MINUTES OF THE 40TH MEETING

OF

FORUM OF REGULATORS (FOR) HELD AT NEW DELHI.

VENUE   :   "HALL NO.3", FIRST FLOOR
VIGYAN BHAWAN
MAULANA AZAD ROAD
NEW DELHI.

DATE   :   02ND APRIL, 2014

LIST OF PARTICIPANTS   :   AT ANNEXURE-I (ENCLOSED).

The meeting was chaired by Shri Gireesh B. Pradhan, Chairperson, CERC/FOR. The Chairperson, Forum of Regulators welcomed Shri Basharat Ahmed Dhar, Chairperson, Jammu & Kashmir State Electricity Regulatory Commission (J&KSERC) and Shri Niharendu Chakraborty, Chairperson, Tripura Electricity Regulatory Commission (TERC) to the Forum as they were attending the Forum meeting for the first time. He also welcomed Shri S.K. Chaturvedi who took over as Chairperson, JERC for all UTs except Delhi on 12th February, 2014, and Shri Vishwanath Hiremath, who took over as Chairperson, Rajasthan Electricity Regulatory Commission (RERC) on 10th March 2014,

Shri Pradhan mentioned that during the last meeting the Forum had discussed some very important agenda items like Amendment to the Electricity Act and draft Terms and Conditions of Tariff notified by CERC. The Forum had made some valuable suggestions on the draft tariff regulations. The Central Commission considered the inputs of the Forum while finalising the Tariff Regulations for the next control period. As decided in the last meeting, he

informed, he had written to the Election Commission seeking clarification on issuance of tariff orders during the currency of the Model Code of Conduct. The Election Commission had responded stating that 'it has no objection to the continuance of the process required for the decision on the power tariff. However, tariff award shall be made only on completion of poll in the relevant State, i.e., after the poll date/dates in the State'. Chair, FOR also drew attention of the Forum towards the observations of the Parliamentary Standing Committee on Energy on the functioning of the Forum and urged the Members to deliberate and evolve a constructive way forward to make FOR all the more effective.

The FOR thereafter took up agenda items for consideration.

AGENDA ITEM NO. 1 :   **CONFIRMATION OF THE MINUTES OF THE 39TH MEETING OF "FOR" HELD DURING 17TH - 19TH JANUARY, 2014 AT CHANDIGARH.**

Action taken on the decisions of the Forum in its last meeting was apprised by Shri Sushanta K. Chatterjee, Joint Chief (Regulatory Affairs), CERC/FOR   It was informed that the draft Model Regulation on Smart Grid would be taken up for discussion in the next meeting. It was also apprised that a study has been initiated on "Review of Renewable Energy Certificate (REC) Framework". The proposal for amendment to the REC regulations as discussed in the last meeting would be taken up after the report was finalized.

The Forum noted and endorsed the minutes of the 39th Meeting of 'FOR' held at Chandigarh during 17th – 19th January, 2014, with the observation that the stand of FOR on open access for 1 MW and above should be articulated clearly in the context of discussion recorded on amendment to the Act. The following should be incorporated in the minutes :-

'While determination of tariff for open consumers in the proposed scheme of separation of distribution carriage and content would lose relevance (in view of the fact that only ceiling tariff could be determined for such open consumers/competing suppliers), the Forum does not agree with the interpretation with reference to the existing provisions of the Act, that all 1 MW and above consumers are mandatory open access consumers and that their tariffs would not be determined by the regulators'.

AGENDA ITEM NO. 2 :   **PROPOSED BUDGET OF "FOR" FOR THE F.Y. 2014 - 15.**

The budget for the year 2014-15 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. After deliberations, the proposed budget was approved.

AGENDA ITEM NO. 3 :   **PROPOSED STUDIES AND TRAINING PROGRAMMES FOR THE YEAR 2014-15.**

It was informed that Ministry of Power grants Plan Assistance to "FOR" every year for Capacity Building Programme and for commissioning studies. It was also informed that the proposal for commissioning the studies and conducting the training programmes during the financial year 2014-15 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 2014-15 :-

Studies –

1. Review of Performance of Distribution Utilities.
2. Study on Road Map for Reduction in Cross Subsidy.
3. Studies to evolve principles for price cap regulation for determination of tariff ceiling two or more distribution licensee operate in same scenario.
4. Framework for Capacity Market/Medium Term Market for Power Procurement.
5. Assignment for formulating pricing methodology for Intra State transmission.
6. Methodology for determination of Cost to serve different Consumer Categories
7. Efficient Power procurement planning- Factors to be considered (factors like portfolio management, demand forecasting, DSM/EE etc.).
8. Consumer Protection – Strengthening of Consumer Advocacy.
9. Review of Functioning of CGRF and Ombudsman.
10. National Level RPO Registry- Development of a framework.
11. Feasibility and Desirability of Competitive bidding in RE.
12. Competitive Tariff viz-a-viz Cost plus Tariff- Critical Analysis.
13. Implementation of Open Access- Review of Status of Implementation and Way Forward.
14. Best Practices on and Strategies fort Loss Reduction.

Any other Study as may be decided by FOR/FOR Chairperson.

(The above studies would be commissioned subject to availability of Plan Assistance from Government of India)

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 in with proposed study visit to LBNL, California ISO, CEA California Public Utilities Commission (CPUC) in USA.
2. Capacity Building Training Programme for Officers of SERCs at IIT Kanpur (including international component)
3. Capacity Building related to DSM.
4. Training Programme on Consumer Protection at NPTI, Faridabad.
5. Training on Legal Issues.
6. Capacity Building through Regulatory Research Institute (being conceptualized).

AGENDA ITEM NO. 4 : DISCUSSION ON ISSUES RELATED TO ENERGY EFFICIENCY & DSM.

A presentation was made by Director General, Bureau of Energy Efficiency (BEE) (copy **enclosed** at **Annexure – II)**. He explained the initiatives being taken by the Bureau on creating awareness about DSM and EE and also apprised the Forum about the Perform, Achieve and Trade (PAT) Scheme, and the roll out plan of energy efficiency certificates. He highlighted the role carved out in the EC Act, for the SERCs on enforcement of efficiency standards and urged the regulators to extend cooperation in implementing the EE Schemes in their States. After discussion, the following observations/suggestions were made :-

➢ There is a need for capacity enhancement in States for promotion of DSM, especially, the capacity building for State Designated Agencies (SDAs).

➢ There is a need for robust monitoring and verification of the DSM programme.

➢ Incentive scheme should be designed to encourage installation of shunt capacitors in agricultural pump.

➢ Tariff interventions like KVAh based tariff, TOD tariff should be considered.

➢ Provisions should be made in ARR for implementation of DSM programme.

DG, BEE assured full support and cooperation in capacity building of regulatory staff and SDAs as highlighted by the members of the Forum. He also committed to engage with individual SERCs for State specific issues.

AGENDA ITEM NO. 5 :   ENFORCEMENT   OF   RENEWABLE
PURCHASE OBLIGATIONS (RPO).

Shri Upendra Tripathi, Secretary, Government of India, Ministry of New and Renewable Energy joined the meeting for an interaction with the members of "FOR" on this agenda item. Shri Tripathi expressed his gratitude for inviting him for interaction with the Regulators. He appreciated the various initiatives taken by "FOR" for promotion of renewable energy sources.

A presentation was made by Shri Alok Srivastava, Joint Secretary, MNRE (copy **enclosed** at **Annexure – III)** highlighting the issues around compliance of RPO. In his presentation Shri Srivastava urged that given the critical role of the State Regulators in promotion of renewable energy, their cooperation in terms of long term RPO trajectory and strict enforcement of RPO would be desirable to revive the sagging sentiment of RE market.

The issues highlighted were discussed in detail. Specific best practices in terms of provision in ARR for RPO compliance by the SERCs of Delhi and Punjab, were noted. It was also informed that UERC had in recent past imposed penalty on the Managing Director of the distribution utility for non-compliance of RPO. MNRE requested the SERCs to demonstrate their commitment on these lines so as to give assurance to the investors about regulatory certainty in the RE sector. After detailed discussion, consensus was evolved around the following :-

✓ National Action Plan on Climate Change (NAPCC) target should be adopted for determination of RPO trajectory on a Pan India basis. Differential RPO for each State as has already been evolved by FOR keeping in view the NAPCC target should be adopted by the SERCs.

If need be, a fresh study could be commissioned by FOR to suggest State-wise RPO trajectory with the larger objective of attainment of NAPCC target on all India basis.

✓ Grid integration of Renewable Energy Source is a major challenge. There were concerns amongst the RE resources rich States on the impact of large scale integration of renewable. This should be studied and in the next meeting, representatives from POSOCO and select SLDCs could be invited to understand the implication in this regard.

✓ Need for incentive to RE resource rich States as well as RE deficit States was articulated and it was decided to request MNRE and MOP to take suitable action in this regard, with due regard to the recommendations of the FOR based on a study conducted in recent past.

AGENDA ITEM NO. 6 :   FUEL AUDIT OF THERMAL GENERATING PLANTS.

A presentation was made by the representatives of CPRI, Bangalore, the Consultant engaged by Punjab State Electricity Regulatory Commission (PSERC) on Fuel Audit of Thermal Generating Plants (copy **enclosed** at **Annexure – IV)**. The issues were discussed in detail. After discussion, the following was decided :-

❖ Subsequent to the CPRI study, CERC has come out with its regulations providing for compensation of Energy Charges based on coal "as received".

❖ CEA recommendation given to the CERC also highlights that the loss of GCV between the coal "as received" and coal "as fired" is negligible and can be ignored.

❖ In view of the above developments and findings, it would be desirable to adopt the principles as provided in CERC regulations on Terms and Conditions of Tariff for 2014-19.

AGENDA ITEM NO. 7 :   **DISCUSSION ON "THE NEED FOR INSULATING THE PRICING OF PUBLIC UTILITY SERVICES LIKE DRINKING WATER, IRRIGATION, POWER AND PUBLIC TRANSPORT FROM POLICY FLUCTUATIONS THROUGH STATUTORY PROVISIONS" (REFERENCE TOR OF 14TH FINANCE COMMISSION)".**

This was discussed. There was a unanimous view that price determination of electricity was fairly insulated from policy shifts as it comes under the statutory provisions of the Electricity Act, 2003. On the other hand the matter of subsidy comes under the State Government's exclusive preview. Views of the FOR to this extent should be communicated to the 14th Finance Commission.

AGENDA ITEM NO. 8 :   **STUDY REPORT ON "IMPACT ASSESSMENT OF PLAN ASSISTANCE TO "FOR" BY MOP DURING 11TH PLAN PERIOD".**

A presentation was made by the representative of M/s. ICRA Management Consulting Services Limited (copy **enclosed** at **Annexure – V**). The Forum noted the issues highlighted and endorsed the report/recommendations. It was also observed that such review should be undertaken periodically (say, after every five years). It was suggested that long-term course could be supported/funded by FOR. The need for institutionalising

Regulatory Research Institute (RRI) as decided by the FOIR was also articulated.

AGENDA ITEM NO. 9 :   **AT & C LOSS STUDIES FOR SIX STATES.**

Two presentations were made – (1) by the representative of M/s Medhaj Techno Concept Pvt. Ltd., who were engaged as a consultant to undertake the study for Rajasthan, Tamil Nadu and Uttar Pradesh and (2) by the representative of M/s. MECON Ltd., who were engaged to undertake the study for the States of Karnataka, Madhya Pradesh and Maharashtra (copy **enclosed** at **Annexure – VI & VII)**.

The studies revealed component-wise AT & C Losses and highlighted the need for interventions at appropriate level to address the critical issues of AT & C Loss in the States. The studies also recommended strategy for reduction of loss based on identified factors. It was suggested that it would be desirable for each SERC to undertake similar study on a longer time horizon to be able to accurately assess AT & C losses and to provide for correct estimation of power procurement requirement and cost in the ARR. The reports were endorsed by the FOR.

The following specific suggestions came out of discussions on the issue of AT & C Loss reduction :-

- HVDS system should be tried in States for loss reduction.

- Technical solutions like use of ABC conductor, feeder separation etc. should also be experimented.

It was highlighted that there were best practices on AT & C losses in different States. In the past, FOR had finalized report on Strategy of Reduction of AT & C Loss. This being an issue of critical importance in terms of restoring viability of distribution sector, a special session of FOR should be convened to discuss the issues at stake and future strategy of State Commissions in this regard.

AGENDA ITEM NO. 10 :   **DISCUSSION / FOLLOW UP ACTION ON THE RECOMMENDATIONS OF STANDING COMMITTEE ON ENERGY.**

The Parliamentary Standing Committee on Energy had observed inter alia that the Forum had evolved consensus on a number of issues but a very few of the decisions taken by the Forum have been implemented. The Standing Committee on Energy had also recommended inter alia that important issues, especially, the issue of AT & C Loss should be discussed and a consensus should be evolved around this issue. The recommendations of the Standing Committee as also the reply given by the FOR Secretariat were noted by the Forum. It was decided that a presentation would be made in the next meeting by the FOR Secretariat highlighting the decisions taken by the Forum so far on important issues and a status of implementation of these decisions in various States.

Any Other Issues -

It was agreed that the next meeting of the Forum of Regulators (FOR) would be held in first/second week of June, 2014 in Mussoorie , Uttarakhand.

A vote of thanks was extended by Shri Sushanta K. Chatterjee, Joint Chief (RA), CERC/FOR. He conveyed his 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.

******

LIST OF PARTICIPANTS ATTENDED THE 40TH MEETING OF

FORUM OF REGULATORS (FOR)

HELD ON 02ND APRIL, 2014 AT NEW DELHI.

S. No.	NAME	ERC
01.	Shri Gireesh B. Pradhan Chairperson	CERC – in Chair.
02.	Dr. V. Bhaskar Chairperson	APERC
03.	Shri Digvijai Nath Chairperson	APSERC
04.	Shri Naba Kumar Das Chairperson	AERC
05.	Shri Umesh Narayan Panjiar Chairperson	BERC
06.	Shri Narayan Singh Chairperson	CSERC
07.	Shri P.D. Sudhakar Chairperson	DERC
08.	Shri R.N. Prasher Chairperson	HERC
09.	Shri Subhash Chander Negi Chairperson	HPERC
10.	Shri Basharat Ahmed Dhar Chairperson	J&KSERC
11.	Shri S.K. Chaturvedi Chairperson	JERC for all UTs except Delhi
12.	Shri M.R. Sreenivasa Murthy Chairperson	KERC
13.	Shri T.M. Manoharan Chairperson	KSERC
14.	Shri Rakesh Sahni Chairperson	MPERC

15.	Shri Anand Kumar Chairperson	MSERC
16.	Shri Donray A. Shishak Chairperson	NERC
17.	Shri S.P. Nanda Chairperson	OERC
18.	Shri Vishwanath Hiremath Chairperson	RERC
19.	Shri Niharendu Chakraborty Chairperson	TERC
20.	Shri Sunil Verma Member	JSERC
21.	Shri Virinder Singh Member	PSERC
22.	Shri G. Rajagopal Member	TNERC
23.	Ms. Meenakshi Singh Member	UPERC
24.	Shri K.P. Singh Member	UERC
25.	Shri Sujit Dasgupta Member	WBERC
26.	Shri Sushanta K. Chatterjee Joint Chief (RA)	CERC

SPECIAL INVITEES

01.	Shri M. Deena Dayalan Member	CERC
02.	Shri A.K. Singhal Member	CERC
03.	Shri Upendra Tripathi Secretary	MNRE
04.	Dr. Ajay Mathur Director General	BEE
05.	Shri Alok Srivastava Joint Secretary	MNRE
06.	Shri Bhaskar Jyoti Sarma Secretary	BEE
07.	Shri Saurabh Kumar Managing Director	EESL

08.	Shri A.K. Saxena Chief (Engg.)	CERC
09.	Shri M.K. Anand Chief (Fin.)	CERC
10.	Shri T. Rout Chief (Legal)	CERC

Energy Efficiency Programmes
# And
Regulatory Oversight

Ajay Mathur

Bureau of Energy Efficiency
Government of India

Overview

- ➢ Discom-led Demand Side Management (DSM) programmes
  - *– regulatory framework provides opportunities to manage load growth*

- ➢ Standards & Labeling of equipment and appliances, and
  Energy Consumption norms for industry (PAT programme)
  - *- adjudication of penalty by SERCs in cases of non compliance*

Managing Load Growth through DSM
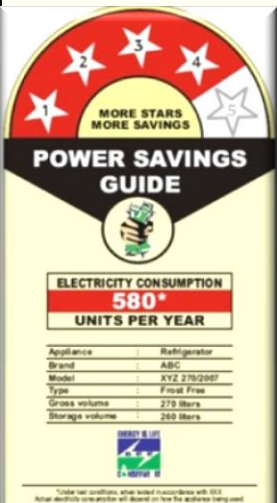
- ➤ Load curve shaving and flattening are cost-effective measures for Discoms to manage supply and investments

- ➤ Load shaving and flattening can be enabled through incentives by discoms to consumers to invest in energy efficient/management technologies

- ➤ Requires regulatory frameworks for discoms to "invest in DSM" – DSM Regulations to be issued – FOR has evolved template that many SERCs have notified

- ➤ Effective DSM programs require:
  - ➤ Strengthening of capacity of private sector players (ESCOs, consultants, equipment suppliers, end users) to assess and implement DSM options
  - ➤ Enabling consumers to secure financing for DSM measures
  - ➤ Targeted outreach and awareness campaigns
  - ➤ Careful and inclusive planning, and program evaluation and mid course corrections

Successful DSM Programmes

- ➢ Street Light EE Retrofit
    - ➢ being implemented in Nashik (EESL), Bhubaneshwar (IFC) – **Potential savings > 50%**

- ➢ Agricultural DSM
    - ➢ Implemented in Solapur (2200 pumps) by BEE and Hubli (590 pumps) by EESL - **Potential savings > 30%**

- ➢ Efficient equipments DSM
    - ➢ LED programme in Puducherry (EESL) - **Potential savings > 80%**
    - ➢ Rebate for Fans/ ACs in Maharashtra (upcoming) - **Potential savings > 50%**

- ➢ Efficient buildings
    - ➢ need for incentives for ECBC compliant buildings - **Potential savings > 20%**

- ➢ Demand Response
    - ➢ pilot by Tata Power (Mumbai) – **15 MW load reduction** achieved during peak hours

Financing DSM Programmes

➢ Regulatory framework could enable:

  ➢ Multi-year DSM programme

  ➢ Mechanisms to transparently apportion savings to users and the utility companies – Standards Offer Programme (SOP)

  ➢ Funding mechanism through levy of Public Benefit Charge, etc. to scale up DSM programmes

➢ BEE to fund DSM preparatory and capacity-building activity in 30 DISCOMs

  ➢ EESL to be the implementer, and will provide
    • 2 full-time consultants
    • support for load research, and
    • training for discom staff

  ➢ Discom should commit to
    • create DSM Cell and post staff
    • request SERC to issue DSM regulations, if not already done
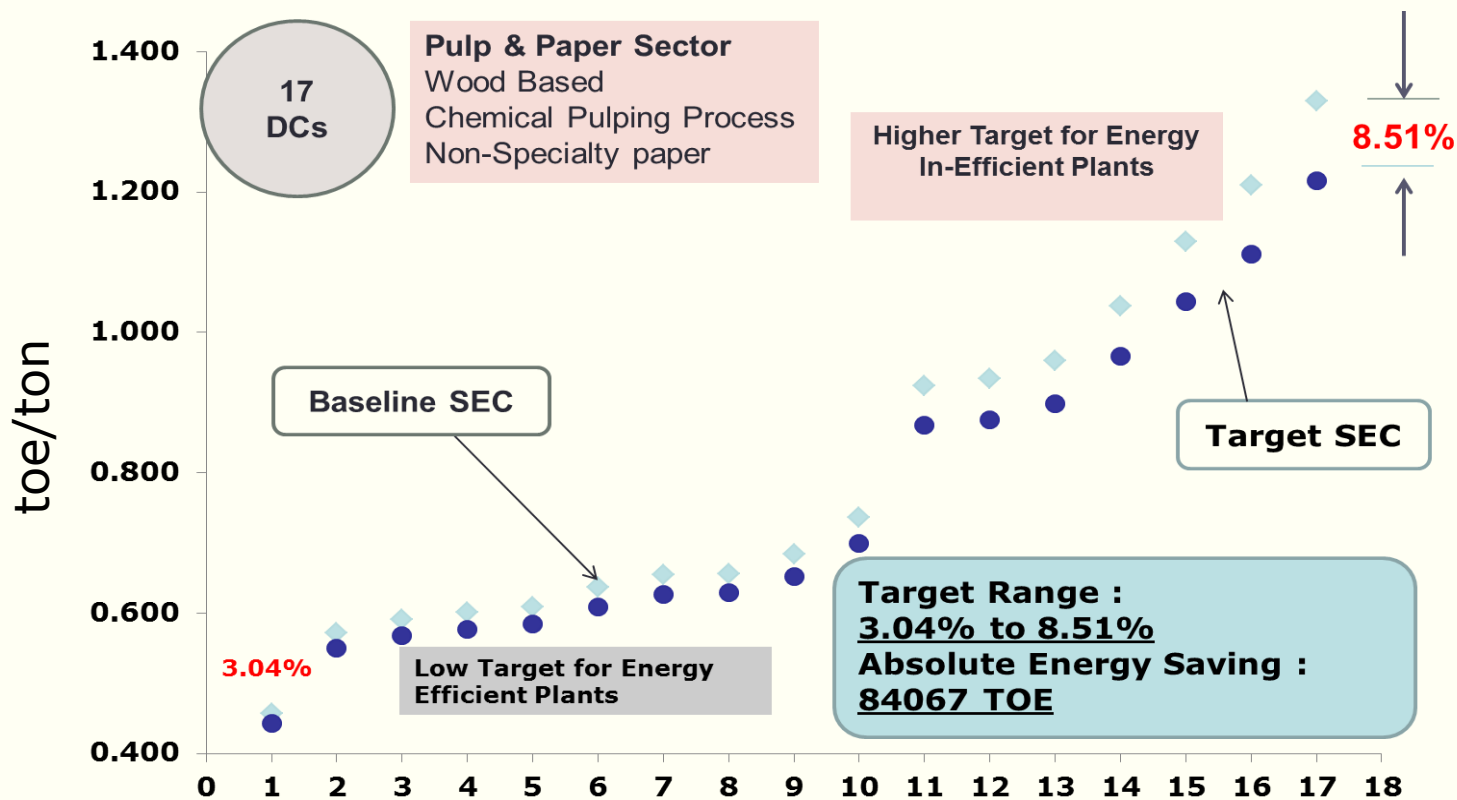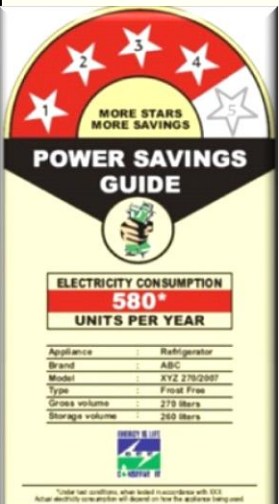   • design, implement, monitor and verify at least one DSM programme

Standards & Labelling Programme

➢ **Mandatory labelling programmes have been introduced for four appliances under section 14 (a & d) of EC Act**

  ➢ Manufacturers report production and pay labelling fee on quarterly basis

  ➢ Standards and labels for Acs and frost-free refrigerators have been upgraded twice

  ➢ Resulted in over 7000 MW of avoided capacity in 11th Plan period

  ➢ Fourteen products under voluntary labelling; three products to be moved to mandatory labelling

➢ **Check testing of labelled products is carried out to ensure "truth in labelling"**

  ➢ Products are bought and sent for testing to NABL-accredited labs

  ➢ Products that fail are subjected to second verification test; products that fail this test are in non compliance

➢ **SERCs to adjudicate penalty**

Energy Consumption Norms for Industry –
Huge spread in Specific Energy Consumption within sectors

17 DCs

Pulp & Paper Sector
Wood Based
Chemical Pulping Process
Non-Specialty paper

Higher Target for Energy In-Efficient Plants

8.51%

Baseline SEC

Target SEC

3.04%

Low Target for Energy Efficient Plants

**Target Range :
3.04% to 8.51%
Absolute Energy Saving :
84067 TOE**

In PAT programme, targets are plant Specific … Less for Energy Efficient plants, and more for Inefficient plants

Perform Achieve and Trade

➢ Specific Energy Consumption (SEC) targets mandated for 478 units in 8 energy intensive sectors under section 14(n) of EC Act

  ➢ Designated Consumers used 165 million toe in 2010-11 (of total of about 500 million toe of fossil fuel consumption in the country)

  ➢ The sectors are: Aluminum, Cement, Iron & Steel, Chlor Alkali, Thermal Power Plants, Fertilizer, Pulp & Paper, and Textiles

  ➢ Target is reduction of 6.686 million toe per year at the end of 1st PAT Cycle (by 2014-15)

  ➢ Targets to be accomplished in 2014-15; new cycle with new targets after that

Perform Achieve and Trade
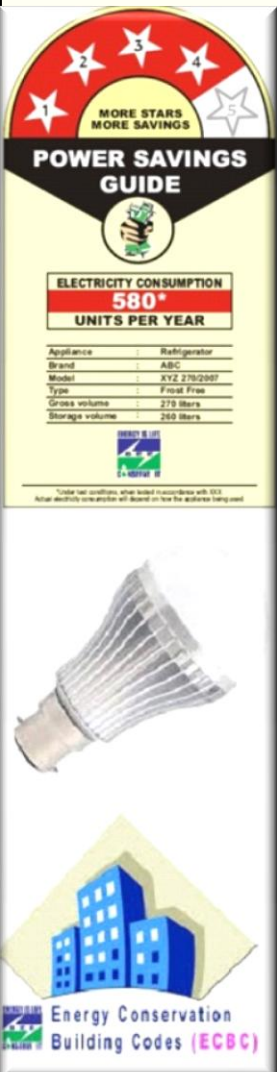
> Energy Savings Certificates will be issued for excess savings; can be traded and used for compliance by other units, Financial penalties for non compliance

> Verification and check verification by Accredited Energy Auditors

> Trading platform for ESCerts in the power exchanges

> The direct benefit for the participating industries in this period is reductions in input costs related to energy of approximately 7,512 Crores per year
>   - EE Projects planned in 2012-15 : 2057
>   - Anticipated investment   : Rs. 18,600 crores

> Widening and Deepening study of PAT scheme is underway to include new designated consumers in the second cycle.

