting cost of supply for the next 5 years
- 2. No improvement in efficiency during the trajectory period. Improvement in efficiency or reduction in losses, may lead to lower tariff hikes

Appendix 10 - Trajectories for reduction of cross subsides (based on ACoS)

# Punjab - Trajectories for reduction of cross subsides

For target of	100% AC	oS cover	age in ne	ext 5 yea	rs							
(T = FY15)	ACoS CAGR		ACoS	covera	ge traje	ectory			<b>Tariff</b>	hike re	quired	
		Т	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%

#### For target of within +/-20% ACoS coverage in next 5 years

(T = FY15)	ACoS CAGR		ACoS	covera	ge traje	ectory			<b>Tariff</b>	hike re	quired	
		Т	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3		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%

- 1. 5 year CAGR for ACoS is considered for projecting cost of supply for the next 5 years
- 2. No improvement in efficiency during the trajectory period. Improvement in efficiency or reduction in losses, may lead to lower tariff hikes

Appendix 10 – Trajectories for reduction of cross subsides (based on ACoS)

# Rajasthan - Trajectories for reduction of cross subsides

For target of a	100% AC	oS cover	age in ne	ext 5 yea	rs							
(T = FY14)	ACoS CAGR		ACoS	covera	ge traje	ectory			<b>Tariff</b>	hike re	quired	
		Т	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%

#### For target of within +/-20% ACoS coverage in next 5 years

(T = FY14)	ACoS CAGR		ACoS	covera	ge traje	ectory			<b>Tariff</b>	hike re	quired	
		Т	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3		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%

- 1. 5 year CAGR for ACoS is considered for projecting cost of supply for the next 5 years
- 2. No improvement in efficiency during the trajectory period. Improvement in efficiency or reduction in losses, may lead to lower tariff hikes

Appendix 10 – Trajectories for reduction of cross subsides (based on ACoS)

# Maharashtra - Trajectories for reduction of cross subsides

For target of a	100% AC	oS cover	age in ne	ext 5 yea	rs							
(T = FY13)	ACoS CAGR		ACoS	covera	ge traje	ectory			Tariff	hike re	quired	
		Т	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic		88%	90%	93%	95%	98%	100%	9%	9%	9%	9%	9%
Agricultural	6.33%	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%

#### For target of within +/-20% ACoS coverage in next 5 years

(T = FY13)	ACoS CAGR		ACoS	covera	ge traje	ectory			Tariff	hike re	quired	
		Т	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3		T+5
Domestic		88%	90%	93%	95%	98%	100%	9%	9%	9%	9%	9%
Agricultural	6.33%	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%

- 1. 5 year CAGR for ACoS is considered for projecting cost of supply for the next 5 years
- 2. No improvement in efficiency during the trajectory period. Improvement in efficiency or reduction in losses, may lead to lower tariff hikes

Appendix 10 – Trajectories for reduction of cross subsides (based on ACoS)

# Madhya Pradesh - Trajectories for reduction of cross subsides

For target of	100% AC	oS cover	age in ne	ext 5 yea								
(T = FY15)	ACoS CAGR		ACoS	covera	ge traje	ectory			<b>Tariff</b>	hike re	quired	
		Т	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic		100%	100%	100%	100%	100%	100%	3%	3%	3%	3%	3%
Agricultural	2.78%	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%

### For target of within +/-20% ACoS coverage in next 5 years

(T = FY15)	ACoS CAGR		ACoS	covera	ge traje	ectory			Tariff	hike re	quired	
		Т	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic		100%	100%	100%	100%	100%	100%	3%	3%	3%	3%	3%
Agricultural	2.78%	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%

- 1. 5 year CAGR for ACoS is considered for projecting cost of supply for the next 5 years
- 2. No improvement in efficiency during the trajectory period. Improvement in efficiency or reduction in losses, may lead to lower tariff hikes

Appendix 10 – Trajectories for reduction of cross subsides (based on ACoS)

# Bihar - Trajectories for reduction of cross subsides

For target of	100% AC	oS cover	age in no	ext 5 yea	rs							
(T = FY15)	ACoS CAGR		ACoS	covera	ge traje	ectory			Tariff	hike re	quired	
		Т	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic		70%	76%	82%	88%	94%	100%	15%	14%	13%	13%	12%
Agricultural	5.44%	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%

#### For target of within +/-20% ACoS coverage in next 5 years

(T = FY15)	ACoS CAGR		ACoS	covera	ge traje	ectory			<b>Tariff</b>	hike ree	quired	
		Т	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3		T+5
Domestic		70%	73%	76%	79%	82%	85%	10%	10%	10%	10%	9%
Agricultural	5.44%	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%

- 1. 5 year CAGR for ACoS is considered for projecting cost of supply for the next 5 years
- 2. No improvement in efficiency during the trajectory period. Improvement in efficiency or reduction in losses, may lead to lower tariff hikes

Appendix 10 – Trajectories for reduction of cross subsides (based on ACoS)

# Meghalaya - Trajectories for reduction of cross subsides

For target of	100% AC	oS cover	age in n	ext 5 yea								
(T = FY15)	ACoS CAGR		ACoS	covera	ge traje	ectory			Tariff	hike re	quired	
		Т	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic		77%	82%	86%	91%	95%	100%	13%	13%	13%	12%	12%
Agricultural	7.14%	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%

#### For target of within +/-20% ACoS coverage in next 5 years

(T = FY15)	ACoS CAGR		ACoS	covera	ge traje	ectory			Tariff	hike re	quired	
		Т	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3		T+5
Domestic		77%	80%	82%	85%	87%	90%	11%	11%	10%	10%	10%
Agricultural	7.14%	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%

- 1. 5 year CAGR for ACoS is considered for projecting cost of supply for the next 5 years
- 2. No improvement in efficiency during the trajectory period. Improvement in efficiency or reduction in losses, may lead to lower tariff hikes

Appendix 10 – Trajectories for reduction of cross subsides (based on ACoS)

# Andhra Pradesh - Trajectories for reduction of cross subsides

For target of	100% AC	oS cover	age in ne	ext 5 yea	rs							
(T = FY14)	ACoS CAGR		ACoS	covera	ge traje	ectory			Tariff	hike re	quired	
		Т	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic		87%	90%	92%	95%	97%	100%	13%	13%	13%	13%	13%
Agricultural	9.69%	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%

### For target of within +/-20% ACoS coverage in next 5 years

(T = FY14)	ACoS CAGR		ACoS	covera	ge traje	ectory			Tariff	hike re	quired	
		Т	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3		T+5
Domestic		87%	88%	88%	89%	89%	90%	10%	10%	10%	10%	10%
Agricultural	9.69%	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%

- 1. 5 year CAGR for ACoS is considered for projecting cost of supply for the next 5 years
- 2. No improvement in efficiency during the trajectory period. Improvement in efficiency or reduction in losses, may lead to lower tariff hikes

Appendix 10 – Trajectories for reduction of cross subsides (based on ACoS)

# Kerala - Trajectories for reduction of cross subsides

For target of	100% AC	oS cover	age in no	ext 5 yea	rs							
(T = FY15)	ACoS CAGR		ACoS	covera	ge traje	ectory			Tariff	hike re	quired	
		Т	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3	T+4	T+5
Domestic		71%	77%	83%	88%	94%	100%	14%	14%	13%	13%	12%
Agricultural	5.71%	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%

#### For target of within +/-20% ACoS coverage in next 5 years

(T = FY15)	ACoS CAGR		ACoS	covera	ge traje	ectory			Tariff	hike re	quired	
		Т	T+1	T+2	T+3	T+4	T+5	T+1	T+2	T+3		T+5
Domestic		71%	75%	79%	82%	86%	90%	11%	11%	11%	11%	10%
Agricultural	5.71%	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%