> Financial penalties will be adjudicated by SERCs

Penalty and Adjudication
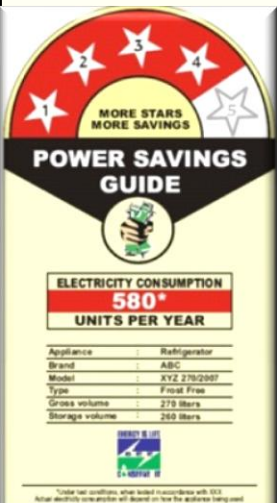
Penalty (Section 26, EC Act)

➢ **Equipment/Appliances and Buildings (26 (1))**
- For each failure: Maximum of Ten Lakh Rupees
- For continuing failure: Ten thousand rupees for every day of such failure

➢ **Designated Consumers under PAT (26 (2))**
- For each failure: Maximum of Ten Lakh Rupees
- For continuing failure: additional penalty not less than the price of every ToE in excess of the prescribed norms

Adjudication (Section 27, EC Act)

➢ **Appointment of Adjudicating Officer**
- State Commission shall appoint any of its members as adjudicating officer
- In case of absence of State Commission, State Government shall appoint adjudicating officer

RPO & REC Market Status
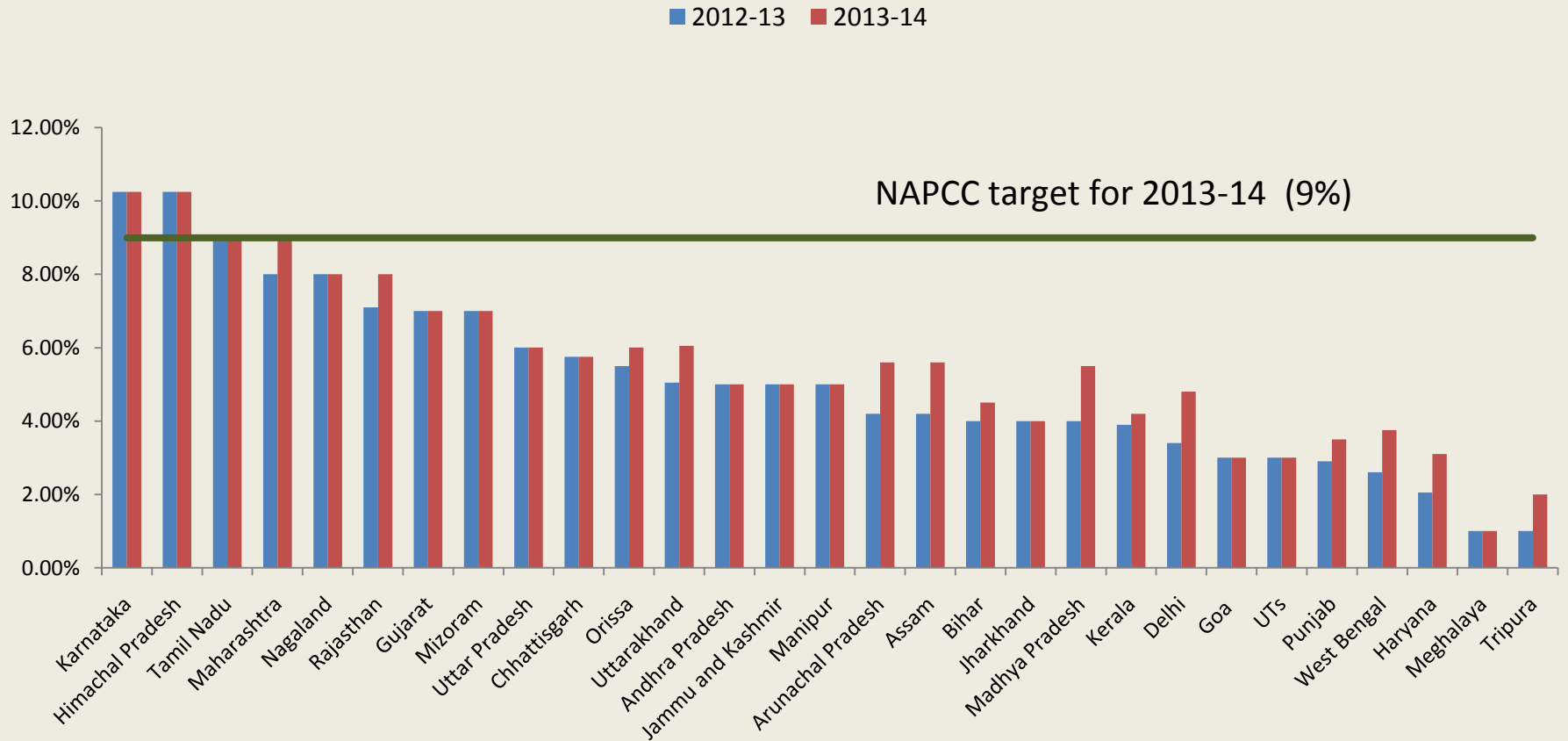
40th FOR Meeting

New Delhi
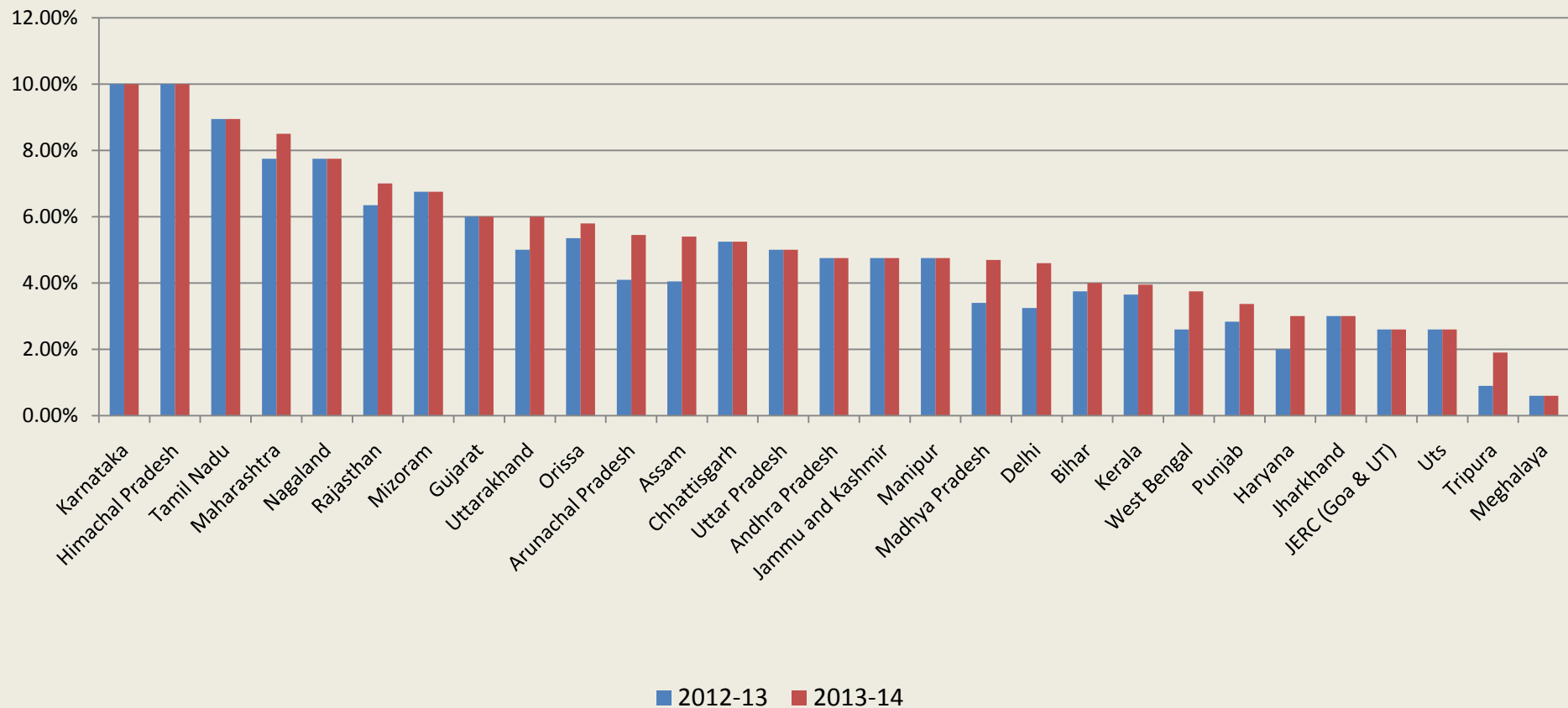
2 April 2014

State-wise RPO Targets

State-wise RPO Targets

■ 2012-13 ■ 2013-14

NAPCC target for 2013-14 (9%)

Non Solar RPO Targets

Source: ARR and RPO regulations declared by regulatory commission

4

Renewable Purchase Obligation Target

S.	STATE	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21
1	Andhra Pradesh			5.00%	5.00%	5.00%	5.00%	5.00%				
2	Arunachal Pradesh			4.20%	5.60%	7.00%						
3	Assam	1.40%	2.80%	4.20%	5.60%	7.00%						
4	Bihar	1.50%	2.50%	4%	4.50%	5.00%						
5	Chhattisgarh	5.00%	5.25%	5.75%	6.25%	6.75%	7.25%					
6	Delhi			3.40%	4.80%	6.20%	7.60%	9.00%				
7	Gujarat	5.00%	6.00%	7.00%	7.00%	8.00%	9.00%	10.00%				
8	Haryana	1.50%	1.5%	2.00%	3.00%	3.25%	3.50%	3.75%	4.50%	5.00%	5.50%	6.00%
9	Himachal Pradesh		10.01%	10.25%	10.25%	10.25%	11.25%	12.25%	13.50%	14.75%	16.00%	17.50%
10	Jammu Kashmir	1.00%	3.00%	5.00%	5.00%	6.00%	7.50%	9.00%				
11	Goa & UT	1.00%	2.00%	3.00%	3.00%	3.30%	3.55%	3.95%	4.30%	4.65%	5.10%	5.50%
12	Jharkhand	2.00%	3.00%	4.00%								
13	Karnataka	10%/7%	10%/7%	10%/7%	10%/7%	10%/7%						
14	Kerala	3.00%	3.30%	3.63%	3.99%	4.39%	4.83%					
15	Madhya Pradesh	0.80%	2.50%	4.00%	5.50%	7.00%						
16	Maharashtra	6.00%	7.00%	8.00%	9.00%	9.00%	9.00%					
17	Manipur	2.00%	3.00%	5.00%								
18	Mizoram	5.00%	6.00%	7.00%								
19	Meghalaya	0.50%	0.75%	1.00%								
20	Nagaland	6.00%	7.00%	8.00%								
21	Orissa	4.50%	5.00%	5.50%	6.00%	6.50%	7.00%					
22	Punjab		2.40%	2.90%	3.50%	4.00%						
23	Rajasthan (Draft)		6.00%	7.10%	8.20%	9.00%	10.20%	11.40%				
24	Sikkim											
25	Tamil Nadu (Draft)		9.00%	9.00%	9.00%	9.00%	9.00%					
26	Tripura	1.00%	1.00%	2.00%								
27	Uttarakhand	9.00%	10.00%									
28	Uttar Pradesh	4.00%	5.00%	6.00%								
29	West Bengal				4.00%	4.50%	5.00%	5.50%	6.00%	7.00%	8.00%	

Solar Purchase Obligation Target

S.	STATE	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
1	Andhra Pradesh		0.25%	0.25%	0.25%	0.25%	0.25%					
2	Arunachal Pradesh		0.10%	0.15%	0.20%							
3	Assam	0.10%	0.15%	0.20%								
4	Bihar	0.50%	0.75%	1.00%	1.25%							
5	Chattisgarh	0.25%	0.50%	0.50%	0.75%	1.00%						
6	Delhi		0.15%	0.20%	0.25%	0.30%	0.35%					
7	Gujarat	0.50%	1.00%	1.00%	1.25%	1.50%	1.75%					
8	Haryana (Draft)	0.50%	0.75%	0.10%	0.25%	0.38%	0.57%	0.86%	1.30%	1.96%	3.00%	
9	Himachal	0.01%	0.25%	0.25%	0.25%	0.25%	0.25%	0.50%	0.75%	1.00%	2.00%	3.00%
10	Jammu Kashmir	0.10%	0.25%	0.25%	0.75%	1.50%	1.75%					
11	Goa & UT	0.30%	0.40%	0.40%	0.60%	0.85%	1.15%	1.50%	1.85%	2.20%	2.60%	0.30%
12	Jharkhand	0.50%	1.00%									
13	Karnataka	0.25%	0.25%	0.25%	0.25%							
14	Kerela	0.25%	0.25%	0.25%	0.25%	0.25%						
15	Madhya Pradesh	0.40%	0.60%	0.80%	1.00%							
16	Maharashtra	0.25%	0.25%	0.50%	0.50%	0.50%						
17	Manipur	0.25%	0.25%									
18	Mizoram	0.25%	0.25%									
19	Meghalaya	0.30%	0.40%									
20	Nagaland	0.25%	0.25%									
21	Orissa	0.10%	0.15%	0.20%	0.25%	0.30%						
22	Punjab	0.03%	0.07%	0.13%	0.19%							
23	Rajasthan (Draft)	0.50%	0.75%	1.00%	1.50%	2.00%	2.50%					
24	Sikkim											
25	Tripura	0.10%	0.10%									
26	Tamil Nadu (Draft)	0.05%	0.05%	0.05%	2.00%	2.00%						
27	Uttarakhand	0.05%										
28	Uttar Pradesh	0.50%	1.00%									
29	West Bengal			0.10%	0.15%	0.20%	0.25%	0.30%	0.40%	0.50%		

Long Term RPO Trajectory-necessary for investment promotion

- Bihar has declared solar RPO trajectory - increasing upto 3% by 2022.

- HP has declared trajectory of solar RPO going upto 3% and non solar RPO upto 16% by 2022.

- Kerala has kept solar RPO constant at 0.25% while increasing the non solar RPO to 6.35% by 2022.

- Delhi, J&K, West Bengal and Uttarakhand have declared increasing RPO upto 2016-17.

- AP, Jharkhand and Maharashtra have declared their RPO upto FY 2016 but kept the RPO constant for the last three years.

- Other states yet to declare their RPOs beyond 2014-15.

State-wise RPO Status

Himachal Pradesh :
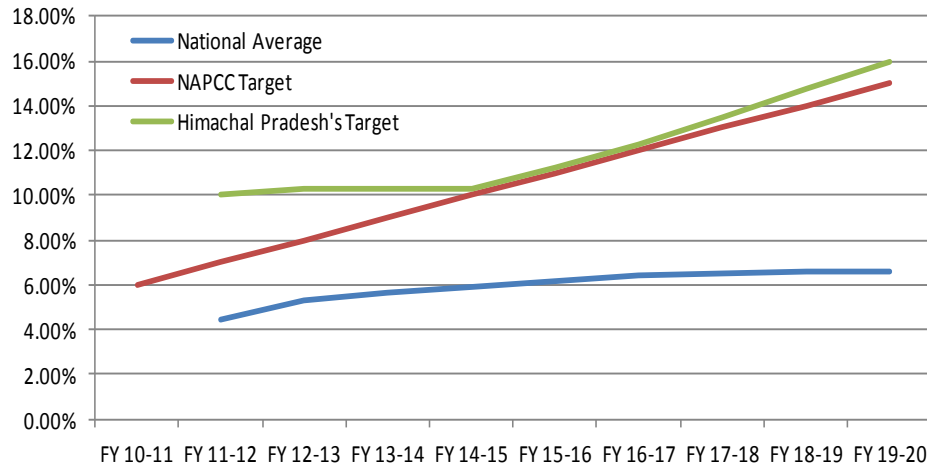
Non-Solar only; See notes on calculation in Annexure

Compliance Status

	Non Solar	Solar
DISCOMS	Complied	Not Complied
0A/CPP	Partial; RECs purchased	Partial; RECs purchased

Enforcement Status

Orders	Non Solar	Solar
FY 11-12	Complied	Carry Forward
FY 12-13	Complied	Carry Forward
FY 13-14	Reviewing	Reviewing
Penalty	Not imposed	Not imposed

Highlights

- HPSEBL has met with non-solar RPO targets of FY12 & FY13
- HPERC has asked OA/CPPs in state to declare their stand-by power unit capacities for reviewing compliance through a public notice issued in March 2014

Uttarakhand :
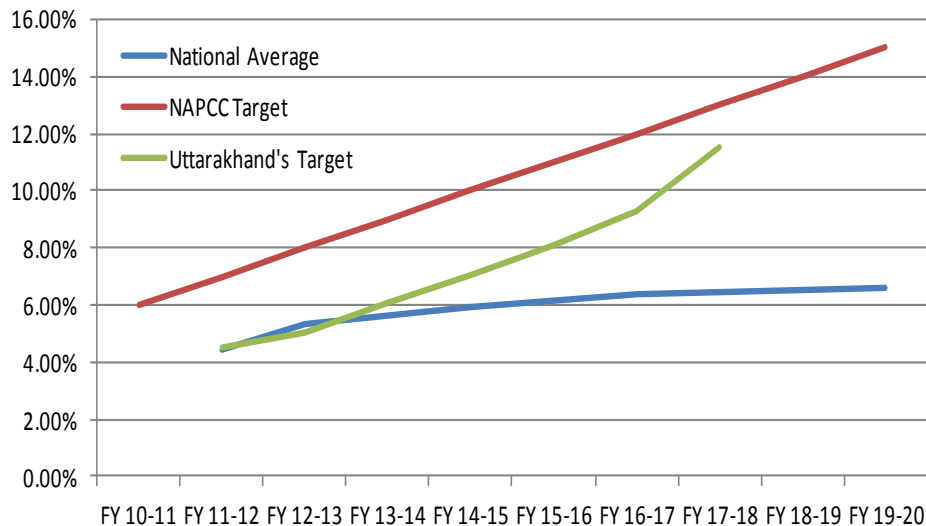
Compliance Status

	Non Solar	Solar
DISCOMS	Not Complied	Not Complied
0A/CPP	Partially complied thru RECs	Partially complied

Enforcement Status

Orders	Non Solar	Solar
FY 11-12	Carry Forward	Carry Forward
FY 12-13	**Penalty imposed**	Carry Forward
FY 13-14	Not Available	Not Available
Penalty	Imposed	NA

Highlights

- Only state till date, to impose penalty for non-compliance on Discoms
- In an order on 13th March, UERC has reviewed RPO compliance of OA consumers; has directed to submit details of compliance by 10th April 2014.
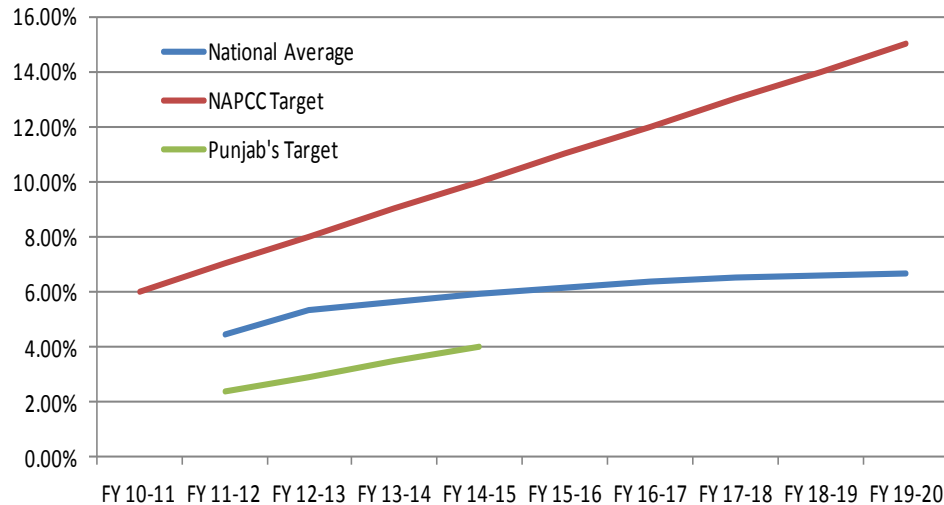
4/25/2014

10

Punjab :

Compliance Status

	Non Solar	Solar
DISCOMS	Partially Complied thru RECs	Partially Complied; **RECs not purchased**
OA/CPP	Partially Complied	Partially Complied

Enforcement Status

Orders	Non Solar	Solar
FY 11-12	Carry Forward	Carry Forward
FY 12-13	PSPCL and OA consumer were asked to comply by Dec'13	
FY 13-14	Not Available	Not Available
Penalty	Not imposed	Not imposed

Highlights

- PSPCL was asked to comply with shortfall of previous years by December 2013
- They were also asked to submit quarterly compliance report to the PSERC
- PSERC has allowed RE/RECs procurement cost under ARR.

Haryana
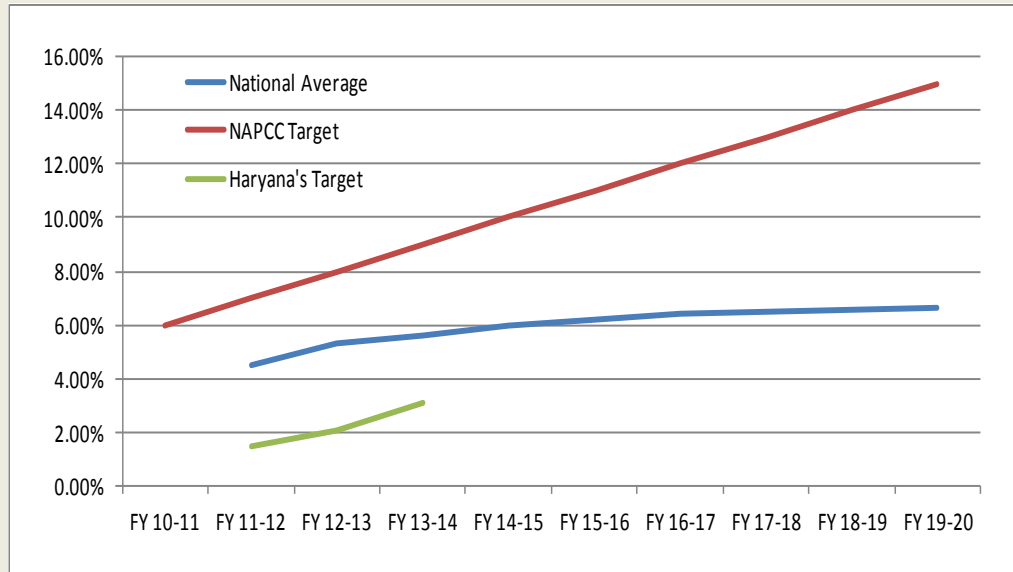
Compliance Status

	Non Solar	Solar
DISCOMS	Partially Complied; RECs not purchased	Partially Complied; RECs not purchased
0A/CPP	Partially Complied; RECs purchased	Partially Complied; RECs purchased

Enforcement Status

Orders	Non Solar	Solar
FY 11-12	Carry forward to FY 14-15	
FY 12-13		
FY 13-14		
Penalty	Not imposed	Not imposed

Highlights

- Order of Nov 2013 allowed carry forward of RPO to FY 2014-15

Chhattisgarh :
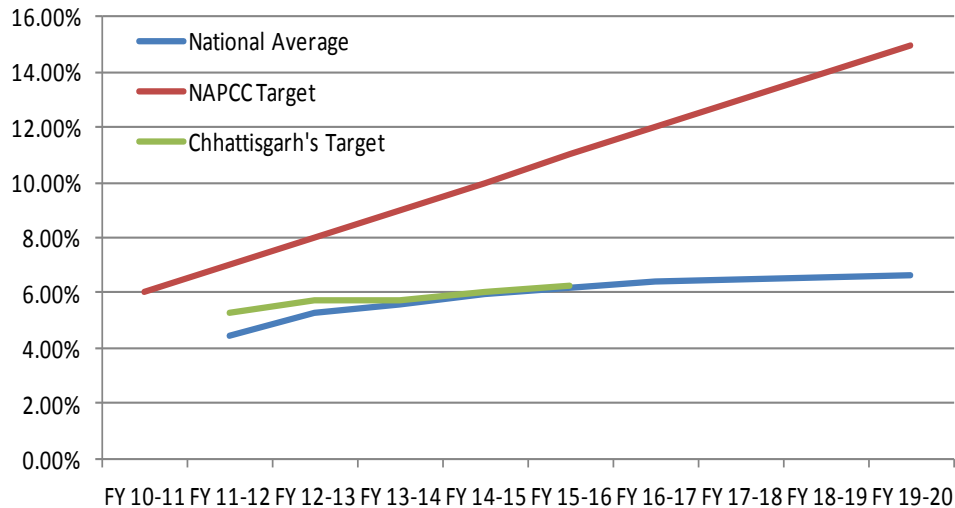
Compliance Status		
	Non Solar	Solar
DISCOMS	Partially Complied	Partially Complied
0A/CPP	Partially complied	Partially complied

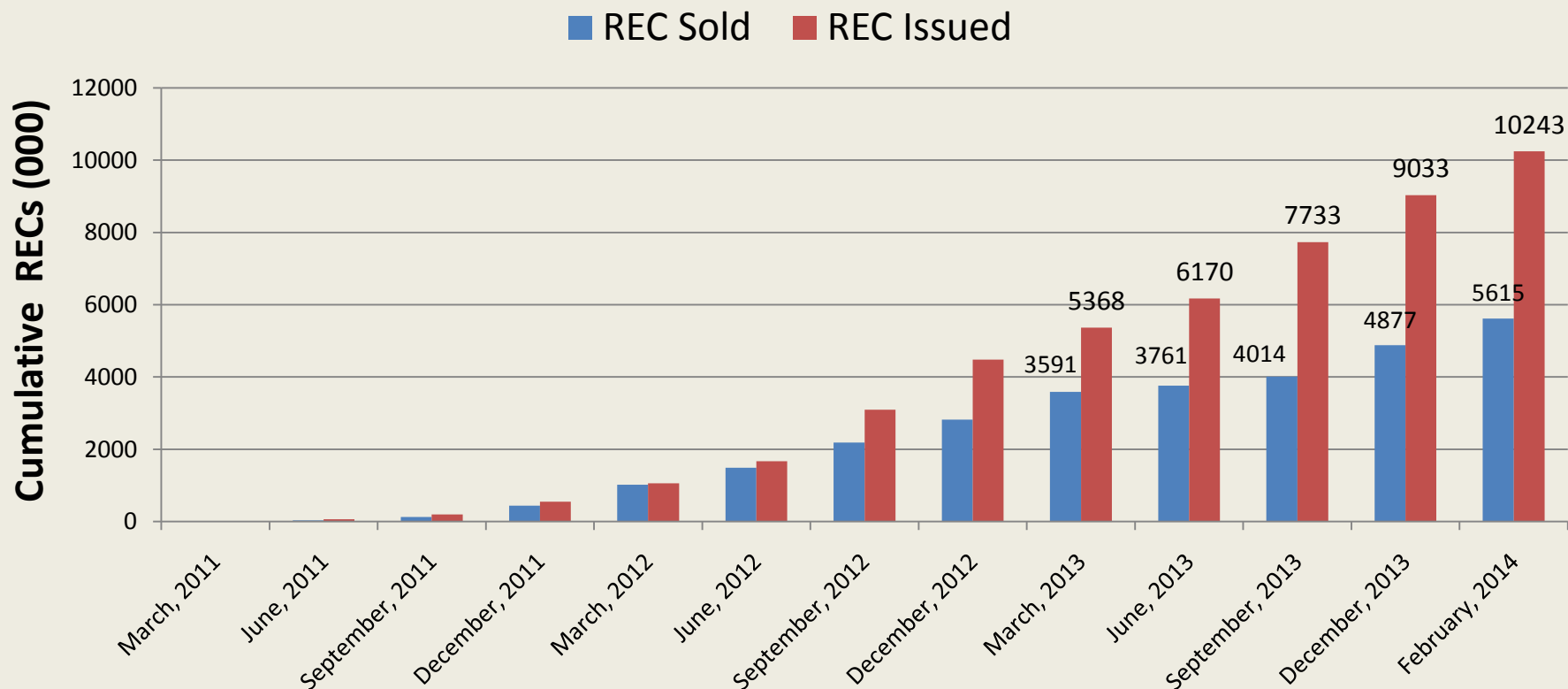| Enforcement Status		
Orders	Non Solar	Solar
FY 11-12	Carry Forward	Carry Forward
FY 12-13	Carry Forward	Carry Forward
FY 13-14	Not Available	Not Available
Penalty	Not imposed	Not imposed

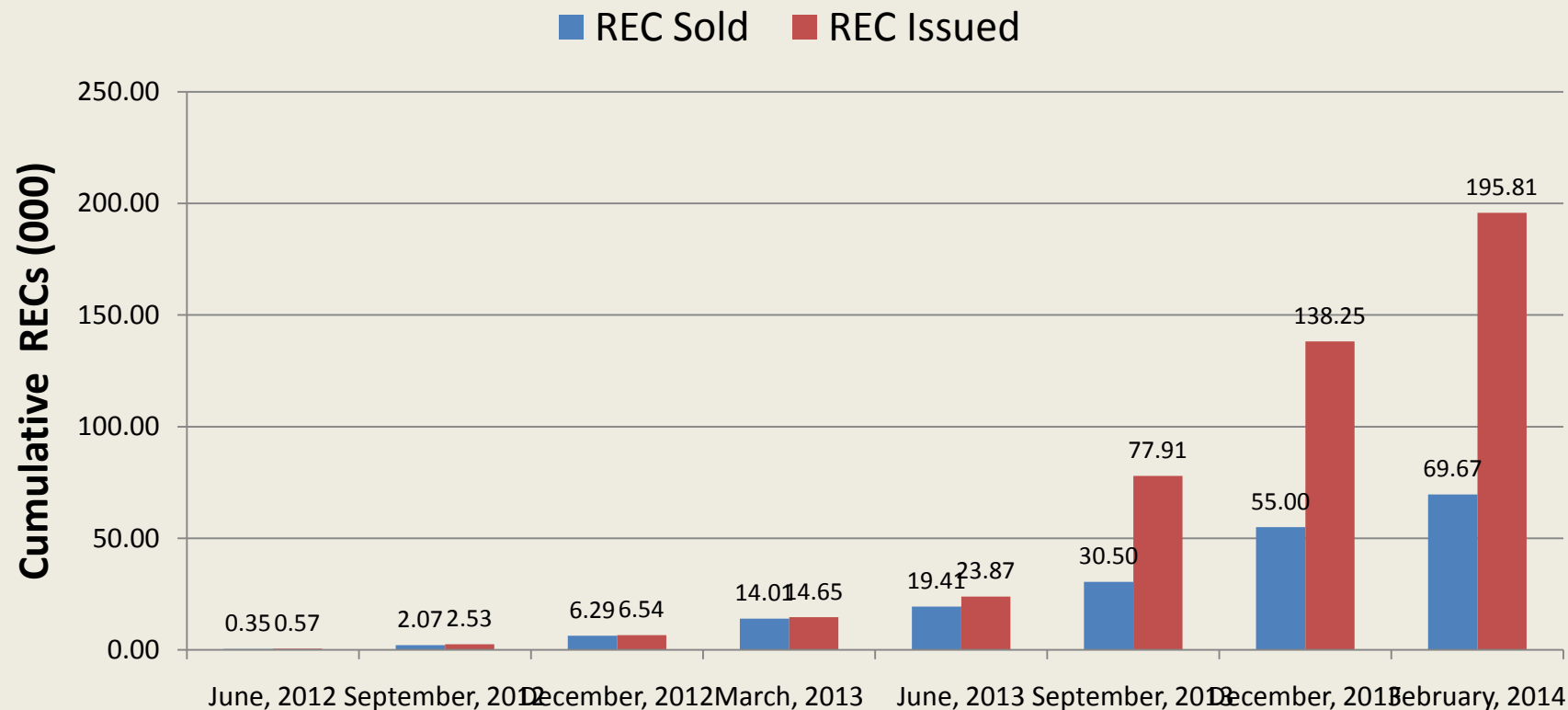| Highlights |
|---|
| • Case Hearing on RPO compliance is scheduled on 25th April 2014 |

REC Mechanism : Status

Non-Solar REC Status

So far 4090.58 MW Non-Solar Projects accredited and 3764.5 MW registered
Around 46.3 Lakh Non-Solar RECs (45.2% of total issued) remain unsold.

15

Solar REC Status

So far 379.39 MW Solar Projects accredited and 333.85 MW registered
Over1.26 Lakh Solar RECs (64.42% of total issued) remain unsold

Source: www.recregistryindia.nic.in

REC Market Performance in FY 13-14
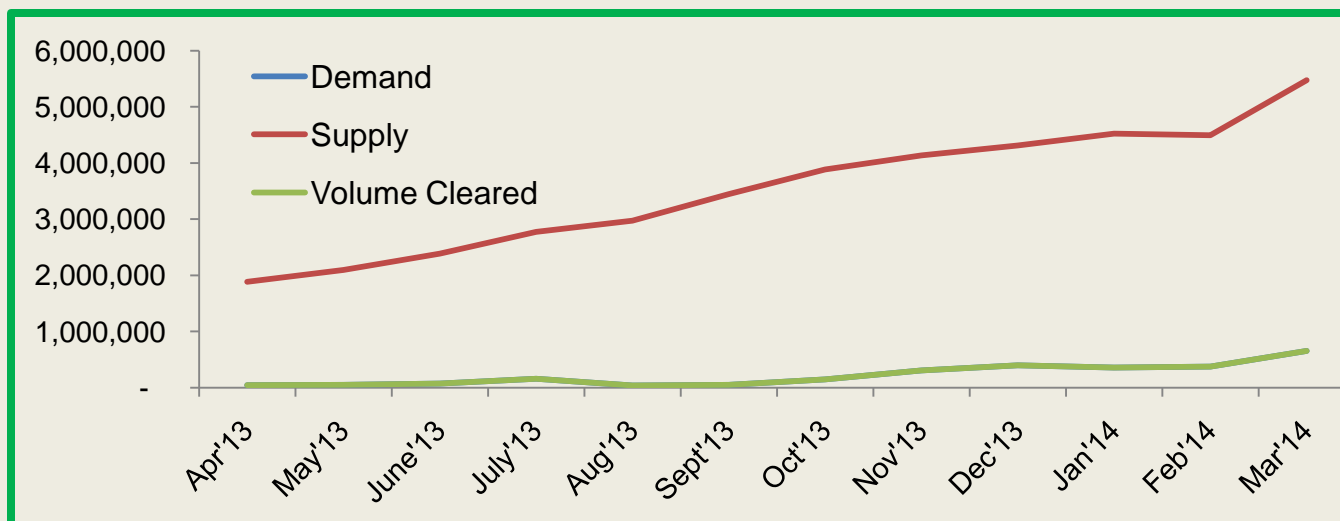
Value of RECs issued in the year – Rs 933 cr

Traded during the year – Rs 402 cr

Outstanding at year end – Rs 827 cr

Non-Solar Demand - Supply – FY 13-14
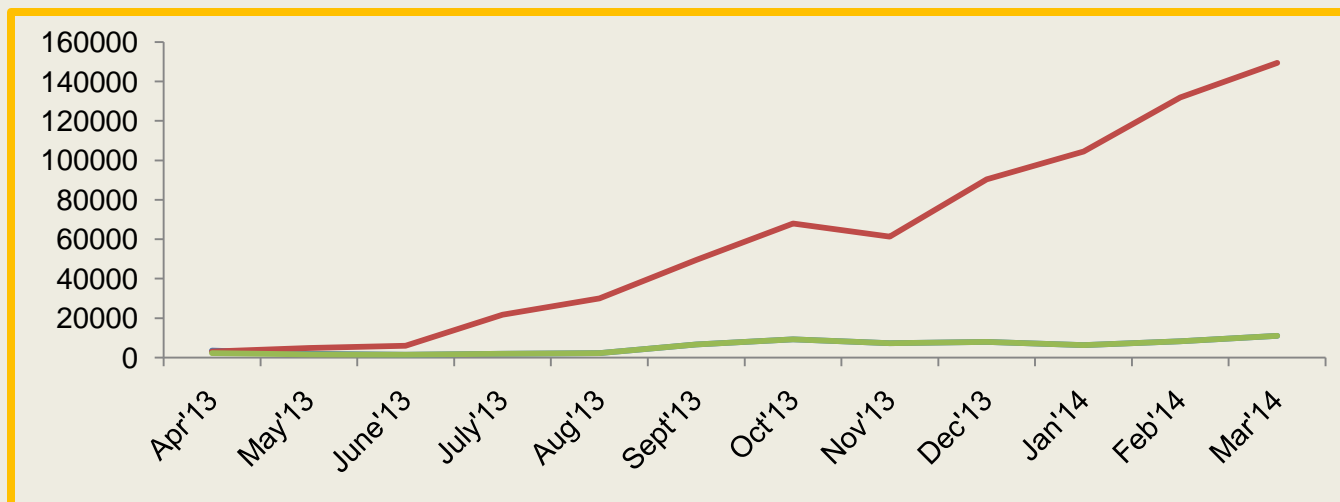
Value of RECs issued in the year – Rs 192 cr

Traded during the year – Rs 62 cr

Outstanding at year end – Rs 130.5 cr

Solar Demand – Supply – FY 13-14

All values at floor prices

4/25/2014

17

REC Trading Analysis – State-Obligated Entity wise

Bar chart titled "REC Trading Analysis – State-Obligated Entity wise". Y-axis labeled "No. of RECs" ranging from 0 to 1200000. X-axis labeled "States" with categories: MAH, PUN, GUJ, RAJ, AP, KAR, MP, TN, UTK, HP, Others. Legend: CPP/OA (olive), DISCOMs (blue).
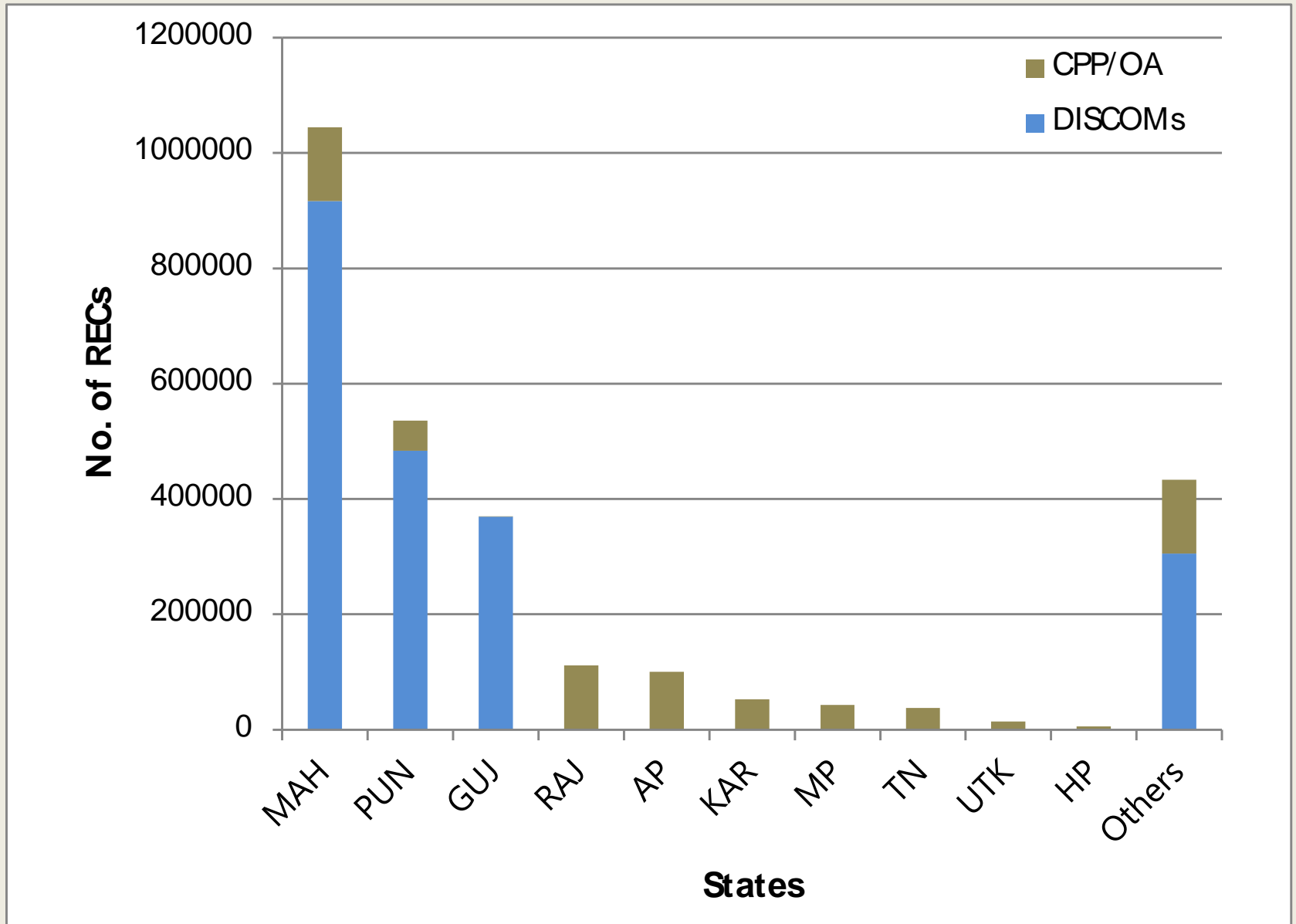
Month wise REC capacity registered

4/25/2014

19
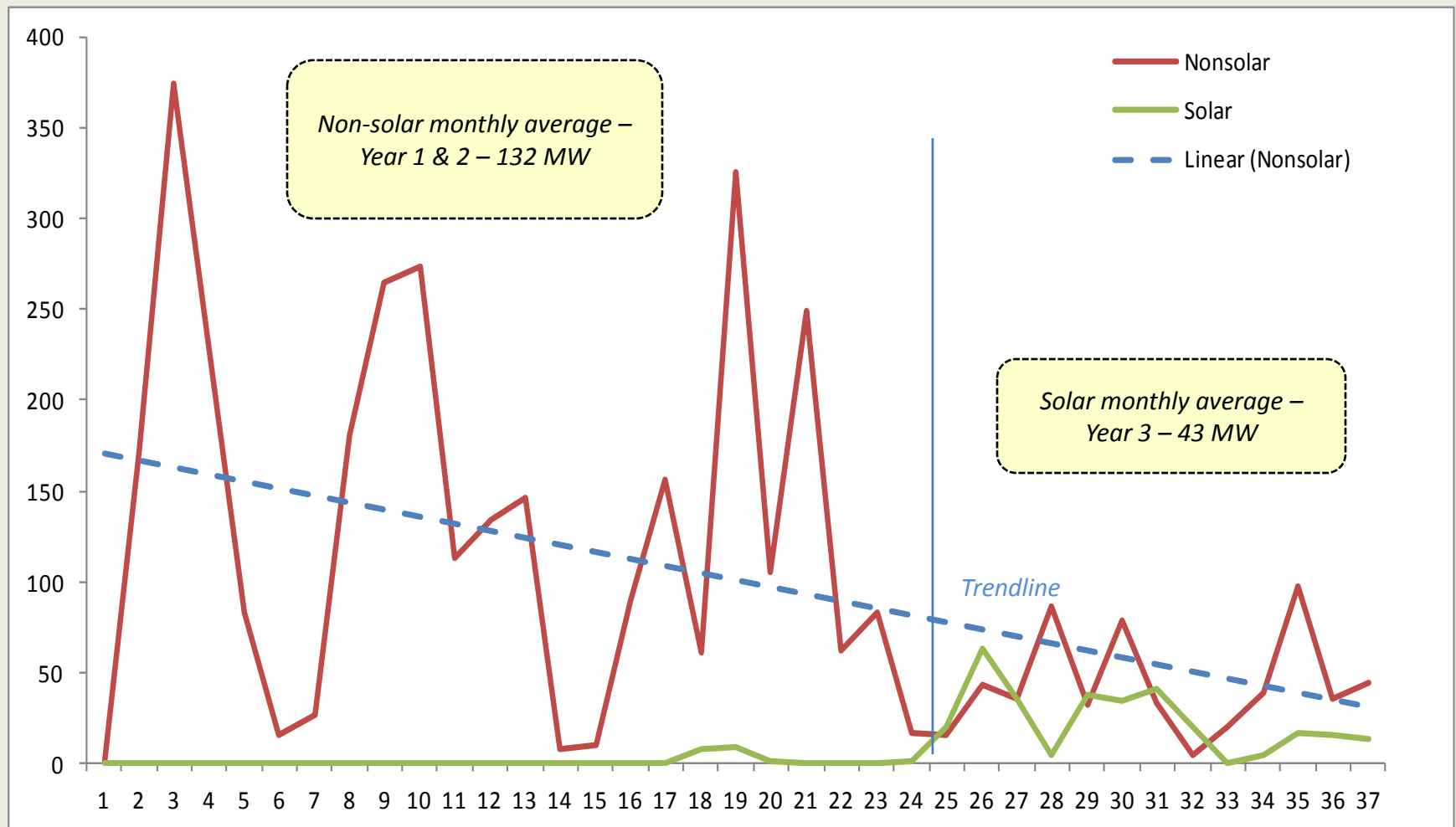
Observations on RPO Compliance

- Renewable power projected to be purchased by the Discoms for the year 2012-13 was 75% of the RPO requirement only and for 2013-14 it became just 50% of the RPO requirement

- In 2012-13, as against the RPO levels of 5.45 % for non-solar and 0.45 % for solar, compliance was 3.74% and 0.08% respectively (Source: Ministry of Power)

- By 2017, ~ 55 GW capacity (51.34 GW non-solar and 3.71 GW solar) will be required to meet RPO requirement.

Creating a Robust RPO regime

- In September 2013, SERCs were requested to issue directions to ensure RPO compliance by invoking penal provisions against defaulting entities (SERCs from Bihar, Karnataka, Gujarat, Punjab, Himachal Pradesh and Tripura responded).

- SERCs may consider to:
    - Align RPO targets in line with the suggestion made in the National Action Plan on Climate Change.

    - Prescribe long term RPO trajectory (say upto 2022).

    - Stipulate regular monitoring, reporting and verification of RPO compliance status and for submission of Quarterly Compliance report (e.g. MERC's action)

    - Need for institutional mechanism for monitoring RPO compliance: State level RPO Registry, National level RPO Registry

    - Include REC purchase cost in the tariff calculations (DERC example)

    - Invoke penal provisions on non-compliance (UERC example)

- Need for amendment in RPO Regulations: RPO can't be met from co-gen with fossil fuel.
- Need for incentives for RPO compliance – for RE resource rich and deficit states.

Thank You !

Fuel audit study of PSPCL thermal power stations

for Punjab State Electricity Regulatory Commission, Chandigarh

By

CENTRAL POWER RESEARCH INSTITUTE,
ENERGY EFFICIENCY & RENEWABLE ENERGY DIVISION,
BANGALORE 560 080

Brief outline about the study

- Study was carried out at:
  - GGSSTP, Roopnagar
  - GNDTP, Bathinda &
  - GHTP, Lehra Mohabbat
- Study period : February 2012

Sl. No.	Coal source	Coal supplier
01	Coal India Ltd mines	CCL, SECL, BCCL, ECL
02	Captive mine	Panem
03	Washeries	MDL, ACBL, Deepika

Scope of work

- Study system of recording, sampling, measurement, reporting, verification & accounting for coal and Oil receipts, consumption and stocking as inventory.

- Identify key constraints with the current fuel accounting system across process, technology, skills and facilities.

- Assess effectiveness of existing coal and oil tracking and accounting system and practices.

- Study the Fuel supply agreements and the relevant regulatory orders / directions / rules and regulations and evaluate whether there is any deviation and procedural gaps.

- Measure the Gap between billed quality and quantity vis-à-vis actual receipt of coal and oil.

- Ascertain the loss and assess reasons for high losses, if any.

- Method of Testing of coal at site and at plant and basis for release of payment.

Scope of work (Continued)

- Treatment of stones or any foreign material in the coal.

- Calorific value based on which coal consumption is worked out i.e. Gross or fired and the extent of difference between the two.

- Various components, including demurrage, loaded on the fuel cost along with their justification.

- Status of availing the rebate being offered by Railways or any other agency.

- Comparison of various fuel consumption parameters with national (comparison with NTPC/Private Sector Thermal Plants) / international standards.

- Submit report on findings, along with recommendations for proper fuel accounting.

- To check more precisely the methodology regarding computation of cost of fuel being passed on to the consumers as an uncontrollable

Salient areas of fuel saving and cost reduction

- Review of the measuring methods and points of measurement of GCV of coal.

- Reduction in the drop of GCV of bunkered coal vis-à-vis receipt coal.

- Reduction in transit loss between the mine and the TPS.

- Reduction in demurrages through improvement in unloading infrastructure.

- Reduction in quantities of stones received through more vigilance at the loading end.

- Review of contract with washeries regarding the quantity and quality of coal inputs and outputs.

- Achievable Station Heat Rate (SHR)

Reduction in drop of GCV between receipt and bunkered coal

The basis for calculation of savings is that the drop in GCV is reduced from 900 to 150 kcal/kg thereby providing this heat to the boilers for power generation.

The inclusion of surface moisture in computation of the GCV (which is presently being computed on equilibrated basis which considers only inherent moisture) of the sending end may be taken up with the appropriate authorities.

Drop in GCV due to 1 % surface moisture increase

Source 1 (Theoretical calculations)

- For 1 % moisture increase, the GCV drop will be (GCV x 0.01) +6.1 kcal/kg. Suppose GCV is 4500 kcal/kg then (4500x0.01) +6.1= 45+6.1 =51.1 kcal/kg

Source 2 (Empirical formula for Indian coal)

- Gross Calorific Value in Kcal/kg = 85.6 x (100-1.1 A) -145.6M

- Where A = Ash content, wt %   M = equilibrated moisture content, wt %

Source 3:

- As per GCV determined through a bomb calorimeter using total moisture (surface moisture + inherent moisture) for as received or as fired coal, the dependence on total moisture (M) (as %) and ash (A) (as %) is given by,

GCV= A_0+A_1(UHV)		UHV= 8900-138 (A+M)	
A_o	A_1	Moisture effect of GCV	
2111	0.6812	94.0056	Ref [1] in report
2437.5	0.6679	92.1702	Ref [2] in report
1977.5	0.5901	81.4338	Ref [3] in report

- As per GCV correlations for 1 % moisture GCV impact is varying between 81 to 100 kcal/kg

Variation of GCV with Moisture

$y = -85.04x + 7216$

$R^2 = 0.906$

GCV, kcal/kg

Total moisture, %
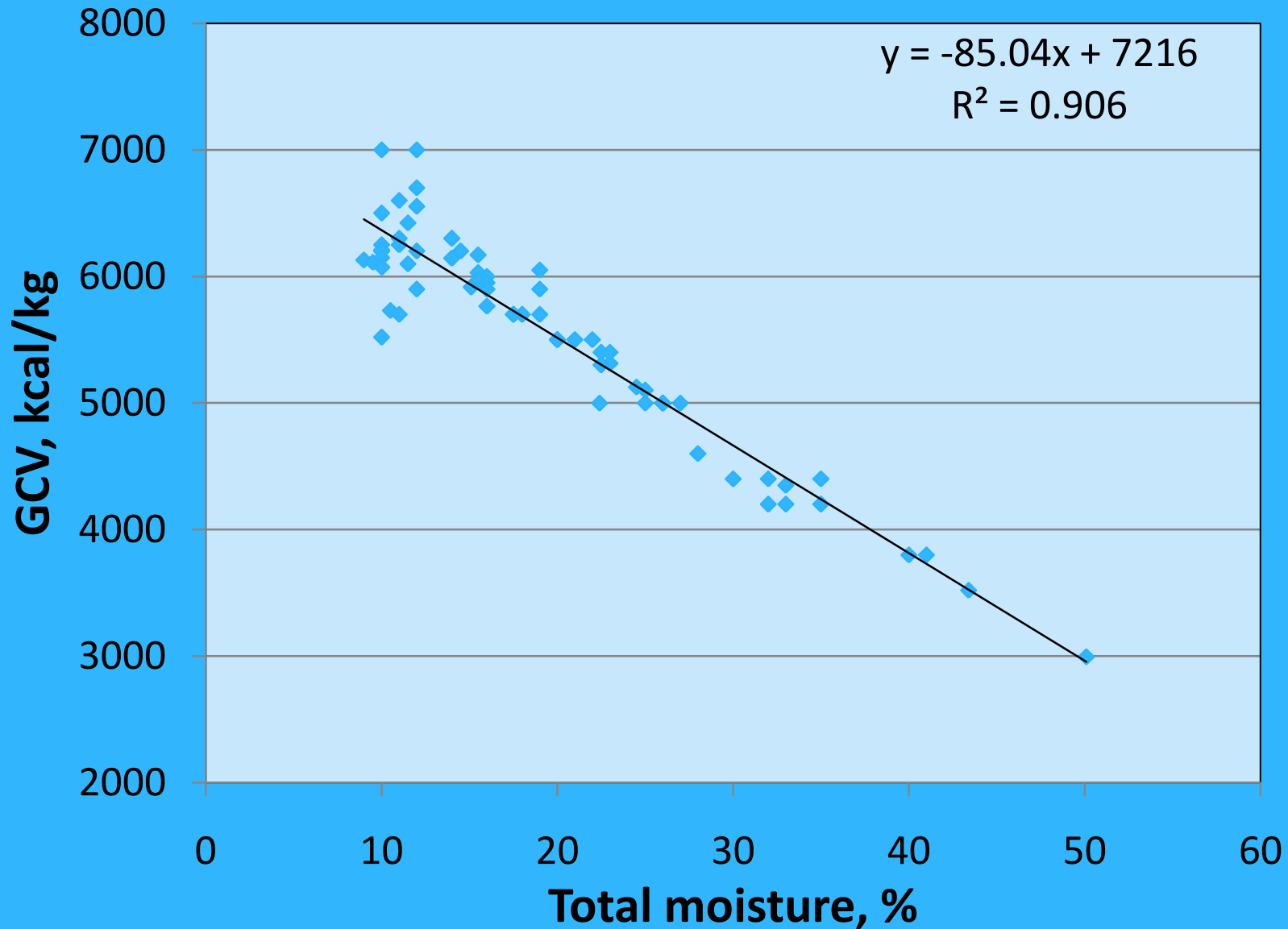
Effect of long term storage of coal - heat generated in stock piles

Stage	Reaction	Weight	Temperature (°C)	Heat generated (kcal/kg)
Adsorption	Water Adsorption	Gain	Any temp.	2-25
Chemisorption	Oxygen absorbed to form peroxides	Gain	70	2-16
Peroxygen decomposition	•Disintegration of peroxygen • Release of water from coal	Loss	70-150	4-18
Oxycoal formation	Formation of stable oxygen complexes	Gain	150-230	6-27

Effect of long term storage of coal -heat generated in stock piles

- Technical study by NTPC, R & D, the maximum drop in GCV of coal in a coal yard is around 600 kcal/kg in an year [1]. 15-50 kcal/kg for 9-30 days.

- According to another study in the Illinois region [2] is in-between 1.4 %/year (70 kcal/kg/year) in winter like weather and 2.1 %/year (105 kcal/kg/year) in summer like weather.

- Hence, for storage of 9 to 30 days, drop in GCV should be below 150 kcal/kg.

[1] Banarjee D., Hirani, M. and Sanyal, S.K. (2000), **Coal- quality deterioration in a coal stack of a power station**, Applied Energy Vol.66, pp. 267-275.

[2] Rees 0. W., Coolican F. C., Pierron E. D. and Beeler C. W. , *Effects of outdoor storage on Illinois steam coals,* Division of the Illinois State Geological Survey, John C. Frye, Chief Urbana, Circular No.313, 1961.

Effect of long term storage of coal -heat generated in stock piles

- As per CEA recommendations, storage loss is around 3 kcal/kg and hence negligible. The SHR can be computed on the basis of receipt coal GCV and zero drop can be assumed with minor weight adjustment to account for difference in weights between receipt and bunkered coal [3].

[3] Recommendations on Operation norms for thermal power stations, Tariff period 2014-19, CEA, Ministry of Power, Govt. of India, January 2014.