- 1. 5 year CAGR for ACoS is considered for projecting cost of supply for the next 5 years
- 2. No improvement in efficiency during the trajectory period. Improvement in efficiency or reduction in losses, may lead to lower tariff hikes



- Hydro Projects
  - Extension of date for competitive bidding
- Renewable Energy Sources
  - New provisions on incentive to distribution utilities and revised solar RPO level
  - Proposed amendment on provisions on RECs
  - incentives to Discoms procuring from renewable sources of energy
- Renewable Generation Obligation (new provision)
- Exemption Of Competitive Bidding For Transmission Projects
- Provision on Ancillary Services
- Cross Subsidy
- Utilization Of Unrequisitioned Generation Capacity New Provision
- Proposed changes regarding Regulatory Assets
- New provision on Smart meters
- Pass Through Of Higher Cost Of Imported/Market Based E-auction Coal Due To Shortfall From LOA Quantity, As Per CCEA Decision – New Provision
- New addition under Para 5.0 General Approach to Tariff

# • <u>Hydro Projects -></u>

 Extension of date for competitive bidding to 2022 – This is required, since hydro projects can have geological surprises, hence uncertainties for the bidder in case he bids. Risks would have to be built into the bids, which is likely to lead to higher tariff bids.

### <u>Renewable Energy Sources</u>

- Increased RPO (Renewable Purchase Obligation) and new provision of RGO (Renewable Generation Obligation) to ensure green energy for lesser emissions, and reduced dependence on fossil fuels and hence reduced imports of coal and gas. In any case, solar tariffs are dropping sharply and have almost reached parity with that of imported coal.
- Back-loaded tariff provision will help reach grid parity immediately (incentive to distribution utilities to purchase renewable power)
- Amendment on provisions on RECs : REC multiplier to encourage new renewable technologies.

- Exemption Of Competitive Bidding For certain Transmission Projects To cater to urgent situations and to prevent holding up of transmission system construction due to no bidders coming forward, as well as to get a price benchmark for new technologies.
- <u>Provision on Ancillary Services</u> Mandated due to requirement of reserves to control frequency variation, especially in view of large scale integration of variable type of renewable energy sources like wind and solar power and to prevent transmission congestion.
- <u>Cross Subsidy</u> Making the cross subsidy surcharge formula more rational, Flexibility to SERCs to adopt a variation of the cross subsidy formula to suit the circumstances of the State.
- <u>Utilization Of Un-requisitioned Generation Capacity</u> To improve utilization of existing generation capacity.
- Proposed changes regarding Regulatory Assets To prevent creation of new Regulatory Assets and liquidation of existing Regulatory Assets, as well as allow carrying cost of existing Regulatory Assets, to benefit the State Distcom.

- <u>New provision on Smart meters</u> A very forward looking step to deal with theft, remote metering and billing, implementation of peak and off-peak tariff and demand side management through demand response. Additional benefit of accurate load forecasting. Demand response essential for responding to variability of generation from variable type of renewable sources of energy.
- Pass Through Of Higher Cost Of Imported/Market Based E-auction Coal Due To Shortfall From LOA Quantity, As Per CCEA Decision – For those developers that set up power plants based on assurance of coal. An attempt to provide stranding of generation assets in a scenario of shortages.
- <u>New addition under Para 5.0 General Approach to Tariff</u> States allowed to procure power from their own generators on cost plus basis. Procurement of power from coal washery rejects based projects exempted from tariff based competitive bidding process for the time being till the price gets discovered.
- <u>Amendment to Para 2.0 on Legal Position of Tariff Policy</u>
- <u>Additional request from MNRE</u> regarding earmarking of upto 0.5% of RPO for Waste –to Energy generation in the States where such wastes are available

# THANK YOU