GCV drop at GGSSTP
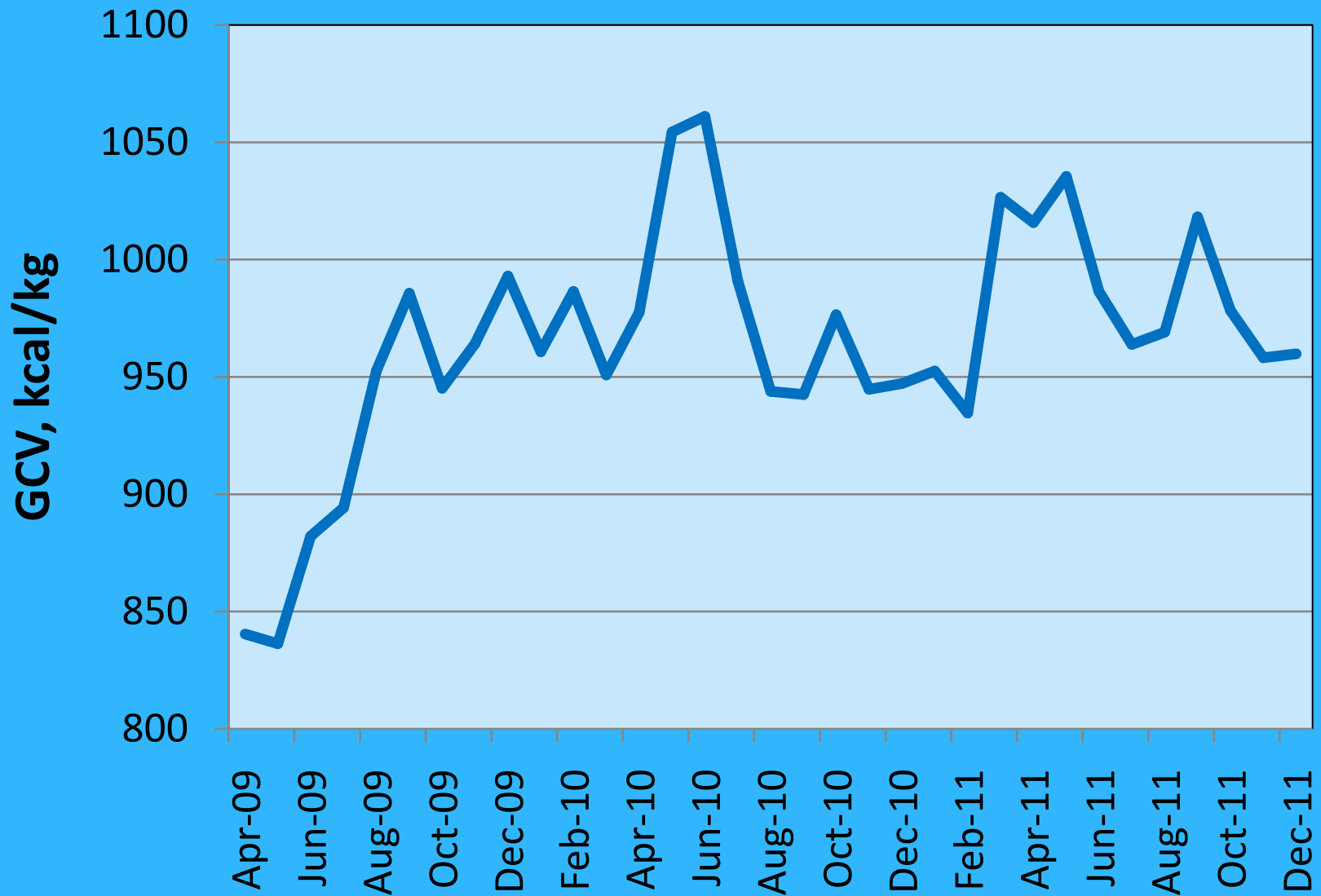
High drop in GCV between tippler and bunker

- Bunkered coal GCV are not based on any logic- random process.
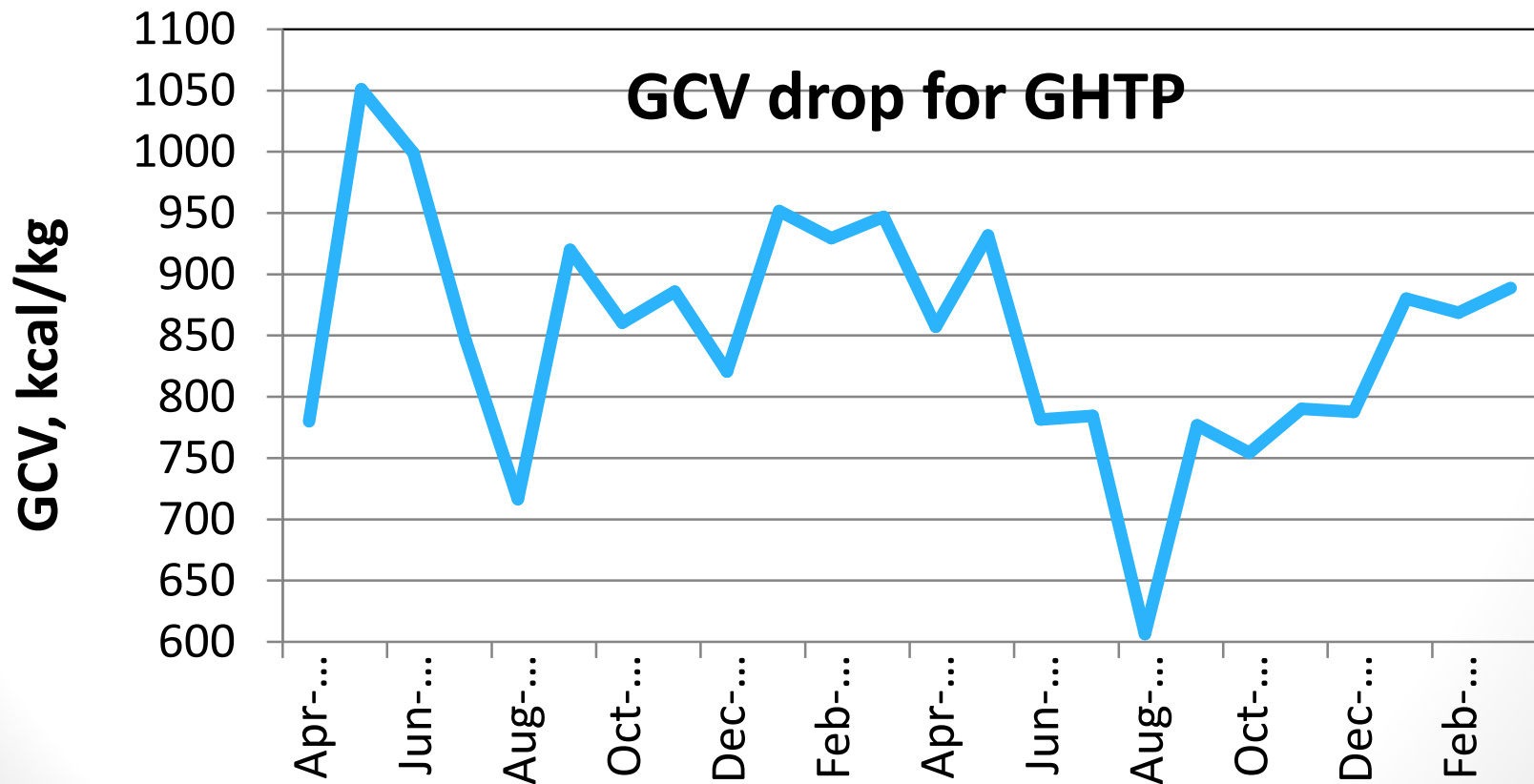
High drop in GCV between tippler (receiving point of the TPS) and bunker (final utilization point)

- Purely technical drop is established from several sources to be within 150 kcal/kg.
- Practical drop (nearly 900 kcal/kg) to be minimized by first in/first out process, compaction, etc. over next 2-3 years.
- [Receipt coal GCV – 150] kcal/kg would adequately take care of stacking losses and also financially correct because payment is only on basis of receipt GCV
- Stacking loss should not be factored in SHR

Drop in GCV -recommendations

- To initiate the process of reduction in drop:

Receipt coal

- *Option A*: *receipt coal GCV* is be determined on equilibrated basis. Total moisture may also be determined for the same sample and the effect of moisture may be added to the receipt coal GCV at the rate of 145 kcal/kg for every 1 % increase in surface moisture.

- *Option B:* Bomb calorimeter. Go for bomb calorimeter results 81-100 kcal/kg and hence it cannot exceed 145 kcal/kg. Bomb calorimeter values also captures degradation and hence no separate degradation can be allowed in this case.

Drop in GCV -recommendations

Bunkered coal

- *Option A:* The ***bunkered coal GCV*** is also be determined on equilibrated basis. The total moisture may also be determined for the same sample and the effect of moisture may be added to the bunkered coal GCV at the rate of 145 kcal/kg for 1 % increase in surface moisture.

- *Option B:* Bomb calorimeter. Go for bomb calorimeter results 81-100 kcal/kg and hence it cannot exceed 145 kcal/kg. Bomb calorimeter values also captures degradation and hence no separate degradation can be allowed in this case.

Difference between receipt and bunkered coal

- **And finally, the difference between receipt and bunkered coal GCV may be worked out and minimized to be within 150 kcal/kg.**

Receipt Coal - Fuel cost -basis

- Rs./t coal cost + Rs./t freight is not a good indicator because of different GCV. Rs./Gcal is a better indicator.

- **Recommendation:** Coal cost to be given in three formats: Rs./t, p /kWh and Rs./Gcal.

GGSSTP	GCV (kcal/kg)	Coal cost (Rs./t)	Freight cost (Rs./t)	Landed cost (Rs./t)	Cost of Energy (Rs./Gcal)
ARYAN	4639.7	1664.2	2051.8 (*)	3716.1	800.9
CCL	4617.2	1422.2	1463.6	2885.8	625.0
MDL	4712.0	1777.2	1820.2	3597.4	763.4
PANEM	4979.1	1227.4	1662.7	2890.2	580.5
SECL	5393.4	2183.3	1333.6	3516.8	652.1
GHTP	GCV (kcal/kg)	Coal cost (Rs./t)	Freight cost (Rs./t)	Landed cost (Rs./t)	Cost of Energy (Rs./Gcal)
CCL	4632.8	1386.1	1496.1	2882.2	622.5
MONNET	4695.6	1630.0	1884.1 (*)	3514.1	748.4
PANEM	4785.7	1073.7	1603.6	2677.2	559.4
DVT IN	4679.6	1166.0	1606.5	2772.5	588.4
GRAND TOTAL	4747.4	1135.0	101135.0	2850.4	596.4
GNDTP	GCV (kcal/kg)	Coal cost (Rs./t)	Freight cost (Rs./t)	Landed cost (Rs./t)	Cost of Energy (Rs./Gcal)
CCL	4561.4	1191.2	1665.2	2856.4	626.0
PANEM	4957.9	1171.0	1616.9	2788.0	562.0
MONNET	4670.2	1656.7	2053.2 (*)	3710.0	796.4
GRAND TOTAL	4929.5	1204.3	1613.8	2818.1	570.3

TRANSIT LOSS

Coal weight= 70 t

- **Weight difference (accuracy of weigh bridge): 0.5 % = 350 kg**
- **Moisture loss of upto 0.3 m depth= 107 kg**
- **Coal falling out from sides= 2 sacks= 70 kg**
- **Unauthorized removal= not quantifiable**
- **Total TL = 527 kg (0.75 % which is within CERC norms)**

Various judgements:

- **TL only depends on pit head or non-pit head**
- **Independent of mode of transport and distance**
- **Inclusive of stacking loss in some utilities- no measurement of bunker coal –only receipt coal minus 0.8 % is the bunker coal.**
- **Lower TL provides disincentive to enroute thefts**
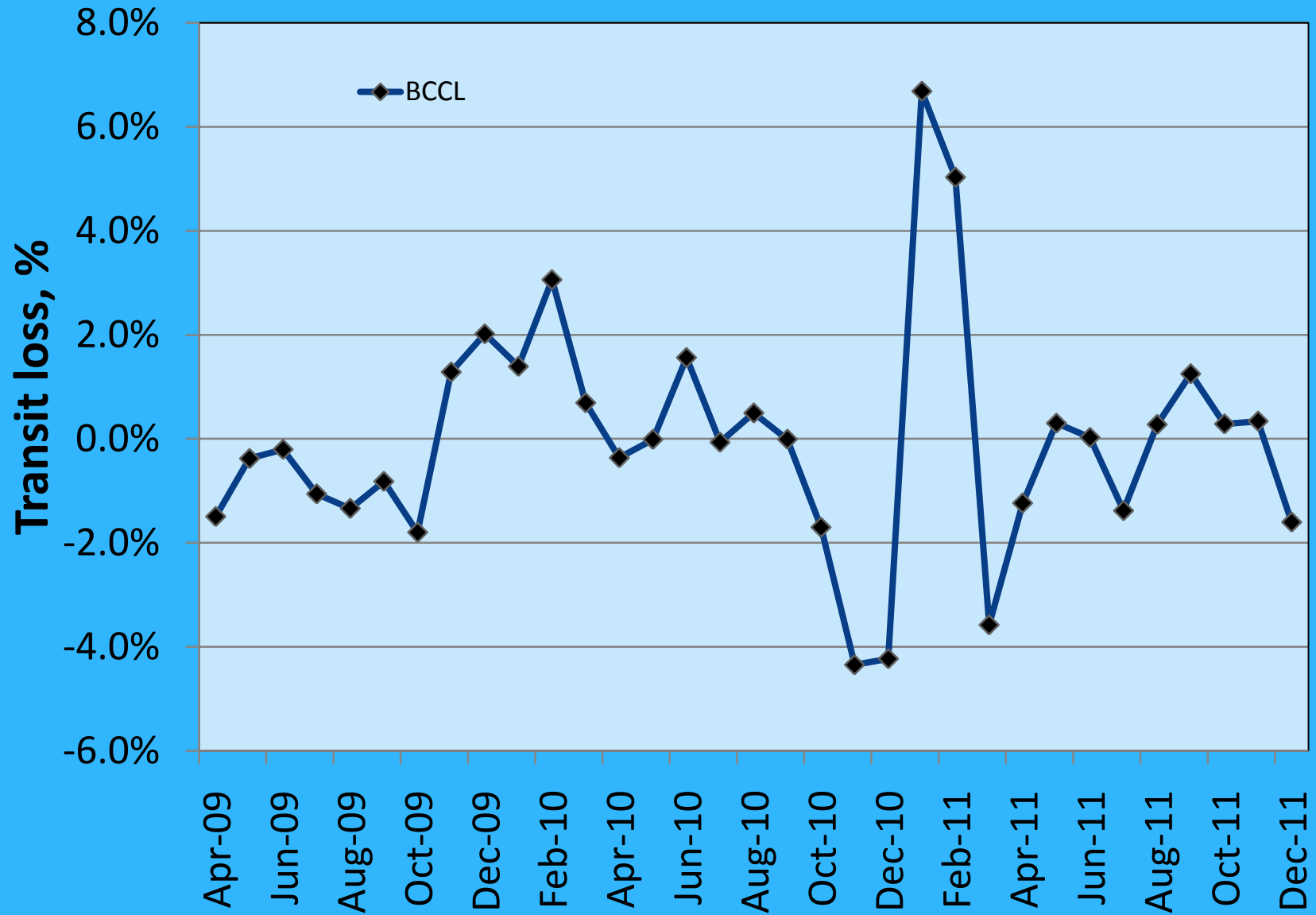
Transit loss (%) - GGSSTP
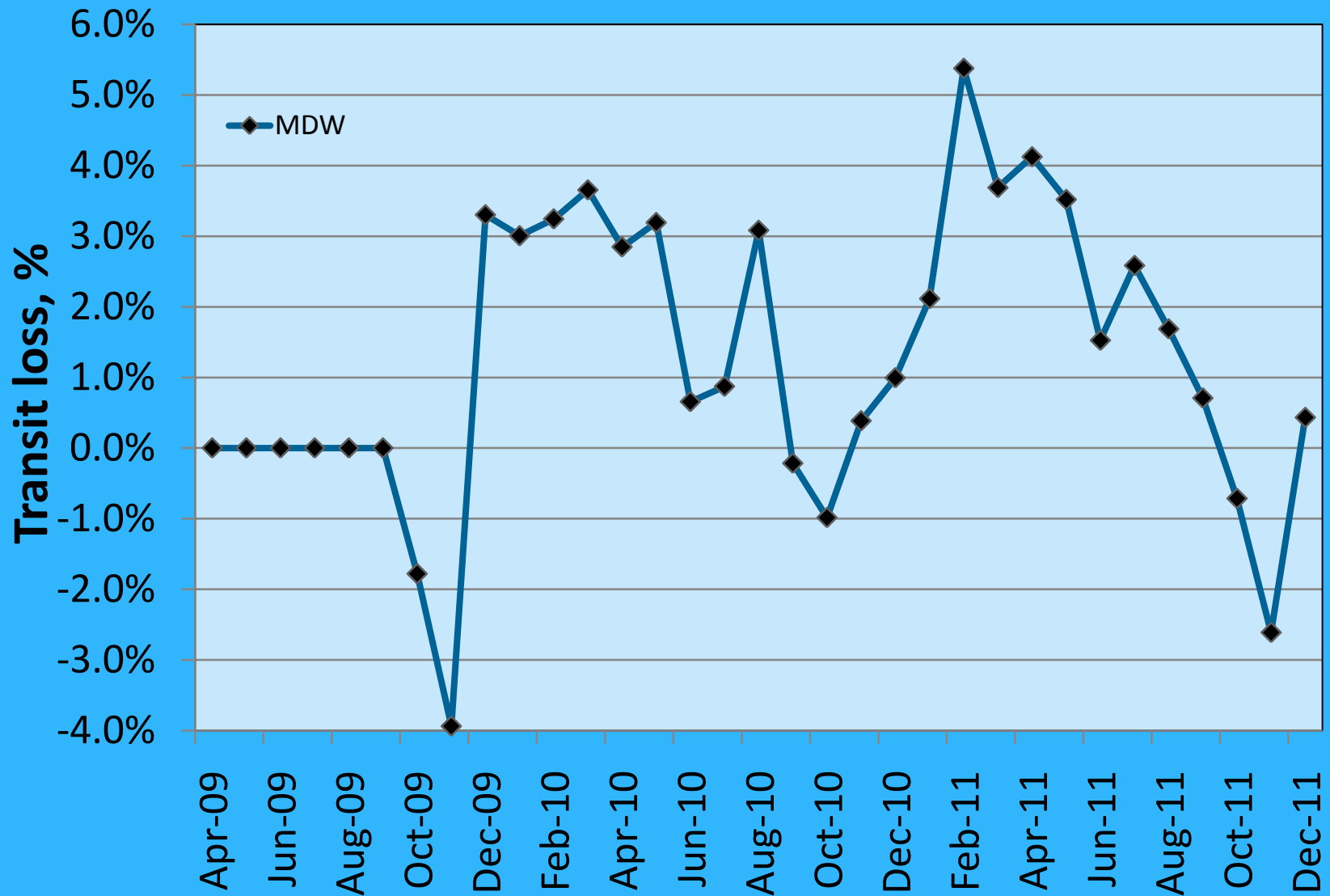
Transit loss (%) - GGSSTP
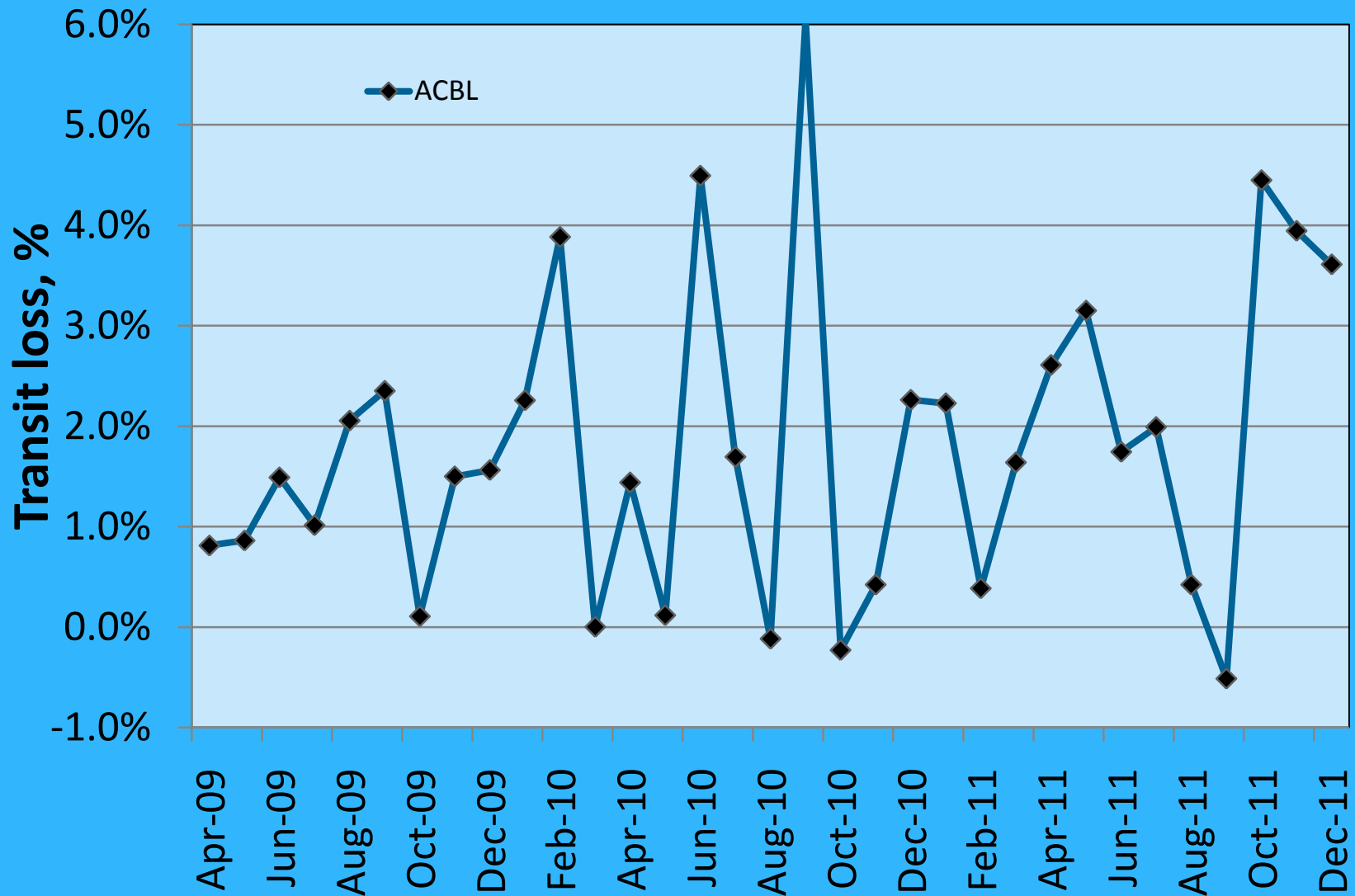
TL -continued

Trajectory was not successful for including in PSPCL in the past years.

Sl No.	TPS	2009-10	2010-11	2011-12
01	GGSSTP, Ropar	1.15	1.16	1.23
02	GNDTP, Bhatinda	0.66	-0.15	0.08
03	GHTP Lehra Mohabbat	1.16	1.33	1.25

TL-continued

- Detailed study of mine wise variations indicates that the TL is because of high moisture coal being loaded and unstable sending end weighting.

- The pattern does not indicate any enroute serious thefts

TPS	Total (Rs. Lakhs)	Rs./ t	Percentage (%)	p/kWh
GGSSTP	487.835	10.49	0.35	0.66
GHTP	492.230	11.25	0.39	0.69
GNDTP	9.932	0.70	0.02	0.05

TL-continued

- Up to 2 % deduction in LA's (Liasoning Agent) payments compensate but above that the LA penalty does not compensate.

- Idea compensate from LA is actual landed price of coal or Rs. 30/t for 1 % shortage.

- **Recommendation:** 0.8 % since 60-80 % coal is not coming under TL, GCV of coal is higher by 1000-1200 kcal/kg higher than in neighboring states, washed coal moisture loss must be in scope of washery, trend in other utilities is to follow CERC.

Loss Rs./t vs. TL -GGSSTP

Loss considering LAs penalty — Loss without LAs penalty

Transit Loss, %

Loss, Rs./t
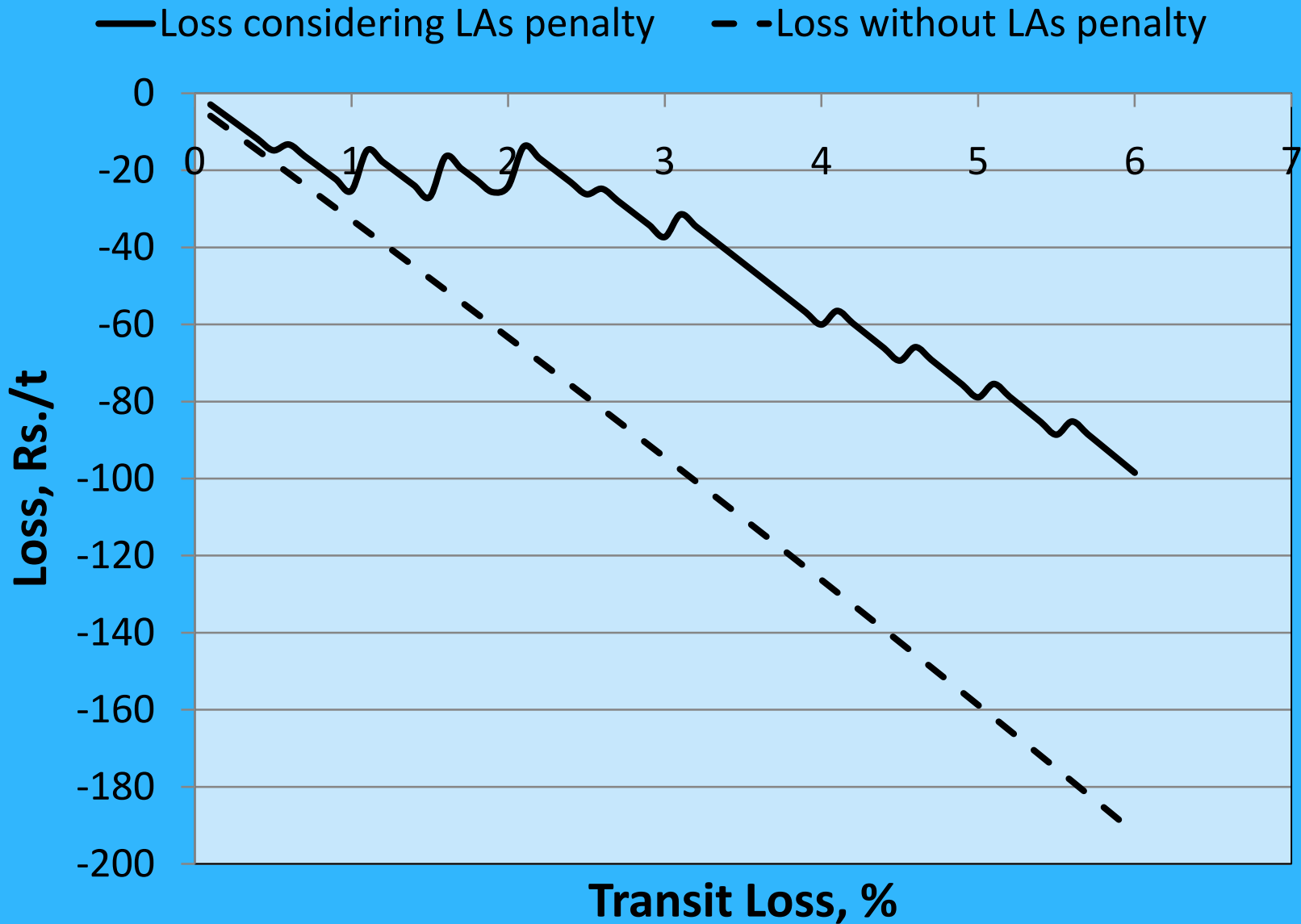
Demurrages: Rs. 60/wagon/h

Uncontrollable factors - bunching

Controllable factors- unloading infrastructure

- Wagon capacity increased from 58.6 t to 71 t and likely to be increased to 74 t/wagon: 20 % increase

- Unloading time decreased from 10 h down to 7 h for tippling type wagons and 2. 5 h for bottom opening wagons: 30 % decrease in time.

- Unloading time is stringent but practical.

- Demurrage waiver: not over 25 %

- Continuous up gradation of unloading infrastructure: Coal conveying time, wagon positioning, wagon tippler capacity.

Demurrage paid for 3 stations
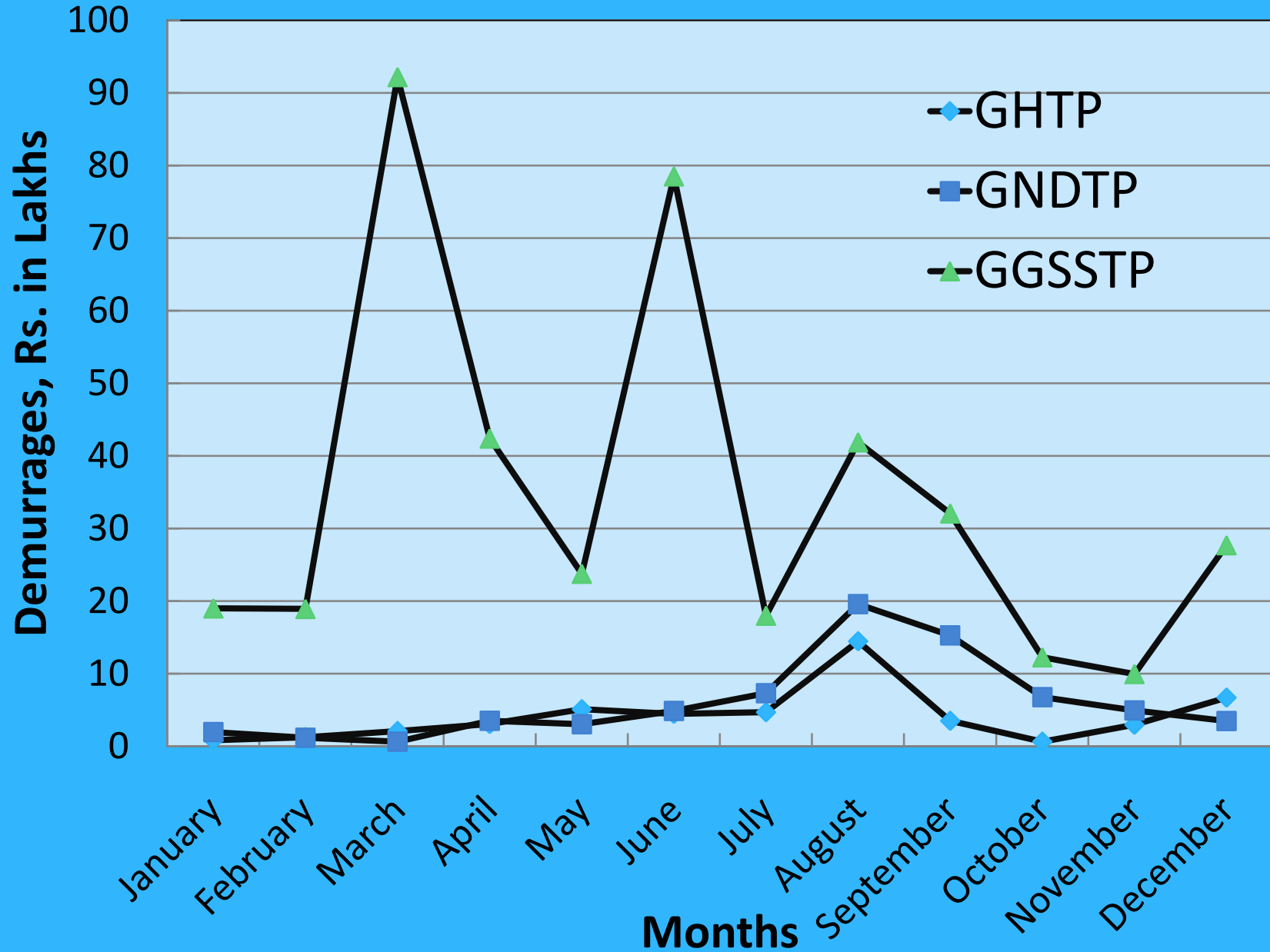
Demurrages

TPS	Total (Rs. Lakhs)	Rs./ t	Percentage (%)	p/kWh
GGSSTP	330.36	7.09	0.18	0.45
GHTP	39.49	0.89	0.02	0.03
GNDTP	53.71	3.83	0.13	0.29

Improvement in unloading infrastructure

- Review of wagon tippler capacity

- Apron feeders

- Rail tracking system

- Grab cranes

- Pneumatic hammers

- Conveying capacity

POL (Penal Over Loading)

- CIL coal: Higher level of vigilance of LA and officials at the loading site.

- Panem: Scope of Panem

- Monnet & Aryan washeries: 50:50 %. POL must be 100 % in the scope of washery.

- POL does not technically benefit washery even with 50 % as the distances involved are too large.

- LA & officials play a large role in bringing down.

POL for coal from CCL and MONNET for GGSSTP
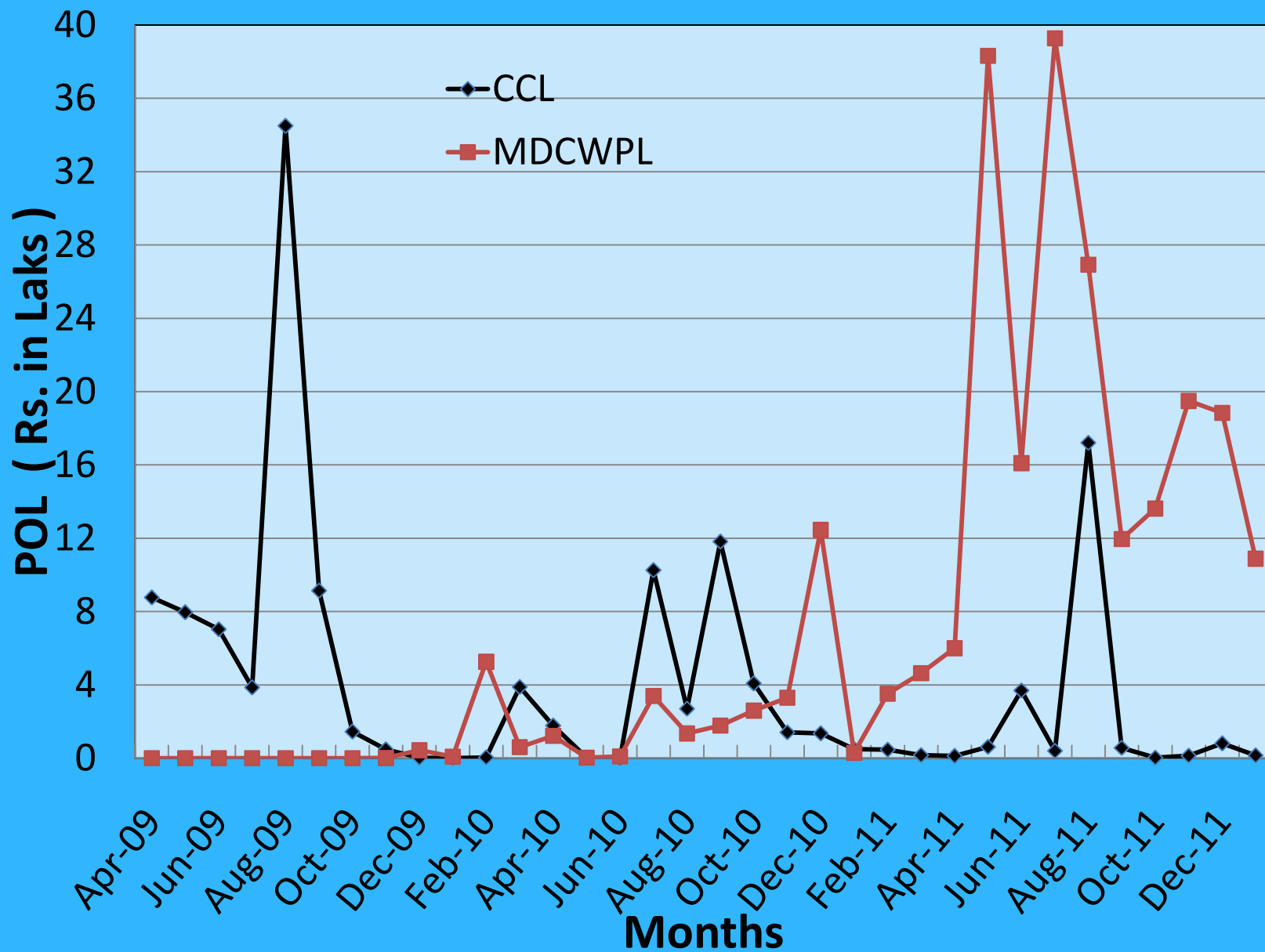
POL

TPS	Total (Rs. Lakhs)	Rs./ t	Percentage (%)	p/kWh
GGSSTP	297.20	6.38	0.22	0.40
GHTP	171.31	3.92	0.14	0.25
GNDTP	4.48	0.35	0.02	0.004

Stones & non-fuel foreign materials

Volume determined periodically by making heaps and taking a density conversion of 1.473 kg/m^3

Joint inspection for rebate

GGSSTP: 1.2 -1.8 %

GHTP: 0.4 %

GNDTP: 0.1 %

Our experience: 0.25 % is a good value

Stones

TPS	Total (Rs. Lakhs)	Rs./ t	Percentage (%)	p/kWh
GGSSTP	428.074	9.20	0.31	0.58
GHTP	619.960	14.17	0.49	0.87
GNDTP	75.425	5.32	0.18	0.40

Note

It is noted that the costs associated with

- TL

- Demurrages

- POL

- Stones

Are highest for GGSSTP and least for GNDTP

FSA WITH WASHERIES

- Clean coal is part of India's integrated energy policy.

- Environmental requirements: > 1000 km, Ash < 34 %

- Justification: Parent coal: 34.90, 34.67 %, 34.43 % for 3 years

- Wet beneficiation process

Monnet - Washery

1. Making ROM coal available-PSPCL

2. Transport of ROM to washery & TL-Monnet

3. TL from washery to TPS- scope of TPS

4. Demurrages for unloading at washery-Monnet

5. Rejects is property of Monnet

6. POL for loading at washery: 50 %/50 %

Recommendation: POL in entire scope of washery.

Monnet - Washery

Payment conditions quality:

1. Ash in coal, grade

2. Moisture within 5 % of equilibrated moisture.

3. Yield is linked to ash below 34 %. If final ash is lower yield will be lower than 80 %.

4. Guarantee on yield is at washery end and not at TPS end.

5. Overall efficiency of the process is 86.29 %.

6. Gain in GCV is 343-367 kcal/kg (7-8 %) against a weight loss is 20 %

Monnet - Washery

Payment conditions quality & quantity:

- Theoretical yield , organic yield: 86 x 0.95

- Organic yield limits are specified (0.1 % of 95 %)

- Equilibrated moisture and surface moisture:

- Surface moisture limits are specified (5%)

- Penalties are decided on limits of organic yield and surface moisture limits. Theoretical yield is an indisputable physical quantity.

- No mention of receipt coal quality in FSA

Monnet - Washery

- Sampling process: 2 samples once in 20 days(too low)

- Recommendation: GCV of ROM and washed coal at washery is to be measured for each and every rake as per the normal sampling process of 350 kg/rake.

- Recommendation: Critical review of initial coal ash content which is bordering 34 (+0.3 to 0.8) %

- Recommendation: Decrease in ash content of final coal is not indicated.

- Recommendation: Moisture content of final coal should not increase in the loaded coal. (Q:1% mc> 1 % ash) Presently 5 % higher.

Monnet - Washery

- GCV increase vis-à-vis mass yield:

- GCV of receipt coal should improve

- Yield to improve to become economical.

- Recommendation: Process Yield Map to be got validated.

- Recommendation: Telemetering is not in place. Hence washing charges are not being paid. Telemetering system to be made operational.

- Recommendation: POL at loading site to be fully in scope of Monnet

- Recommendation: Only equilibrium coal must be loaded or No net moisture addition.

Yield (%) vs Ash in washed coal (input coal ash: 34 %)

$y = 2.950x - 6.993$

$R^2 = 0.969$

% of YIELD

% of ASH
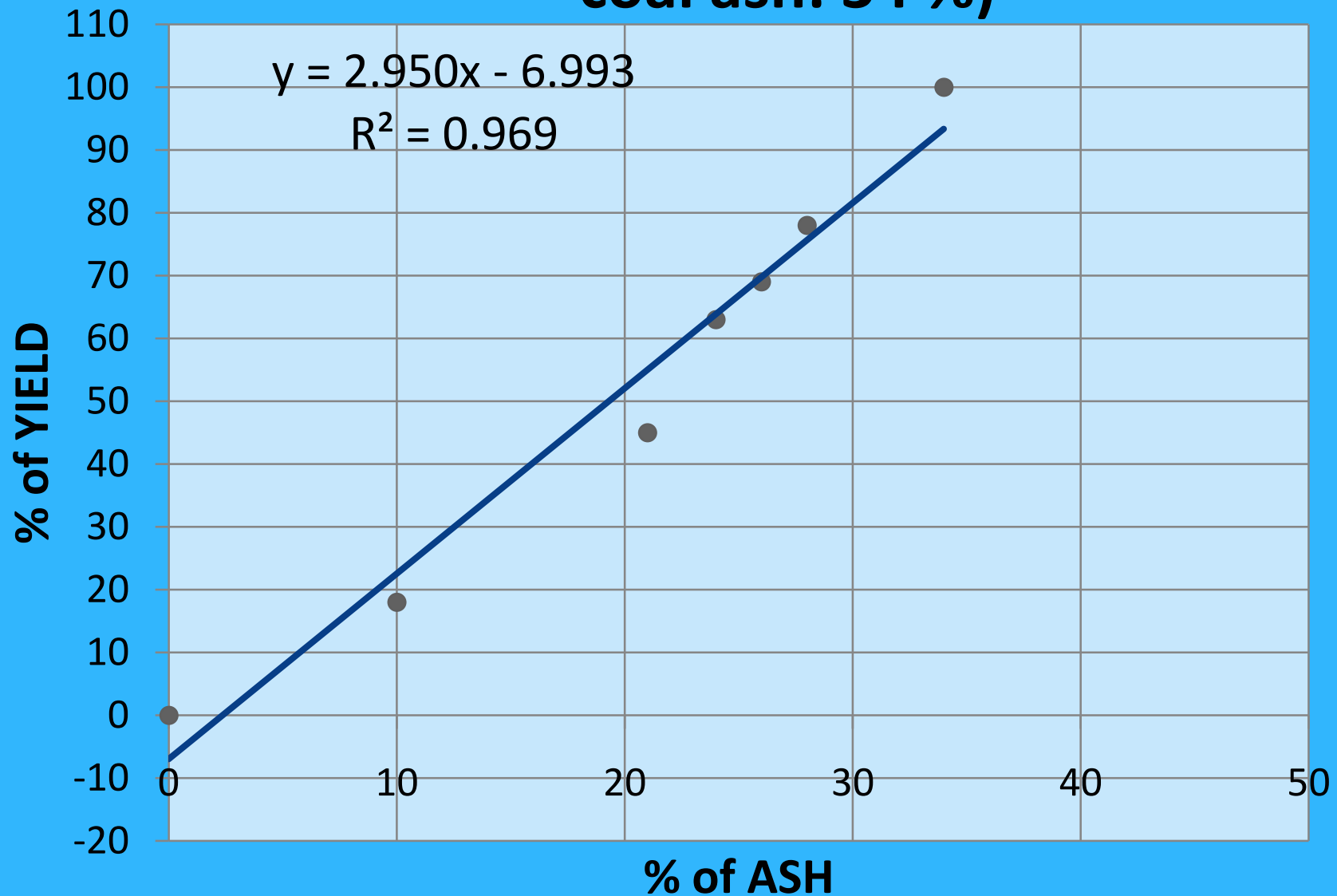
Monnet & Dipika

Recommendation: Since cost is higher by 22-28 % on heat basis, sampling must be rake to rake basis (350 kg/rake)

Dipika-ABCL: Grade wise specification must be switched over to GCV basis specification of quality.

Agreement with LA

Recommendation: TL to be in scope of LA, landed cost (Rs. 30/t presently)

Recommendation: Higher level of vigilance required for avoiding POL from LA

Conclusions

The main conclusions of the fuel study are:

- While the audit of quantities of coal are in order, a drop in GCV is observed between the receipt and bunkered quantity beyond the normal deterioration. The process needs to be improved to minimize the drop in the GCV of receipt coal and bunkered coal to 150 kcal/kg. A number of measures have been suggested for the coal yard and for the monitoring process of coal quality.

- The process of measurement of GCV needs to be made uniform for receipt and bunkered coal through adding the surface moisture effect @145 kcal/kg for 1 % to the GCV determined on equilibrated basis through a bomb calorimeter.

Conclusions

- **In the case of loading end the consideration for inclusion of surface moisture effect in the GCV which is presently being determined only through equilibrated basis may be taken up with appropriate authority**.

- In cases where the payment is based on quality measurement at the TPS end only, random and periodic samples need to be sent to third party truly independent labs under committee supervision.

Conclusions

- The concept of the fuel basket must be used to report the receipt coal GCVs, i.e., source wise GCV must be provided.

- The quantities and quality of fuel oil audited is in order.

- The reporting period for coal consumption and reconciliation of stock must be a month.

Conclusions

- The overall energetics of the washed coal vis-à-vis the benefits are presently not economical. Presently the washed coal is expensive by almost 22-28 % as compared to the raw coal. The washed coal must be cost economical in addition to the environmental obligation to not transport coal above 34 %. A validation of the process must be undertaken by a neutral third party agency at the earliest.

- In the case of MDL the UHV of the raw coal lifted by the washeries is recorded. In the case of Dipika washery of SECL, the band width of UHV of F grade is varying between 2400 to 3600 kcal/kg, implying that there is almost 1200 kcal/kg difference between the band limits of the F grade.

Conclusions

- The sampling frequency of the coal lifted by washeries must be on the basis of similar to rake sampling, i.e., around 350 kg per 4500 tonnes, i.e., 80 ppm (parts per million). Hence, for all coal lifted by the washery the GCV must be specified to verify the overall energetics of the process.

- Considering the national trends in transit loss, the TL fixed for stations with similar transit distances, high GCV of coal by almost 1200-1500 kcal/kg as compared to other states a TL of 0.8 % is recommend for CIL coals excluding Panem. Since the stations are getting majority of coals 60-90 % from Panem, TL is applicable only to CIL coal and washed coal.

Conclusions

- In the case of washed coals, TL on account of moisture loss must be to the account of Washery since they have to load coals after equilibrium is reached.

- The transit loss may be fully included in the scope of the liasoning agent by linking it up with the coal cost (Rs. 30/t for 1 full rake of 4000 t for 1 % loss).

- Upgrading coal handling capacity of tipplers and conveyors; and mechanical equipment for removal of stones could bring down demurrages.

Conclusions

- The percentage of stones at GGSSTP is on the higher side (1.2-1.8 %) and steps need to be taken to bring them to under 0.25 % of the receipt coal.

- The unloading infrastructure at the three stations needs to be comprehensively reviewed to keep in tune with the increasing of the wagon capacity by 20 % (with further increase to 74 t wagons in the offing) as well as reduction in unloading time by 30 % (7 h as compared to 10 h earlier). The upgradation of the apron feeder capacity, conveyor belt capacity, tippler capacity, etc., needs to be studied keeping the futuristic scenario. Wagon position equipment (in-haul out-haul betel charges or side arm charges) must be put into service or purchase a new.

Conclusions

- POL can be minimized by higher level of vigilance from the Liasion agent as well as the PSPCL officials at the sending end.

- Since loading is in the scope of Monnet, POL may be brought into the scope of Monnet (presently it is 50/50 between Monnet and PSPCL).

Conclusions

- The GGSSTP units are capable of operating at SHR of 2500 kcal/kWh which is achievable during 2012-2013 through operational optimization and implementing a few medium term measures as immediate measures. The GNDTP units are capable at SHR of 2825 kcal/kWh which is achievable during 2012-2013 through operational optimization measures.

- An investment of Rs. 8.58 crores is anticipated for investment into unloading infrastructure, coal quality and quantity measurement upgradation and tracking of rail positions.

Sl. No.	Type of measure	Investment (Rs. In lakhs)	Savings (Rs. Lakhs)		Pay back period (months)+
01	Improvement in coal quality and quantity measurement processes; measurement of both receipt and bunkered coal at the TPS.	309	GGSSTP	20670	1 month
			GNDTP	5410	
			GHTP	4530	
			Total	30610	
02	Improvement in unloading infrastructure, coal management at the coal yard and reduction of demurrages	489	GGSSTP	162.71	29.8 months (2.5 years)
			GNDTP	27.15	
			GHTP	7.29	
			Total	197.15	

Sl. No.	Type of measure	Investment (Rs. In lakhs)	Savings (Rs. Lakhs)		Pay back period (months)+
03	Improvement in TL	60	GGSSTP	170.54	2 months
			GNDTP	No TL	
			GHTP	196.15	
			Total	366.69	
04	Reduction in stones in receipt coal	nil	GGSSTP	368.62	Not applicable since no investment
			GNDTP	Stones within limits	
			GHTP	177.13	
			Total	545.75	
05	Total investment and saving	858	GGSSTP	21371.87	1 month
			GNDTP	5437.15	
			GHTP	4910.57	
			Grand total	31719.59	

Sl. No.	TPS	Saving Rs. In lakhs
01	GGSSTP	21371.87
02	GNDTP	5437.15
03	GHTP	4910.57
	Total	31719.59
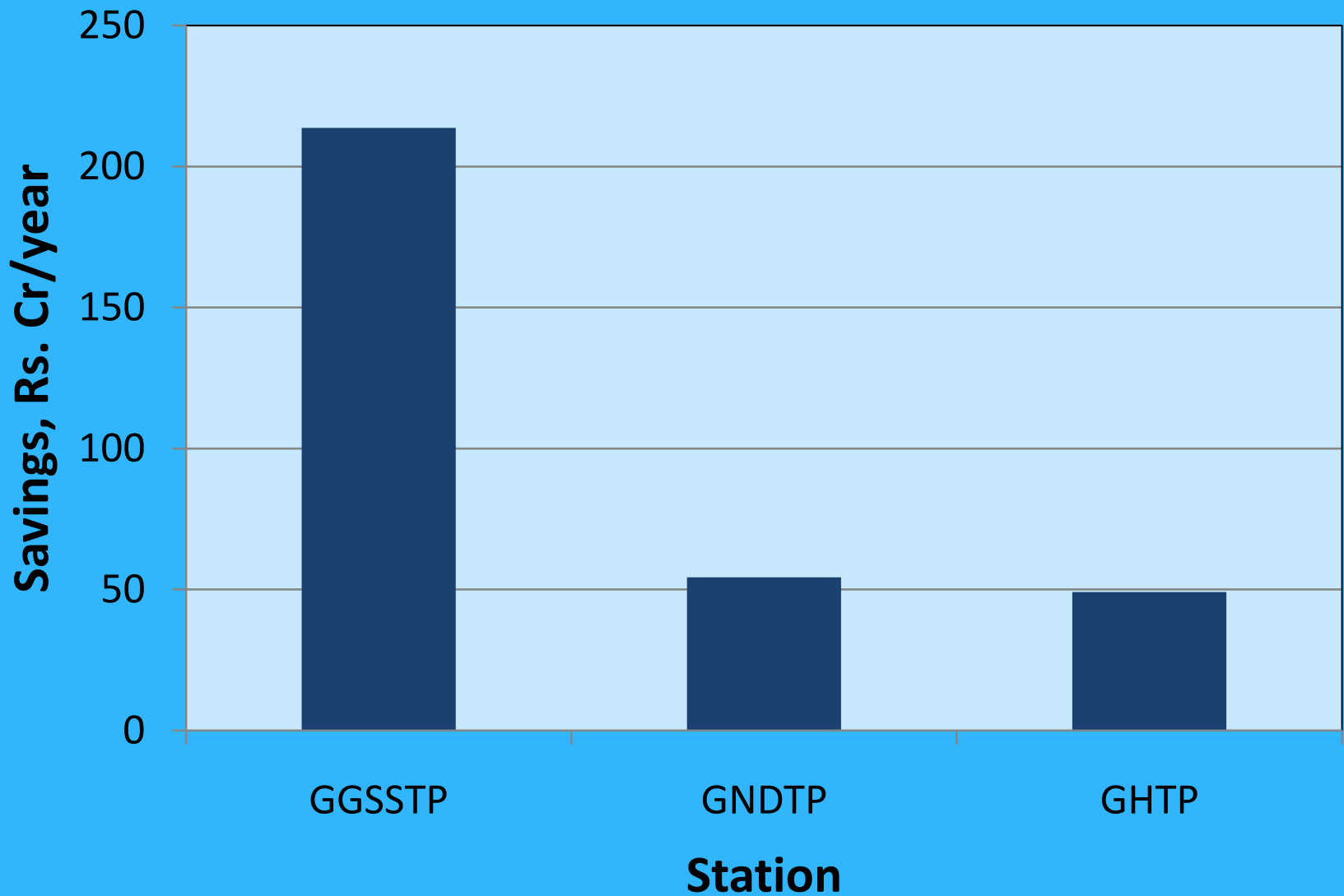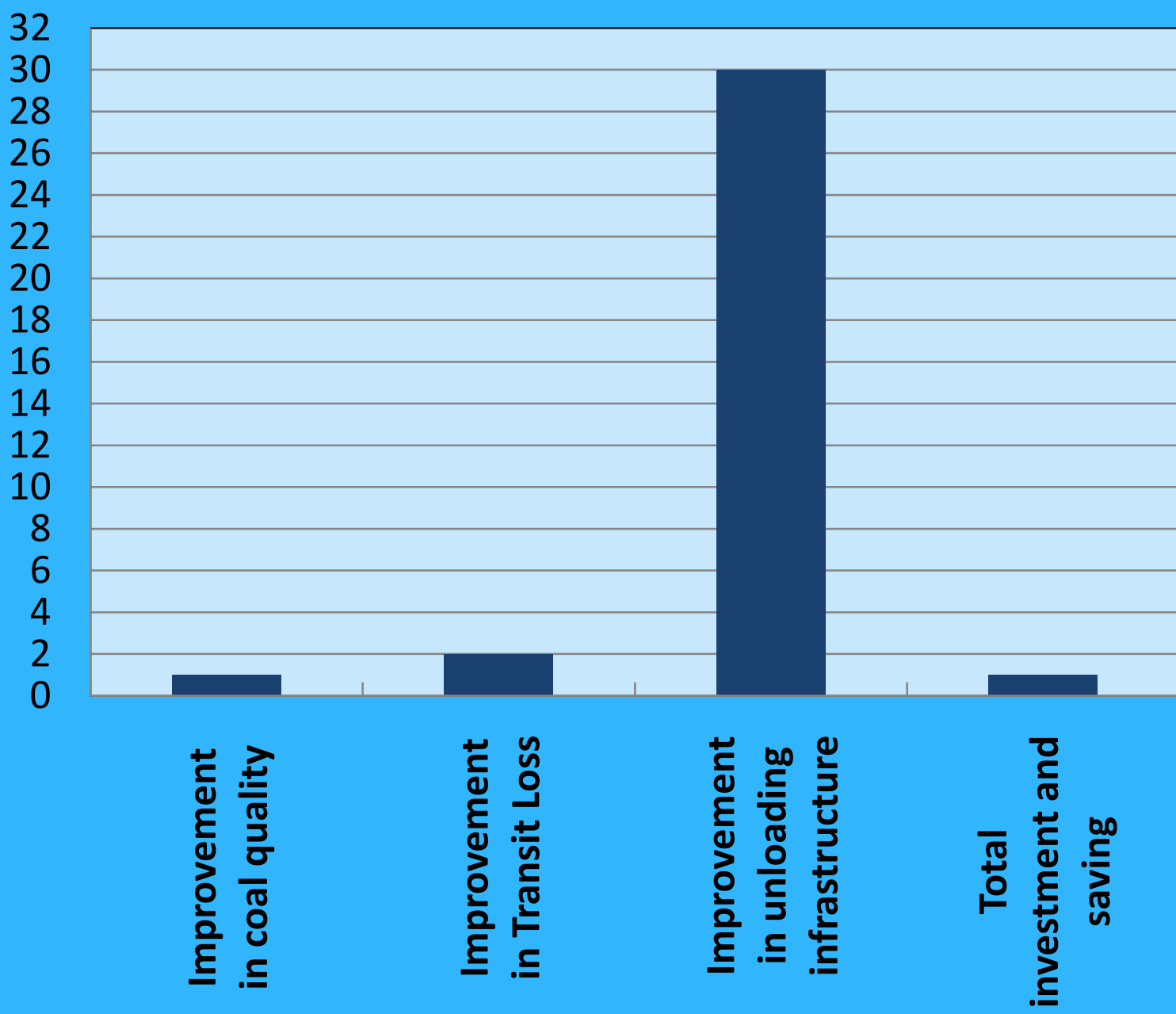
Actual drop in GCV (kCal/kg) after implementation of Fuel Audit Study Report

Actual drop in GCV (kCal/kg) after implementation of Fuel Audit Study Report

Month	Actual drop in GCV (kCal/kg)		
	GNDTP, Bathinda	GHTP, Lehra Mohhabat	GGSSTP, Ropar
Nov, 2012	238.52	71.06	555.00
Dec, 2012	319.26	-6.00	365.00
Jan, 2013	185.34	101.00	360.00
Feb, 2013	107.00	103.00	133.00
Mar, 2013	278.00	164.00	195.00
April, 2013	40.85	161.00	190.00
May, 2013	110.48	96.00	175.00
June, 2013	122.28	127.00	183.00
July, 2013	100.14	77.00	175.00
Aug, 2013	55.90	131.00	146.00
Sep, 2013	147.46	65.00	115.00
Oct, 2013	84.42	142.00	129.00
Nov, 2013	89.11	103.00	123.00
Dec, 2013	151.49	145.00	196.00

Actual drop in GCV (kCal/kg) after implementation of Fuel Audit Study Report
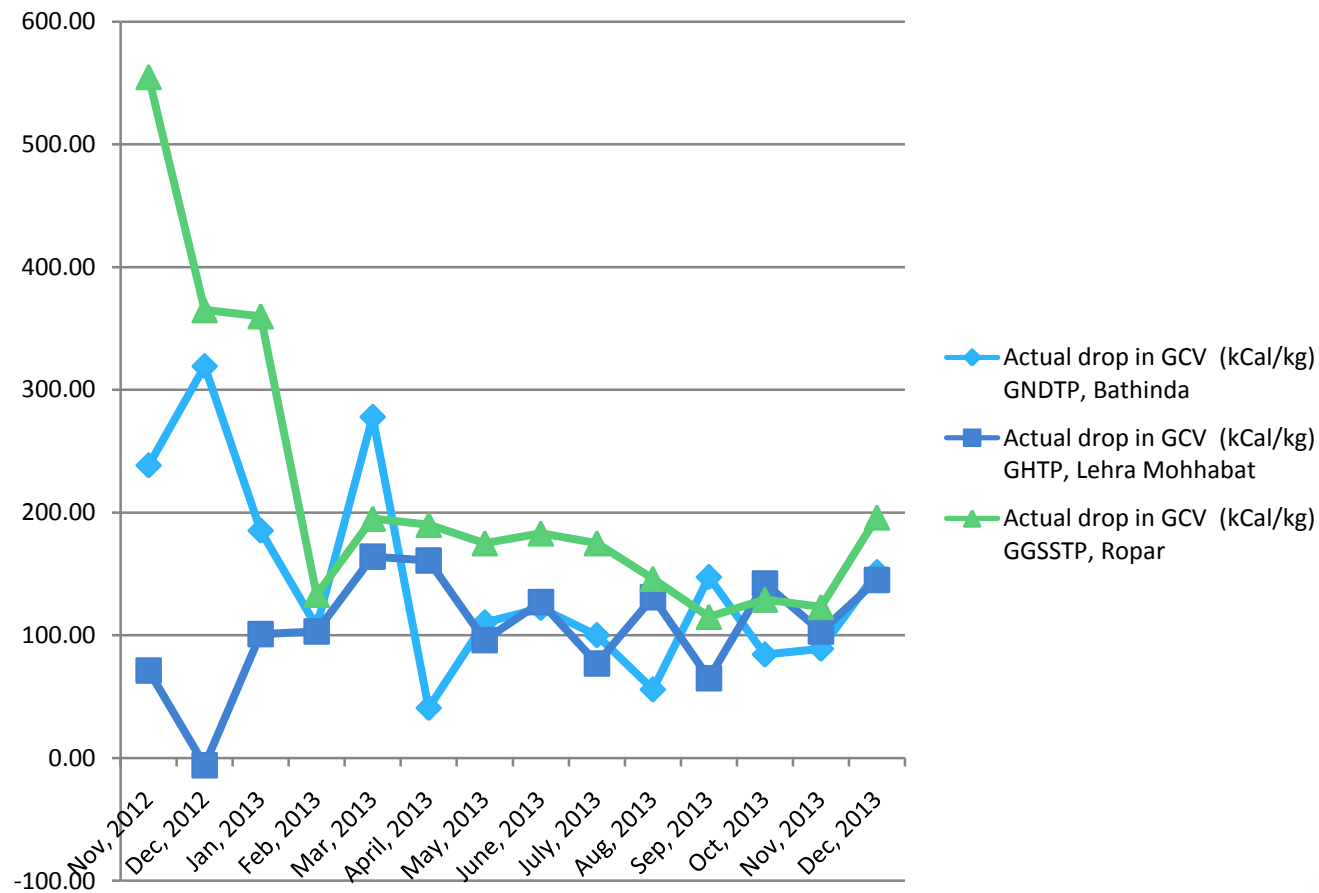
Forum of Regulators

Study on Impact Assessment of Plan Assistance to the Forum of Regulators by the Ministry of Power during the 11th Plan Period

New Delhi   April 02, 2014

ICRA Management Consulting Services Limited

Objectives

- ❑ Impact Assessment of the Studies conducted by the Forum of Regulators during the 11th plan

- ❑ Impact Assessment of the Capacity Building Workshops undertaken by the Forum of Regulators during the 11th plan

iMaCS

Scope of Work

The scope of work, as per the Terms of Reference covers the following :-

1) Design of parameters for Impact Assessment

2) Impact Assessment keeping in view of the objectives

3) Detailed analysis of feedback obtained from participants from participants of various SERCs / JERCs with respect to various Capacity Building Programmes during the financial year

Evaluation framework based on quantitative and qualitative approach

❑ Quantitative approach- Data collected from a stakeholder survey and is corroborated by a qualitative analysis

❑ Evaluation framework used for the quantitative impact assessment is a customized form of logical framework

❑ Overall impact score is assessed on a scale of 1 to 5

- where score of 1 indicates least satisfaction and score of 5 indicates most satisfaction.

❑ Overall impact score for the Studies and CBPs indicated a high level of satisfaction from the respondents

- Studies- 3.91
- CBPs- 4.01

❑ Statistical analysis is conducted to-

- Ensure the reliability, validity and free of bias nature of the data
- Verify the weights assigned to the evaluation sub-parameters

❑ Impact scores were verified by using modified weights derived based on statistical analysis for the evaluation sub-parameters.

The Evaluation Framework for Studies consists of sixteen parameters categorized under three main categories and six sub categories

INPUTS (10%)

Resources (10%)

1- Financial resources (2.5%)
2- Human resources (2.5%)
3 - Partners (5%)

OUTPUT (70%)

Activities (65%)

4-Topic selection (10%)
5-Objective definition (5%)
6-Scope of the study (5%)
7-Report Structure (5%)
8-Content (40%)

Participation (5%)

9-Involvement of the stakeholders (5%)

OUTCOMES (20%)

Short Term (7.5%)

10-Creating Awareness (2.5%)
11-Knowledge enhancement (5%)

Short to Medium Term (5%)

12-Adoption of Best Practice (2.5%)
13-Policy formulation (2.5%)

Long Term (7.5%)

14-Impact on consumer interest (2.5%)
15-Economic impact (2.5%)
16-Environmental impact (2.5%)

Format- *Par/Cat/Sub cat (Weight)*
ST< 6 Months, MT>6M<3Y, LT> 3Y from date of publishing of report

iMaCS

The Evaluation Framework for CBPs consists of thirteen parameters categorized under three main categories and five sub categories

INPUTS (15%)

Resources (10%)

1- Financial resources (5%)
2- Human resources (5%)
3 - Partners (5%)

OUTPUT (70%)

Activities (60%)

4-Topic selection (10%)
5-Content and program delivery (50%)

Participation (10%)

6-Number of participants (5%)
7-Quality of class discussion (5%)

OUTCOMES (15%)

Short Term (10%)

8- Improvement in skills (2.5%)
9- Creating Awareness (2.5%)
10-Knowledge Enhancement (2.5%)
11- Enhancing Motivation (2.5%)

Short to Medium Term (5%)

12-Adoption of Best Practice (2.5%)
13-Policy formulation[5] (2.5%)

Format- *Par/Cat/Sub cat (Weight)*
ST< 6 Months, MT>6M<3Y from date of conclusion of the programme

Categories are classified based on objectives- Evaluation Framework

Output

Measures the adequacy and effectiveness of the activities undertaken as part of conducting Studies and CBPS.

Input

Assesses the adequacy and appropriateness of the resources invested for conducting Studies and CBPs

Outcome

Assesses the short, medium and long term achievements of the Studies and CBPs

Evaluation Framework
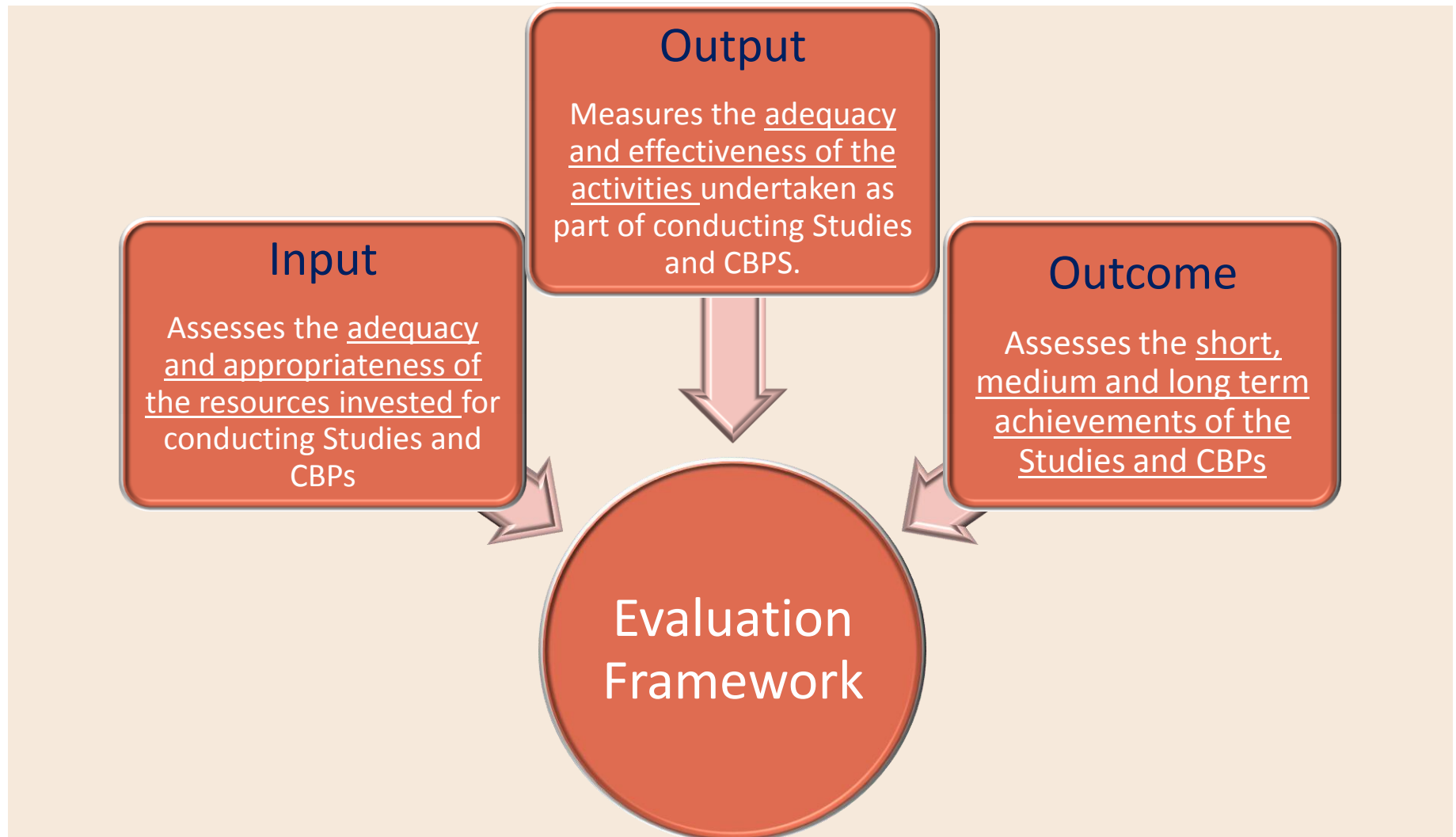
Bases of assinging of weights to three categories of Evaluation Framework

Input

Assigned lower weight-
→ Relatively less important compared to Output category
→ Responses obtained from a limited set of respondents and not from a wider set of respondents

Output

Most important category
→ Assesses adequacy and effectiveness of activities

Outcome

Assigned a lower weight
→ Resources were not invested for activities such as conducting dissemination workshops and implementation support to ERCs that were required to ensure achievement of outcomes.
→FOR is only a recommendatory body and hence has a minimal influence on the implementation of the suggested initiatives

Evaluation Framework

Data Collection: 41 and 35 responses collected for Studies and CBPs respectively

Set#	Respondents	Part – A (Studies)		Part-B (CBPs)	
		Administered	Collected	Administered	Collected
1	Officers in the Secretariat of FOR	4	4	4	4
2	Chairpersons/Members and Officers in 28 ERCs	58	41	57	35
	Total	**62**	**45**	**61**	**39**
	% Response		73%		64%

[1] *In the survey on Studies, 2 forms were administered to each ERC except DERC where 4 forms were administered*
[2] *In the survey on CBPs, 2 forms were administered to each ERC except DERC where 3 forms were administered*

The overall impact score for Studies is 3.91 out of a maximum score of 5

INPUTS (10%)

Resources (10%)- 3.50

1- Financial resources (2.5%) -3.50
2- Human resources (2.5%)-3.25
3 - Partners (5%)- 3.63

OUTPUT (70%)

Activities (65%)- 4.01

4-Topic selection (10%)- 4.45
5-Objective definition (5%)- 4.32
6-Scope of the study (5%)- 4.05
7-Report Structure (5%)- 4.09
8-Content (40%)- 3.83

Participation (5%)- 3.82

9-Involvement of the stakeholders (5%)- 3.82

OUTCOMES (20%)

Short Term (7.5%)- 4.23

10-Creating Awareness (2.5%) -4.14
11-Knowledge enhancement (5%)- 4.32

Short to Medium Term (5%)- 3.75

12-Adoption of Best Practice (2.5%)- 3.73
13-Policy formulation (2.5%)- 3.77

Long Term (7.5%)- 3.83

14-Impact on consumer interest (2.5%)- 3.91
15-Economic impact (2.5%)- 3.75
16-Environmental impact (2.5%)- 3.91

Format- *Par/Cat/Sub cat (Weight) – Score*
ST< 6 Months, MT>6M<3 Y, LT> 3Y from date of publishing of report

The overall impact score for CBPs is 4.01 out of a maximum score of 5

INPUTS (15%)

Resources (15%)- 3.77

1- Financial resources (5%) –3.40
2- Human resources (5%)- 3.80
3 - Partners (5%)- 4.10

OUTPUT (70%)

Activities (60%)- 4.08

4-Topic selection (10%)- 4.40
5-Content and program delivery (50%)- 4.02

Participation (10%)- 3.86

6-Number of participants (5%)- 3.69
7-Quality of class discussion (5%)- 4.03

OUTCOMES (15%)

Short Term (10%)- 4.15

8- Improvement in skills (2.5%) — 4.00
9- Creating Awareness (2.5%)- 4.31
10-Knowledge Enhancement (2.5%)- 4.23
11- Enhancing Motivation (2.5%)- 4.06

Short to Medium Term (5%)- 3.93

12-Adoption of Best Practice (2.5%)- 3.86
13-Policy formulation (2.5%)- 4.00

Format- *Par/Cat/Sub cat (Weight) – Score*
ST< 6 Months, MT>6M<3 Y from date of conclusion of the programme

Weighted Average Scores under different sub categories and Total Impact score (on a scale of 5) for Studies and CBPs

Studies

Resources	Activities	Participation	Short Term Outcomes	Short Term/ Medium term Outcomes	Long term outcomes	Total Impact Score
3.5	3.98	3.76	4.13	3.71	3.83	3.91

CBPs

Resources	Activities	Participation	Short Term Outcomes	Short Term/ Medium term Outcomes	Total Impact Score
3.77	4.08	3.86	4.15	3.93	4.01
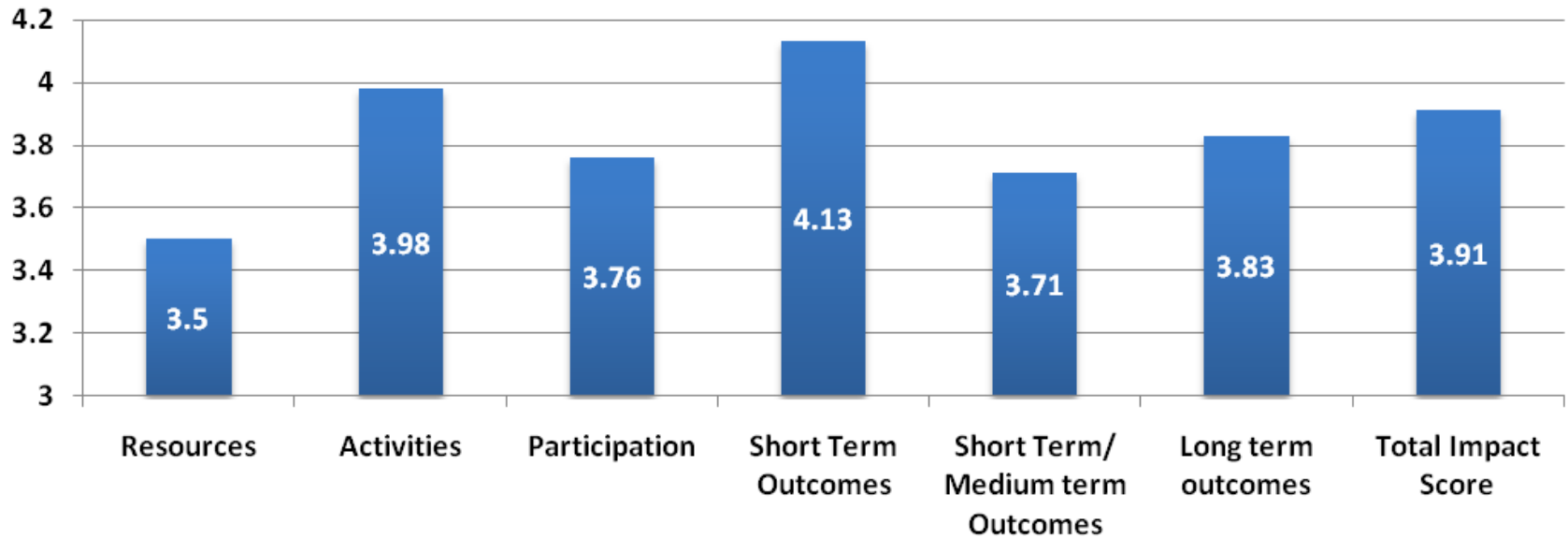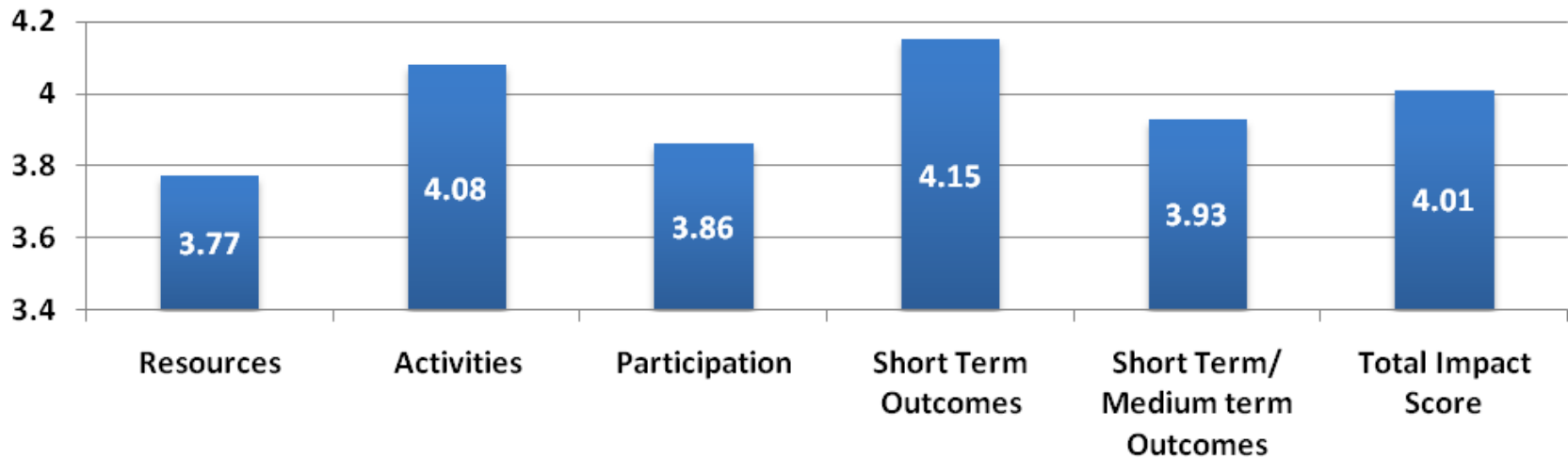
Statistical analysis identified key sub-parameters that are major contributors to the positive impact of the Studies and CBPs

- The difference in the impact scores when compared to the scores computed using original weights was found to be less than 1% in the case of Studies and less than 2% in the case of CBPs

- Qualitative inputs received - Studies and CBPs conducted by FOR contributed to improving regulatory certainty in the electricity sector as well as harmonization and coordination amongst the ERCs

- High level of satisfaction is observed from most of the discussions where respondents also provided examples of the positive impact of Studies and CBPs.

- Qualitative analysis indicates that there is a scope to enhance the impact of the Studies and CBPs by deepening the focus on specific aspects as well as taking up a wider range of programmes.

- Statistical analysis has identified key sub-parameters that are the major contributors to the positive impact of the Studies and CBPs.

iMaCS

Key findings of qualitative discussions on the impact of Studies and CBPs

❑ **Key findings from the qualitative discussions on the impact of the Studies:**

- The topics of the Study reports were found be critical and important to the ERCs as these addressed the key regulatory issues in the Indian electricity sector.

- Studies were helpful in drafting regulations, orders and in other activities performed by ERCs.

- Respondents also appreciated the Studies for providing useful insights and background information. These reports also served as a good reference material.

❑ **Key findings from the qualitative discussions on the impact of the CBPs:**

- Case studies discussed in the CBPs were directly relevant to the ERCs. For example, insights from an international case study on fuel audit had resulted into policy implementation and thus saving of money for a state.

- Mix of participants in the CBPs was found to be adequate and versatile.

- Faculty were rated high in terms of the subject expertise as well as in effectiveness of communication.

Key suggestions made by stakeholders to enhance the impact of the Studies and CBPs

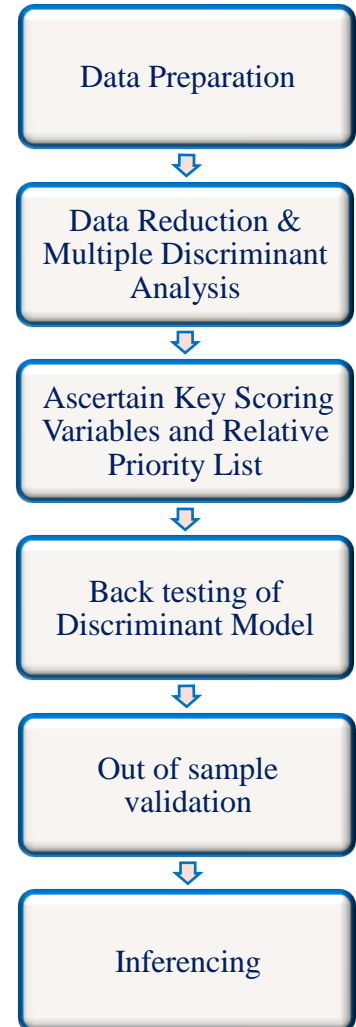❑ **Key suggestions made by stakeholders to enhance the impact of the Studies:**

- Enhanced focus is suggested on international experiences, recent examples, innovation, real world problems.

- It was suggested that state specific case studies may be included in the CBPs.

- It was suggested that ERCs may be consulted for selecting the topics for the Studies. There were suggestions on topics for the future Studies such as

  o Reduction in AT&C losses in areas with marginal HT consumers

  o Governance issues

  o Performance of the regulatory system.

❑ **Key suggestions made by stakeholders to enhance the impact of the CBPs:**

- The CBPs should be conducted at least for 4 to 5 days to facilitate in depth understanding of the subject.

- New topics such as the following were suggested to be taken for future CBPs:

  o Optimal power procurement planning

  o Legal aspects of Indian electricity sector

  o Financial or Tariff modelling

Statistical Analysis Framework

❑ Studies- 35 responses as the sample for the discriminant analysis and 6 for "out of sample validation"

❑ CBPs- 30 responses as the sample for discriminant analysis and 5 for "out of sample validation".

❑ For multiple discriminant analysis, 3-way classification of the ranked responses, based upon the median values of the impact scores :

- Perceived Impact- Low
- Perceived Impact- Medium
- Perceived Impact- High

❑ Fischer discriminant function developed to represent the classification based on the scoring variables

❑ Structure matrix developed to represent the correlation of the scoring variables with the discriminating functions.

❑ Partial correlation coefficients for each of the scoring variables with respect to the classification are arrived and are used as the basis for modified weights for evaluation frameworks.

Data Preparation
⇩
Data Reduction & Multiple Discriminant Analysis
⇩
Ascertain Key Scoring Variables and Relative Priority List
⇩
Back testing of Discriminant Model
⇩
Out of sample validation
⇩
Inferencing

Reliability, Validity and Free of Bias nature of the data

Reliability

- **Definition-** A measure is said to have a high reliability if it produces similar results under consistent conditions

- **Explanation-** Checked by back testing of the fisher discriminant model.

- **Observation-** _91.4% and 90% of the original grouped cases were correctly classified_ in the responses for Studies and CBPs respectively.

Validity

- **Definition-** Validity is the extent to which a measurement is well-founded and corresponds accurately to the real world

- **Explanation-** Validity was checked by "out of sample" validation tests.

- **Observation-** _83% and 100% of the "out of sample" cases were correctly classified_ in the responses for Studies and CBPs respectively.

Free of Bias

- **Selection bias was avoided** by administering the questionnaires to all the 28 ERCs across India to provide one response at officer level and one response at Chairperson/Member level.

- _**Data Parity checks** were undertaken to ensure even representation of the collected sample._ It was observed that the collected samples were well represented across the regions and hence it ensures the parity check.

iMaCS

Impact Scores based on evaluation framework and partial correlation coefficients

- Partial correlation coefficients used to arrive at the weights for each of the sub-parameter.

- A nominal weight of 1% was given to parameters that had a negative partial correlation coefficient.

- The weights thus arrived for different sub-parameters. The impact scores based on a scenario using weights arrived from the partial correlation coefficients were compared to the scores computed based on the weights used in the evaluation framework are compared.

- The percentage difference was marginal being -0.8% and -1.8% in the case of Studies and CBPs respectively.

Impact Scores based on	Studies	CBPs
Weighs used in the **evaluation framework**	3.91	4.01
Weights arrived based on the **partial correlation coefficients**	3.88	3.94

7 out of the 22 and 5 out of the 20 identified sub-parameters are found to be the most important and critical for Studies and CBPs respectively

SN	Q No	Key scoring sub parameters for Studies
1	Q 2	Studies' objectives in terms of clarity, focus and relevance to the ERCs
2	Q 3	Scope of the Studies in terms of comprehensive coverage of intended aspects of the selected topic
3	Q 8	Presentation, clarity and coherence of the report
4	Q 11	Contribution of the Studies in creating awareness about the subjects
5	Q 12	Contribution of the Studies in enhancing the knowledge of the subjects
6	Q 13	Adoption of best practices/ state of the art technologies
7	Q 14	Contribution of the Studies in formulation of regulations/ policies/ orders/ guidelines/approach papers

SN	Q No.	Key scoring sub parameters for CBPs
1	Q 2	Trainers/ faculty in effective delivery/pedagogy of the training modules
2	Q 4	Quality of the programmes in terms of comprehensive coverage of intended topics
3	Q 6	Adequacy of the infrastructure and facilities available for the training programmes
4	Q 7	Quality of the training materials provided
5	Q 10	Quality of the class discussion in the programmes

Reference Slides

Research Process
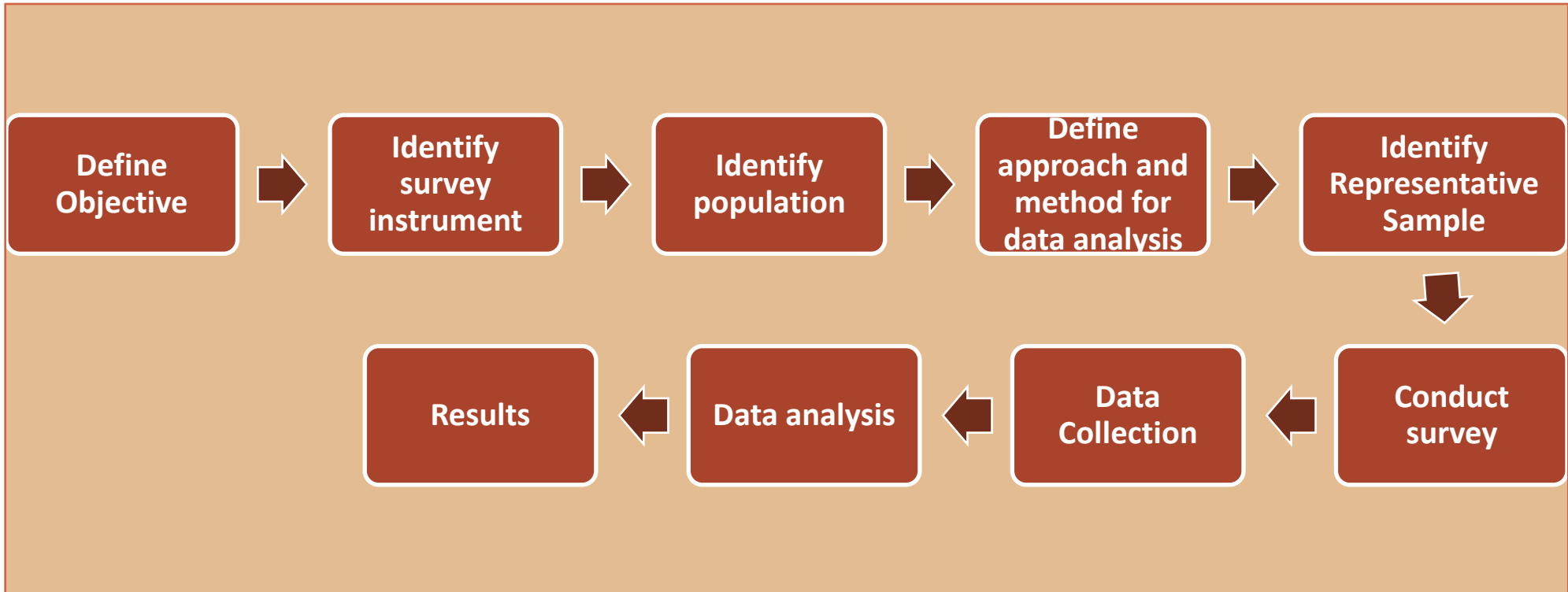
Research includes the collation of data from -

1) Chairpersons/Members/ Officers in Electricity Regulatory Commissions.

2) Chairpersons/Members/ Officers in Secretariat of FOR

Define Objective → Identify survey instrument → Identify population → Define approach and method for data analysis → Identify Representative Sample → Conduct survey → Data Collection → Data analysis → Results

Qualitative assessment of Sub categories for Studies

❑ **Resources:**

- Scope for enhancing the resources deployed from FOR for conducting the studies for the improvement in the quality of the Studies.

❑ **Activities:**

- Selected topics were critical and important to the regulatory aspects of the electricity sector. Topics such as the following were suggested for taking up in the future-

    o Reduction in AT&C losses in areas with marginal HT consumers

    o Studies which are specific to particular states of India

    o Efficient utilization of coal for power sector

- Reports were found to be good reference material as a wide range of topics were covered.

- ERCs appreciated the quality and content of Study reports.

- It desirable to have more focus on recent examples and innovations. It was also suggested relevant international experiences should be studied e.g. Achievement of 6% AT&C losses in South Korea, Lower average cost of power in US in spite of higher renewable installation etc.

❑ **Participation:**

- Few stakeholders from ERCs indicated that ERCs should have higher involvement in the Studies.

Qualitative assessment of Sub categories for Studies------(cont.)

❑ **Short term outcomes:**

- Studies helped in increasing knowledge and motivation of the stakeholders.

❑ **Short to Medium term outcomes:**

- Following studies were found to be highly useful in drafting the regulations, orders and other activities:
  - Model regulations for Protection of Consumer Interest
  - Assessment of various renewable energy resources potential in different states of RPO trajectory and its impact on tariff
  - Model standard of performance regulations for distribution licensees

❑ **Long term outcomes:**

- Studies helpful from the environmental perspective.
- Several studies focussed on better utilization of renewable energy potential having a positive impact on environment in long term.
- It was suggested that more Studies may be conducted on 'Discom's finances and viability' and 'Viability of solar projects with Indian equipment sourcing component' in future

_i_MaCS

Qualitative assessment of Sub categories for CBPs

❑ Resources:

- There is a scope for enhancing the resources deployed.

❑ Activities:

- Comments received:

  o Training materials provided were adequate.

  o Faculty is rated high in terms of subject expertise, effective communication and preparation.

  o Participants may be given real world problems so that they gain the knowledge which can be used in their work domain.

  o It was also suggested that the number of state specific case studies may be increased. The exchange of state specific knowledge will help in better understanding and more options can be explored.

  o Topics such as the following were suggested for taking up in the future-

    ↓ Optimal Power Procurement Planning

    ↓ Legal aspects in the Indian power sector

    ↓ Financial or Tariff modelling

  o Programme duration should be increased to at least 4-5 days to facilitate in-depth understanding of the subject

IMaCS

Qualitative assessment of Sub categories for CBPs-----(cont.)

□ Participation :

- Mix of participants was adequate& versatile.

- Mix of participants should be homogeneous for a particular programme to have the same level of initial understanding of the subject.

- Number of technical members shall be increased as they undertake many activities in the state

- Since Secretary plays a crucial role in the functioning of the ERCs programmes should also be conducted at secretary level

- Mix of backgrounds (financial/technical/ regulatory) of participants in programme provides an effective platform for exchanges of idea which can be improved further by involvement of International regulators.

- Quality of the CBPs can be improved by conducting the programmes in universities which have specialized training facilities

□ Short term outcomes:

- High level of satisfaction can be seen for Short term outcomes

□ Short to Medium term outcomes:

- Insights gained from an international case study on fuel audit had resulted in policy implementation and thus saving of money in a particular state

Analysis of Studies conducted by FOR during the 11th plan period

Weighted average score for 'Resources' is 3.50 out of a maximum of 5

Sub category- Resources
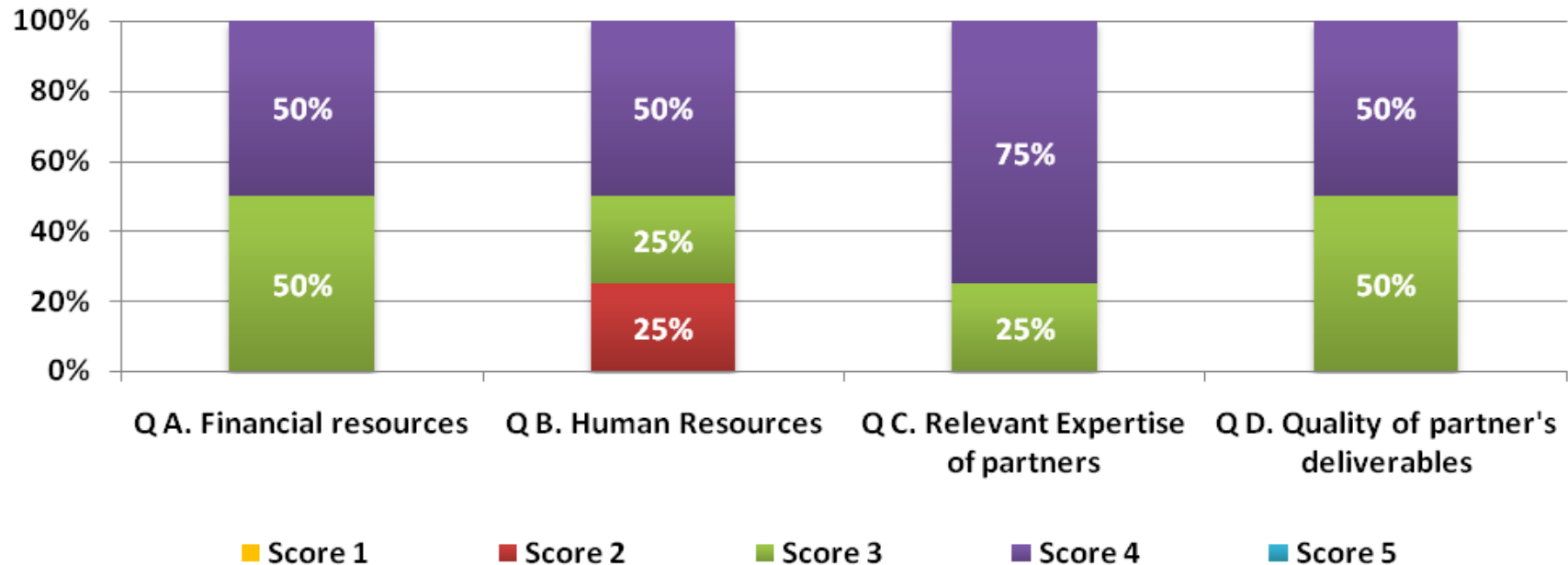
Weighted Average Score- 3.5 (out of max of 5)

❑ **Scope for enhancing the resources** deployed for conducting the studies for the improvement in the quality of the Studies.

❑ A high level of **satisfaction from the relevant expertise of the partners** and quality of deliverables can be observed

Weighted average score for 'Activities' is found to be 3.98 out of a maximum of 5

Sub category- Activities

Weighted Average Score- 3.98 (out of max of 5)

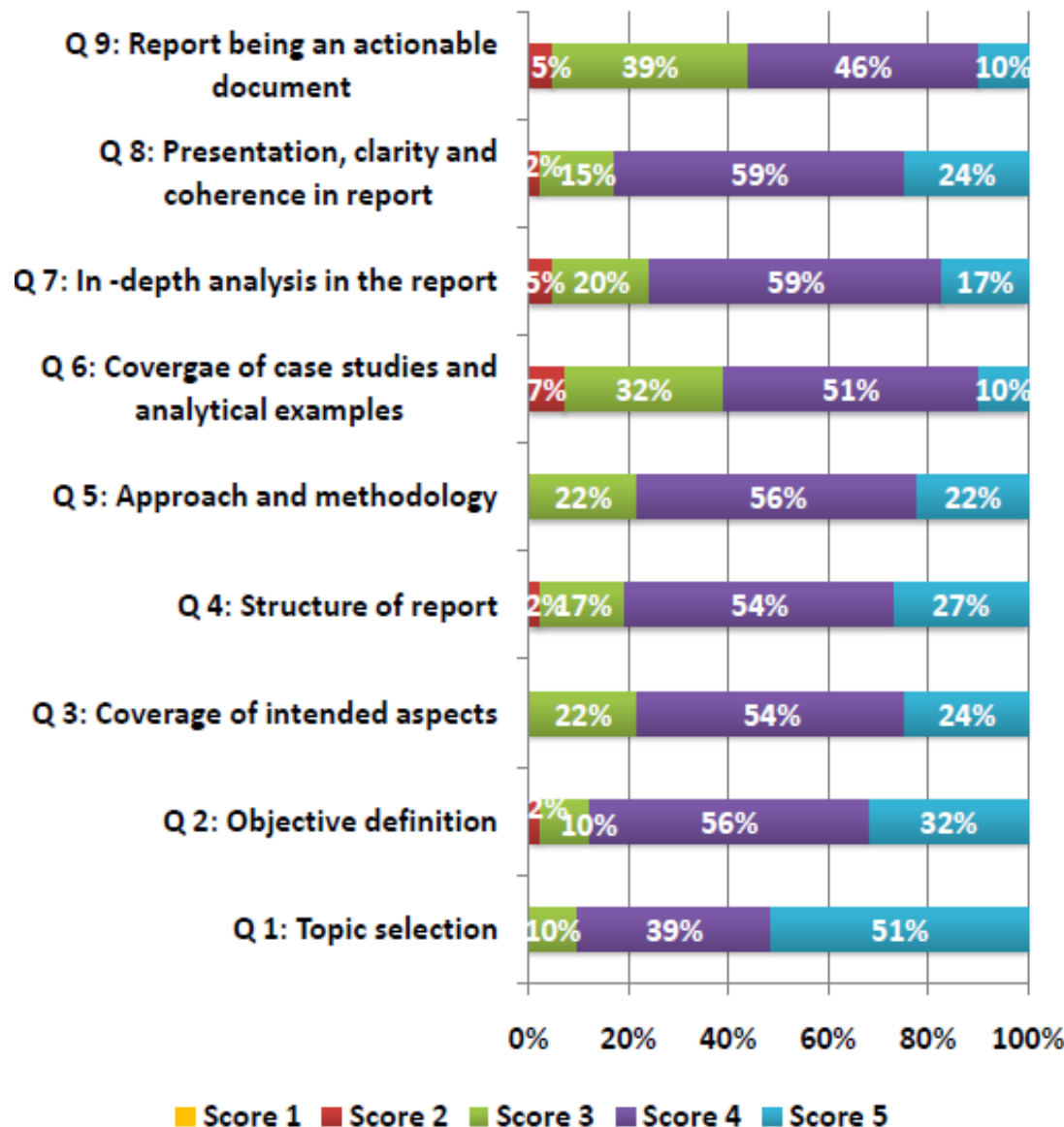- ❑ Studies **addresses the key issues** of the Indian Power Sector such as Electricity Reforms and Regulations, Capital Cost Benchmarking for the Distribution Business, Assessment of reasons for Financial Viability of Utilities and other relevant issues.

- ❑ Reports are **good reference material** as a wide range of topics are covered

- ❑ **Topics are critical and important** to the power sector

Question	Score 2	Score 3	Score 4	Score 5
Q 9: Report being an actionable document	5%	39%	46%	10%
Q 8: Presentation, clarity and coherence in report	2%	15%	59%	24%
Q 7: In -depth analysis in the report	5%	20%	59%	17%
Q 6: Covergae of case studies and analytical examples	7%	32%	51%	10%
Q 5: Approach and methodology		22%	56%	22%
Q 4: Structure of report	2%	17%	54%	27%
Q 3: Coverage of intended aspects		22%	54%	24%
Q 2: Objective definition	2%	10%	56%	32%
Q 1: Topic selection		10%	39%	51%

0% 20% 40% 60% 80% 100%

■ Score 1 ■ Score 2 ■ Score 3 ■ Score 4 ■ Score 5

ERCs are highly satisfied with the sub parameters under sub category 'Activities'

- ❑ Suggested topics-
    - • Reduction in AT&C losses in areas with marginal HT consumers
    - • Studies which are specific to particular states of India
    - • Efficient utilization of coal for power sector- (*Mechanism for utilization of domestic coal for all non coastal power plants and imported coal for all coastal power plants, based on the GCV of imported coal and fluctuating international prices*)

- ❑ Scope of work is **adequately covered** in the Study reports

- ❑ **Objectives for the Studies are suggested** during the qualitative discussions:
    - • Issues related to governance
    - • Action plans to improve the current level of AT&C losses
    - • Performance of the regulatory system

- ❑ Respondents **appreciated specific studies** for providing useful insights and background.

- ❑ ERCs have also **appreciated the quality and content** of the study reports.

- ❑ Suggested **more focus is required on recent examples and innovations** and also on international experiences. (*For ex: Achievement of 6% AT&C losses in South Korea, lower average cost of power in US in spite of higher renewable installation etc*)
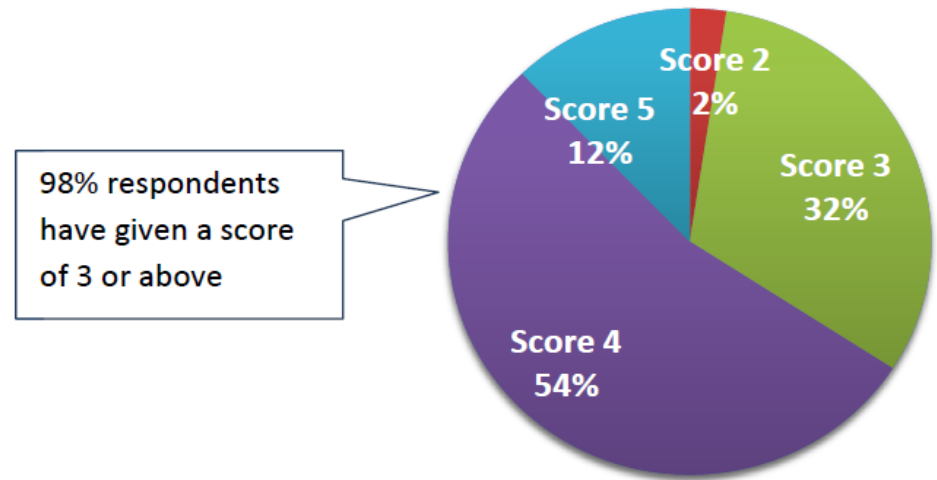
Weighted average score for 'Participation' is found to be 3.76 out of a maximum of 5

Sub category- Participation

Weighted Average Score- 3.76 (out of max
of 5)

❑ Some of the qualitative discussions
indicated that ERCs would like to have
higher involvement in Studies

98% respondents have given a score of 3 or above

Score 2 2%
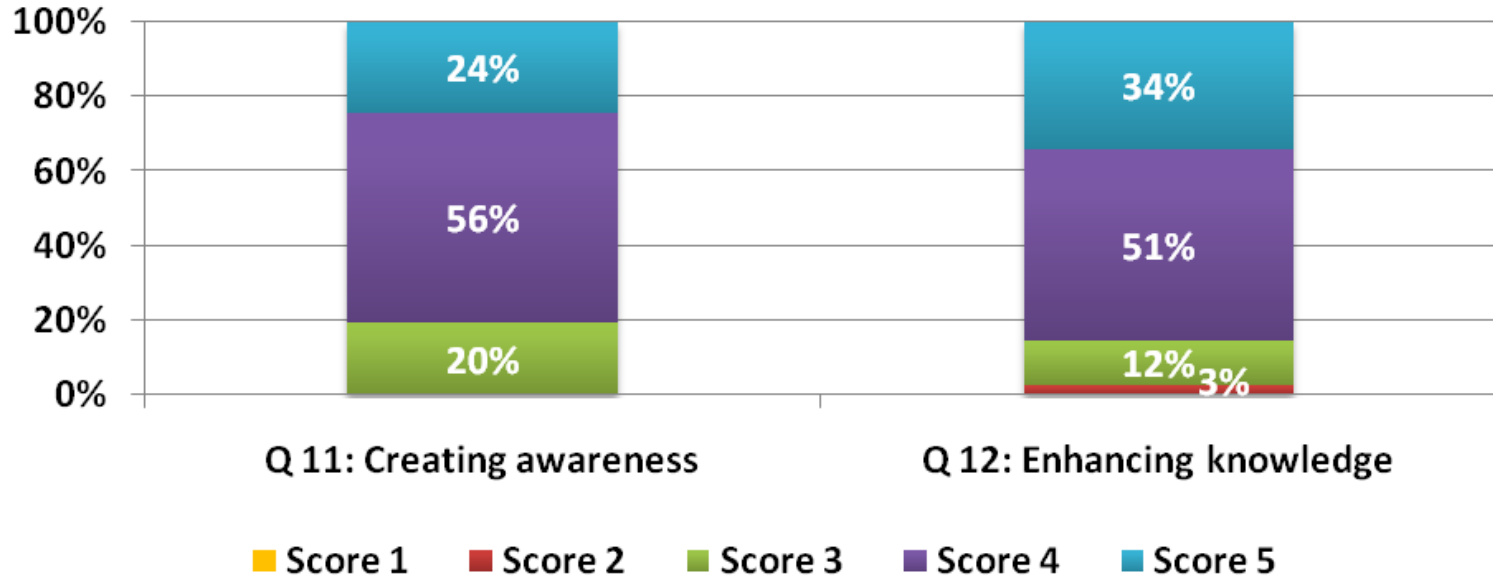
Score 5 12%

Score 3 32%

Score 4 54%

Weighted average score for 'Short term Outcomes' is found to be 4.13 out of a maximum of 5

Sub category- Short Term Outcomes

Weighted Average Score- 4.13 (out of max of 5)

❑ Studies have **helped in increasing knowledge and motivation** of readers

Weighted average score for 'Short to Medium term Outcomes' is found to be 3.71 out of a maximum of 5

Sub category- Short to Medium Term Outcomes
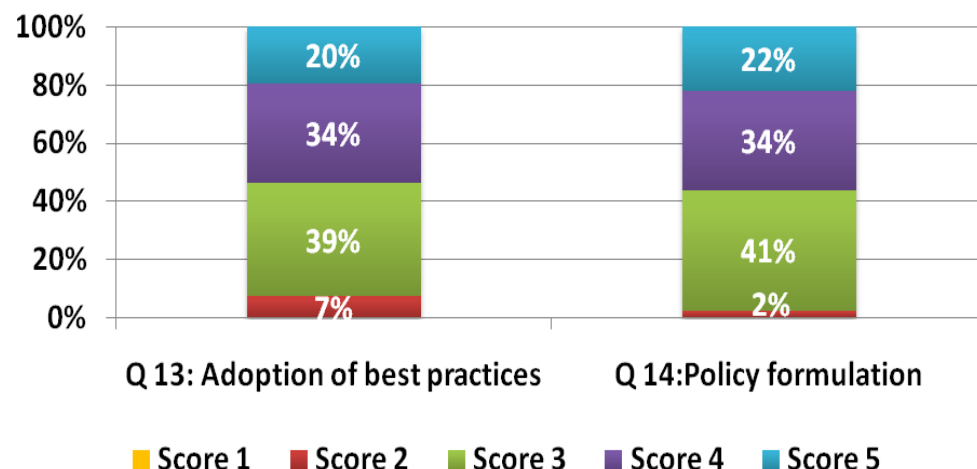
Weighted Average Score- 3.71 (out of max of 5)

Chart: Q 13: Adoption of best practices / Q 14: Policy formulation

Q 13: 7%, 39%, 34%, 20%
Q 14: 2%, 41%, 34%, 22%

Legend: Score 1 | Score 2 | Score 3 | Score 4 | Score 5

❑ Studies **helpful in drafting regulations, orders and other activities**:

- "Model regulations for Protection of Consumer Interest (Consumer Grievance Redressal Forum, Ombudsman and Consumer Advocacy Regulations)"
- "Assessment of various renewable energy resources potential in different states of RPO trajectory and its impact on tariff"
- "Model standard of performance regulations for distribution licensees "
- "Assist the Commission for evolving parameters for generic tariff for Renewable Energy sources "

❑ **Timely preparation of report by FOR has proved to be useful** for ERCs for the issues related to amendments and notification of the Regulation.

❑ **ERCs have adopted the principles laid down** under the studies conducted by Secretariat of FOR.

Weighted average score for 'Long term Outcomes' is found to be 3.83 out of a maximum of 5

Sub category- Long Term Outcomes
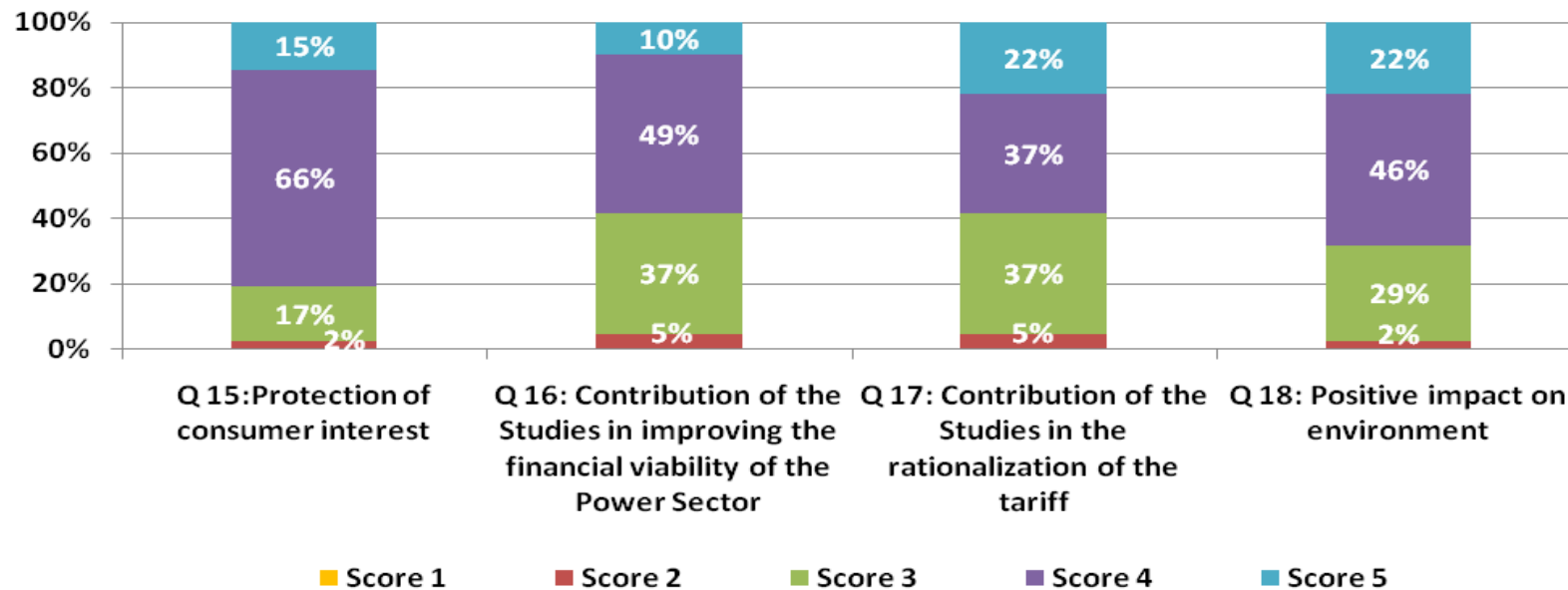
Weighted Average Score- 3.83 (out of max of 5)

- Suggested that **more studies** may be conducted on **Discom's finances and viability, Viability of solar projects with Indian equipment component**

- Studies are **helpful from the environmental perspective**.

- Several studies **focussed on better utilization of renewable energy potential** which will have positive impact on environment in long term.

Maximum weighted score is 4.41 for the sub parameter- 'Selection of topics' for Studies and overall Impact score for Studies is 3.91

Total Impact Score	3.91
Long term outcomes	3.83
Short Term/ Medium term Outcomes	3.71
Short Term Outcomes	4.13
Participation	3.76
Activities	3.98
Resources	3.5
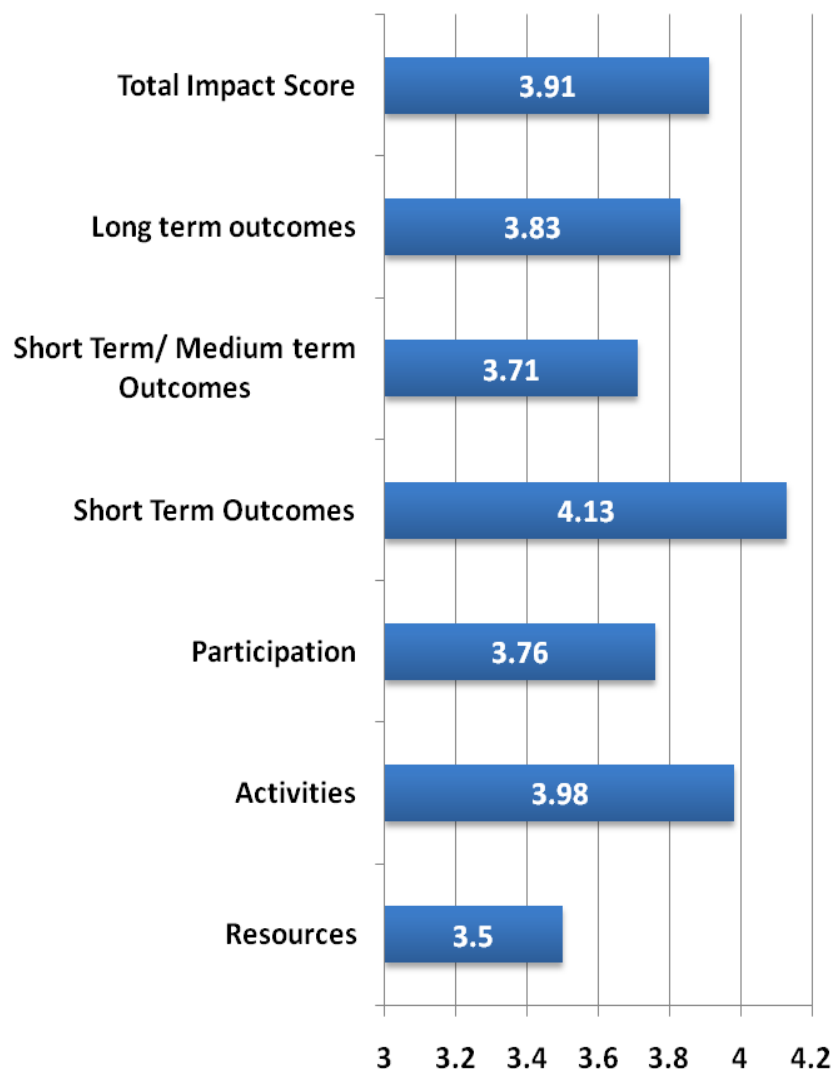
Sub parameters- Weighted score is more than total impact score	Score
Contribution of the Studies in protection of consumer interest	3.93
Approach and methodology adopted in the studies	4.00
Comprehensive coverage of intended aspects of scope of Studies	4.02
Report structure in terms of understand ability and sequence of the topics	4.05
Presentation, clarity and coherence of the topics in the report	4.05
Contribution of the Studies in creating awareness	4.05
Clarity, focus and relevance of objectives of studies	4.17
Contribution of the Studies in enhancing knowledge	4.17
Relevance of selected topics	4.41

Minimum weighted score is 3.25 for the sub parameter- 'Allocation of Human Resources' for Studies

Sub parameters- Weighted score is less than total impact score	Score
Adequate allocation of human resources	3.25
Adequate allocation of financial resources	3.5
Quality of partner's deliverables in terms of coverage of Terms of reference	3.5
Reports being an actionable document	3.61
Coverage of case studies /analytical examples/ national/international practices/ state of the art technologies	3.63
Contribution of the Studies in improving the financial viability of the Power Sector	3.63
Contribution of the Studies in adoption of best practices/ state of the art technologies	3.66
Relevant Expertise of partners	3.75
Adequacy of the participation of ERCs	3.76
Contribution of the Studies in formulation of regulations/ policies/ orders/ guidelines/approach papers	3.76
Contribution of the Studies in the rationalization of the tariff	3.76
Quality of the reports in terms of in-depth analysis of the subject	3.88
Positive impact of the studies on environment	3.88

Instances where SERCs have benefitted from the Studies conducted by Secretariat of FOR

S. No.	Name of the Study	Year	Examples of orders/guidelines/policies/regulations/approach papers issued by SERC after the Study report conducted by FOR
1	Model standard of performance regulations for distribution licensees	2008-09	• HPERC [Distribution Performance Standards] Regulations, 2010 • PSERC (Amendment) Regarding procedure for payment of compensation in the event of failure to meet the standards of performance by the Licensee
2	Evolving an appropriate model for distribution margin	2008-09	• Retail Supply Margin Introduced by APERC – Ref: ARR and Tariff Proposals for Retail Supply Business (FY 13) – Although, no reference to distribution margin or FOR has been made
3	Evolve an appropriate model of incentive-disincentive mechanism for Distribution Utilities	2009-10	• CSERC (MYT) Regulations, 2012 – Issued on October 06, 2012 • MERC (MYT) Regulations, 2011 – Issued on February 04, 2011 • GERC (MYT) Regulations, 2011 – Issued on March 22, 2011
4	Comparative Analysis of supply codes in 10 states	2009-10	• Chhattisgarh State Electricity Supply Code, 2011 – Issued on November 28, 2011 • The study also helped several Regulatory Commissions including MERC, BERC, HPERC, MPERC, TNERC, etc, make amendments to its existing code
5	Implementation of REC Framework- Forbearance Price and Floor Price of REC	2009-10	• Several States announced RPO targets for its obligated entities. Visibility of price range increased confidence among the renewable energy players
6	Implementation & impact analysis of time of day (TOD) tariff in India	2009-10	• Although many States had already implemented ToD Tariffs prior to this study, it helped them understand overall framework required for implementation of ToD Tariff
7	Standardization of distribution franchisee model	2010-11	• Bihar has recently allotted distribution franchisee for improvement of financial condition and AT&C losses in the areas where these are substantial. DPSC and SMPL Infra have bagged the distribution franchisee in Gaya and Bhagalpur region respectively. Rajasthan has also recently initiated the process for award of distribution franchisee.

Instances where SERCs have benefitted from the Studies conducted by Secretariat of FOR

S. No.	Name of the Study	Year	Examples of orders/guidelines/policies/regulations/approach papers issued by SERC after the Study report conducted by FOR
8	Standardisation of Regulatory Accounts	2010-11	• In the discussion paper on Multi-Year Tariff Regulations for the Second Control Period, GERC mentioned the following: "It is proposed that based on FOR recommendations, as and when published, GERC may notify the Regulatory Accounts for the State of Gujarat" • In May, 2012, DERC has floated a tender for appointment of consultant for Regulations for preparation of Regulatory Accounts – Although, no reference of FOR is made • Thus, Regulatory Commissions are definitely guided by the studies conducted by FOR and the recommendations thereof
9	Model regulations for Protection of Consumer Interest (Consumer Grievance Redressal Forum, Ombudsman and Consumer Advocacy Regulations)	2010-11	• GERC issued the GERC (Consumer Grievances Redressal Forum and Ombudsman) Regulations, 2011 on April 07, 2011 • DERC also issued DERC GERC (Consumer Grievances Redressal Forum and Ombudsman) Regulations, 2011
10	Evolving measures for the effective implementation of Prepaid Metering in the country	2011-12	• Various States in India have implemented prepaid metering systems in certain areas/for certain consumers. Recently, Bihar Electricity Regulatory Commission (BERC), in the electricity tariff order for 2013-14, directed Bihar State Power (Holding) Company Ltd to install prepaid meters at some government departments and homes in Patna. Also, PVVNL (NOIDA) is in the process of installing pre-paid meters. Pre-paid meters have already been installed in some parts of Navi Mumbai and Pune by MSEDCL

Brief assessment of Studies...(1)

- Studies on Model regulations (like Model Regulations on Standard Of Performance (SOP), Model regulations for Protection of Consumer Interest etc) have helped in **bringing uniformity in the ERCs and encouraging the certainty in the Power Sector.**

- Study reports on model regulations have helped SERCs/JERCs **in the country to adopt the regulations partially or fully**. ERCs have **made changes in the provisions** of the model regulations based on suitability for their state.

- Assessment of reasons for financial viability of Utilities for 10 different states in India. This study has highlighted major issues that **have high impact on the financial viability of the utilities like:**

  - Timeliness of tariff determination process/ tariff revision
  - Disallowance of legitimate costs
  - Fuel Purchase Adjustments
  - Untreated gap/Regulatory Assets

- Based on the identified issues '**Model Regulations' have been framed by the Secretariat of FOR to address the issues.**

Brief assessment of Studies...(2)

- Based on the study conducted by FOR, APTEL suo- motu order OP no 1 of 2011 has been issued directs the SERCs/JERCs to perform the following:

  - Revision of tariff every year

  - Initiating suo- moto hearings on tariffs if tariff revisions are not filed by Discoms

  - Study has resulted in issuance of tariff order for retails supply for FY 2012-13 by 26 states in India.

  - As per the section 10.2 of the APTEL's Judgment OP no 1 of 2011 *"In a study conducted by Forum of Regulators of ten States for assessment of tariff revision and financial viability of DISCOMS (published in November, 2010), it is estimated that additional increase to the tune of 1% to 39% is required to fully recover the cost of supply"* (*source- APTEL OP no 1 of 201 1*).

- <u>Studies in Renewable Energy sector-</u>

  - Following studies have been conducted by Secretariat of FOR on Renewable Energy sector-

    - Implementation of Renewable Energy Certificate

    - Implementation of REC Framework - Forbearance Price and Floor Price of REC

    - Assessment of various renewable energy resources potential in different states of RPO trajectory & its impact on tariff

    - Assist the Commission for evolving parameters for generic tariff for Renewable Energy sources

    - Preparing incentive structure for States for fulfilling Renewable Purchase Obligation (RPO) targets

i/MaCS

- As an outcome of the studies in Renewable Energy Sector, several ERCs in the country have adopted the regulations on REC mechanism and RPO targets. This has brought the competition in the renewable energy market thus helping in increasing the efficiency in terms of use of renewable energy resources.

❑ Standardization of distribution franchisee model-

  - The objective of this study is to frame a standard model for Distribution Franchisee (DF) based on the review of experience of Distribution Franchisee (DF) and the discussion with different Stakeholders. This study was useful in designing of framework and model contractual documents.

  - Ministry of Power (MoP) has adopted the standard bid documents (SBD) prepared by Secretariat of FOR for preparation of SBD for appointment of DF in urban areas. These documents are adopted with certain modification based on the DFs.

❑ DSM Regulations-

  - The DSM regulations evolved by Secretariat of FOR has aided in being the guiding document to the ERCs while drafting the DSM regulations. Required modifications are being done for the State specific attributes. These model regulations have been adopted by several states in India.

Weighted Average Score for the Input Category is 3.50 out of a maximum of 5 for Studies

Q. No.	Sub category	Parameter	Sub Parameter	Weight	Weighted average score
			INPUT CATEGORY		
Q A	Resources	Financial Resources	Adequate allocation of financial resources	2.5%	3.50
Q B	Resources	Human Resources	Adequate allocation of human resources	2.5%	3.25
Q C	Resources	Partners	Relevant Expertise of partners	2.5%	3.75
Q D	Resources	Partners	Quality of partner's deliverables in terms of coverage of Terms of reference	2.5%	3.50
		Sub Total		10.0%	3.50

Weighted Average Score for the Output Category is 3.96 out of a maximum of 5 for Studies

Q. No.	Sub category	Parameter	Sub Parameter	Weight	Weighted average score
OUTPUT CATEGORY					
Q1	Activities	Topic Selection	Relevance of selected topics	10.0%	4.41
Q2	Activities	Objective Definition	Clarity, focus and relevance of objectives of studies	5.0%	4.17
Q3	Activities	Scope of the Study	Comprehensive coverage of intended aspects of scope of Studies	5.0%	4.02
Q4	Activities	Report Structure	Report structure in terms of understandability and sequence of the topics	5.0%	4.05
Q5	Activities	Content	Approach and methodology adopted in the studies	8.0%	4.00
Q6	Activities	Content	Coverage of case studies /analytical examples/ national/international practices/ state of the art technologies	8.0%	3.63
Q7	Activities	Content	Quality of the reports in terms of in-depth analysis of the subject	8.0%	3.88
Q8	Activities	Content	Presentation, clarity and coherence of the topics in the report	8.0%	4.05
Q9	Activities	Content	Reports being an actionable document	8.0%	3.61
Q10	Participation	Involvement of the Stakeholders	Adequacy of the participation of ERCs	5.0%	3.76
Sub Total				70.0%	3.96

Weighted Average Score for the Outcome Category is 3.91 out of a maximum of 5 for Studies

Q. No.	Sub category	Parameter	Sub Parameter	Weight	Weighted average score
OUTCOME CATEGORY					
Q11	Short Term	Creating Awareness	Contribution of the Studies in creating awareness	2.5%	4.05
Q12	Short Term	Knowledge Enhancement	Contribution of the Studies in enhancing knowledge	5.0%	4.17
Q13	Short to Medium Term	Adoption of Best practices	Contribution of the Studies in adoption of best practices/ state of the art technologies	2.5%	3.66
Q14	Short to Medium Term	Policy formulation	Contribution of the Studies in formulation of regulations/ policies/ orders/ guidelines/approach papers	2.5%	3.76
Q15	Long Term	Impact on consumer interest	Contribution of the Studies in protection of consumer interest	2.5%	3.93
Q16	Long Term	Economic impact	Contribution of the Studies in improving the financial viability of the Power Sector	1.25%	3.63
Q17	Long Term	Economic impact	Contribution of the Studies in the rationalization of the tariff	1.25%	3.76
Q18	Long Term	Environmental impact	Positive impact of the studies on environment	2.5%	3.88
Sub Total				20.0%	3.91

TOTAL IMPACT SCORE FOR STUDIES ---- 3.91

Analysis of CBPs conducted by FOR during the 11th plan period

Weighted average score for 'Resources' is 3.77 out of a maximum of 5

Sub category- Resources
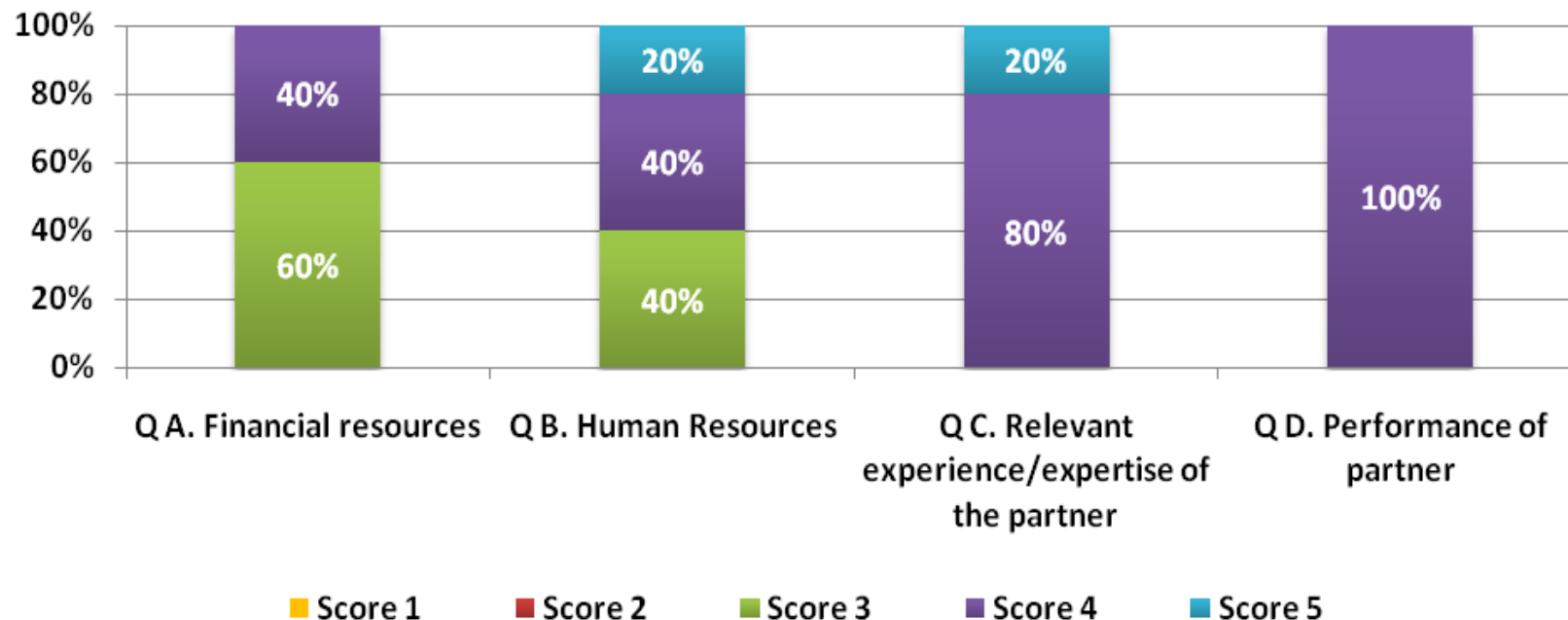
Weighted Average Score- 3.77 (out of max of 5)

❑ **Scope of deploying more resources** for conducting the CBPs to improve the effectiveness of the programmes

Weighted average score for 'Activities' is found to be 4.08 out of a maximum of 5

Sub category- Activities

Weighted Average Score- 4.08

(out of max of 5)

❑ Faculty and training materials provided were adequate.

❑ Faculty was well prepared.

❑ Faculty has good understanding of subject and was able to communicate the same

Q 8:Coverage of national/international practices/ state of the art technologies — 6% 23% 49% 23%

Q 7:Quality of the training materials — 6% 17% 46% 31%

Q 6: Available infrastructure and facilities — 3% 3% 46% 49%

Q 5:Presentation of case studies and analytical examples — 6% 20% 60% 14%

Q 4:Coverage of intended topics — 3% 14% 60% 23%

Q 3:Duration of programmes — 9% 23% 37% 31%

Q 2: Delivery/ pedagogy of training modules — 3% 17% 49% 31%

Q 1: Topic selection — 6% 6% 31% 57%

■ Score 1 ■ Score 2 ■ Score 3 ■ Score 4 ■ Score 5

Back

ERCs are highly satisfied with the sub parameters under sub category 'Activities'

❑ Advised that participants should be given real world problems so that they gain the knowledge which can be used in their work domain.

❑ Suggested number of state specific case studies shall be increased. The exchange of state specific knowledge will help in better understanding and more options can be explored.

❑ Suggested topics of CBPs for ERCs-

- Optima Power Procurement Planning

  o *"Considering scheduling of power, purchase of power through all modes includes power exchanges and benefit through selling surplus"*

- Legal aspects in the Indian power sector
- Financial or Tariff modelling

❑ Suggested that the programme duration should be increased. CBPs should be conducted at least for 4-5 days for in depth understanding of the subject.

Weighted average score for 'Participation' is found to be 3.86 out of a maximum of 5

Sub category- Participation

Weighted Average Score- 3.86

(out of max of 5)

❑ Different opinions received as a result of qualitative discussion

Q 9: Number of participants
- Score 2: 11%
- Score 3: 29%
- Score 4: 40%
- Score 5: 20%

Q 10: Quality of class discussion
- Score 3: 14%
- Score 4: 69%
- Score 5: 17%

Legend: Score 1 | Score 2 | Score 3 | Score 4 | Score 5

- Mix of participants was adequate & versatile.

- Mix of participants should be homogeneous for a particular programme to have the same level of initial understanding of the subject.

- Number of technical members shall be increased as they undertake many activities in the state

- Since Secretary plays a crucial role in the functioning of the ERCs programmes should also be conducted at secretary level

- Mix of backgrounds (financial/technical/ regulatory) of participants in programme provides an effective platform for exchanges of idea which can be improved further by involvement of International regulators.

- Quality of the CBPs can be improved by conducting the programmes in universities which have specialized training facilities

iMaCS

Weighted average score for 'Short term Outcomes' is found to be 4.15 out of a maximum of 5

Sub category- Short Term Outcomes
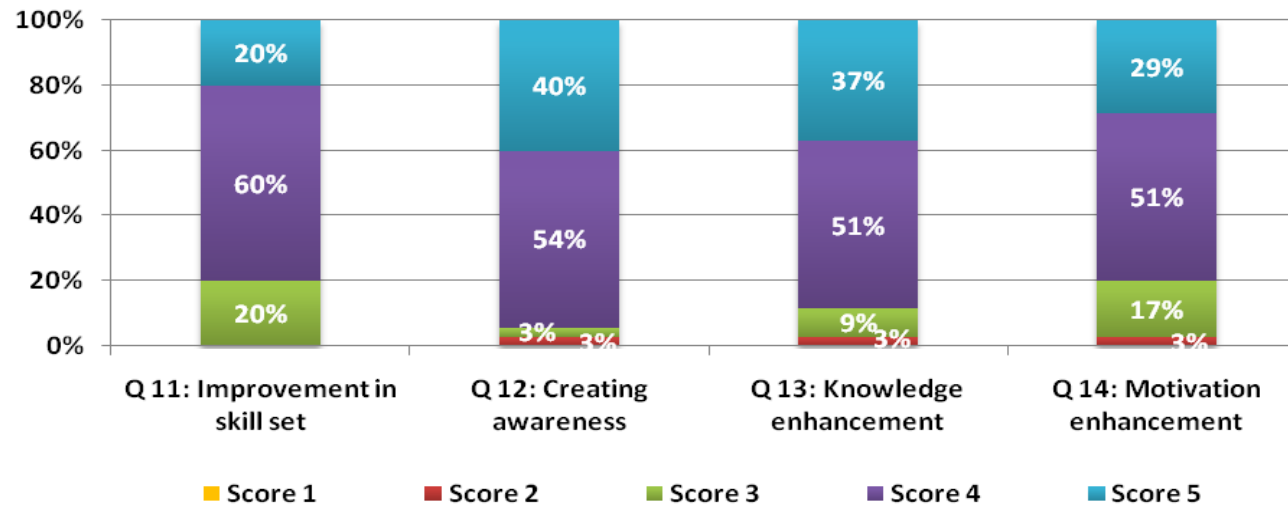
Weighted Average Score- 4.15 (out of max of 5)

❑ A high level of satisfaction can be seen for Short term outcomes

❑ 100% of the respondents have given a score of 3 or above for contribution of CBPs in improvement of skill set

❑ 97% of the respondents have provided a rating of 3 or above for the following sub parameters- Contribution of programmes in creating awareness, enhancing knowledge and enhancing motivation

Weighted average score for 'Short to Medium term Outcomes' is found to be 3.93 out of a maximum of 5

<u>Sub category- Short to Medium Term Outcomes</u>
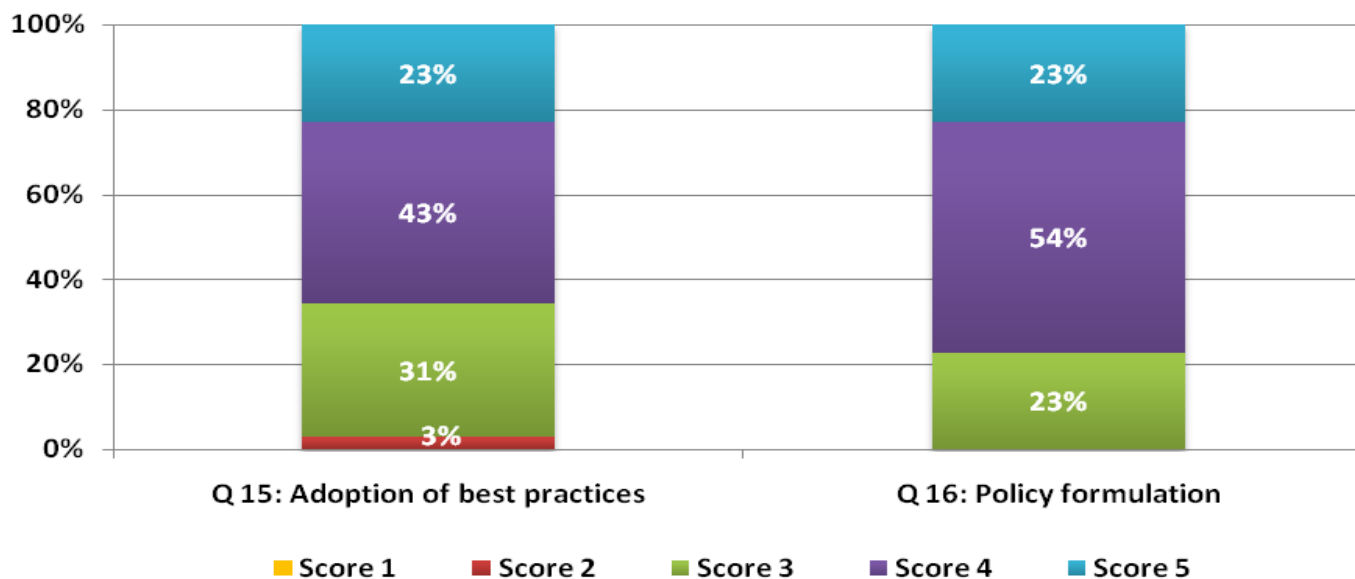
Weighted Average Score- 3.93 (out of max of 5)

- The information received during the qualitative discussion that implementation of ideas discussed during one of the programme on international case studies on fuel audit had resulted into policy implementation and thus saving of money for their state..

Overall score impact score of CBPs is 4.01 out of a maximum of 5
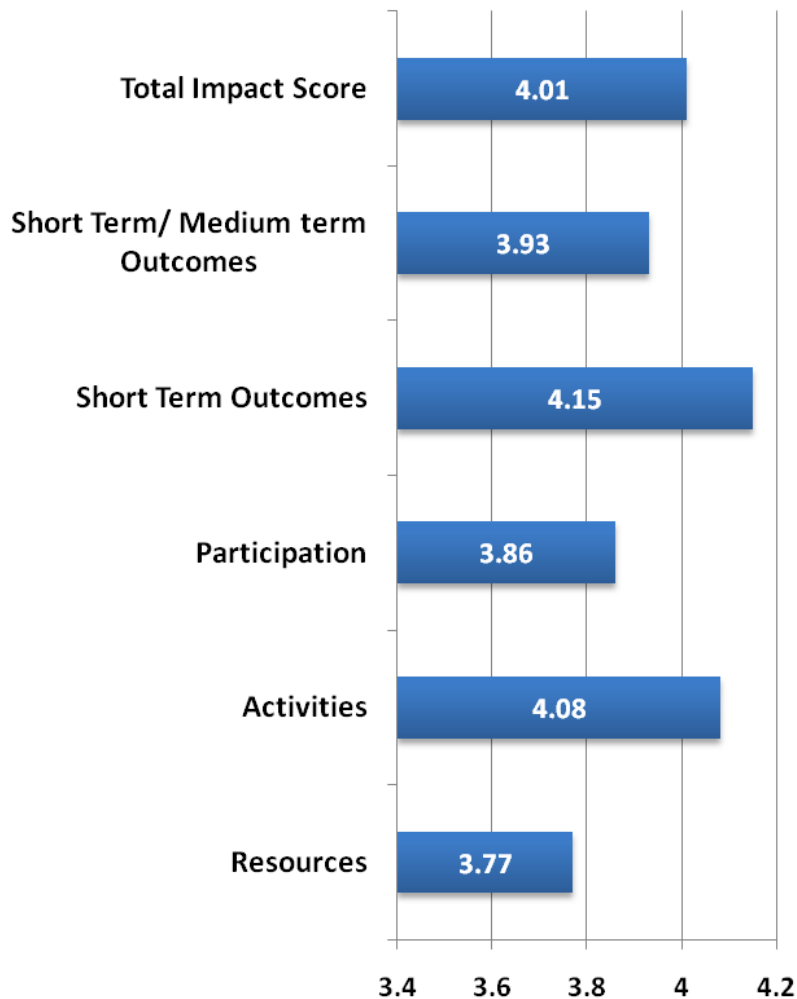
- CBPs have proved to be **useful as the ERCs are facing a challenge of lack of skilled manpower**.
- CBPs are even more **important for the newly established commissions** in India.
- The feedback received from the participants of CBPs **provides the way forward** to Secretariat of FOR to conduct the future CBPs.
- As observed from the feedback given by the participants, **CBPs have helped the participants in providing information about their role as a regulator.**
- The programmes were found to be informative. The **visits conducted during the programmes** (for ex: visits to Solar plants, IEX, NRLDC and meeting with CPUC Commission etc.) are also **appreciated** by the participants.

Individual weighted score of different sub parameters of CBPs ranges from 3.4 to 4.4 on a scale of maximum of 5

Sub parameters- Weighted score is less than total impact score	Score	Sub parameters- Weighted score is more than total impact score	Score
Adequate allocation of financial resources	3.40	Comprehensive coverage of intended topics	4.03
Appropriate participation of number of participants	3.69	Quality of the training materials	4.03
Adequate allocation of human resources	3.80	Quality of the class discussion	4.03
Presentation of the case studies and analytical examples	3.83	Effective delivery/pedagogy of the training modules	4.06
Contribution of the CBPs in adoption of the best practices/ state of the art technologies	3.89	Contribution of the CBPs in enhancing motivation	4.06
Coverage of national/international practices/ state of the art technologies in the power sector	3.89	Relevant Expertise/Experience of partners	4.20
Adequacy of the duration of the programmes	3.91	Contribution of the CBPs in enhancing knowledge	4.23
Performance of partners in conducting CBPs	4.00	Contribution of the CBPs in creating awareness	4.31
Contribution of the CBPs in improvement in the skill set	4.00	Adequacy of the available infrastructure and facilities	4.37
Contribution of the Studies in formulation of regulations/ policies/ orders/ guidelines /approach papers	4.00	Relevance of selected topics	4.40

Weighted Average Score for the Input Category is 3.77 out of a maximum of 5 for CBPs

Q. No.	Sub category	Parameter	Sub Parameter	Weight	Weighted average Score
INPUT CATEGORY					
Q A	Resources	Financial Resources	Adequate allocation of financial resources	5.0%	3.40
Q B	Resources	Human Resources	Adequate allocation of human resources	5.0%	3.80
Q C	Resources	Partners	Relevant Expertise/Experience of partners	2.5%	4.20
Q D	Resources	Partners	Performance of partners in conducting CBPs	2.5%	4.00
Sub Total				**15.0%**	**3.77**

Weighted Average Score for the Output Category is 4.05 out of a maximum of 5 for CBPs

Q. No.	Sub category	Parameter	Sub Parameter	Weight	Weighted average Score
OUTPUT CATEGORY					
Q1	Activities	Topic Selection	Relevance of selected topics	10.0%	4.40
Q2	Activities	Content and Program delivery	Effective delivery/pedagogy of the training modules	8.0%	4.06
Q3	Activities	Content and Program delivery	Adequacy of the duration of the programmes	7.0%	3.91
Q4	Activities	Content and Program delivery	Comprehensive coverage of intended topics	7.0%	4.03
Q5	Activities	Content and Program delivery	Presentation of the case studies and analytical examples	7.0%	3.83
Q6	Activities	Content and Program delivery	Adequacy of the available infrastructure and facilities	7.0%	4.37
Q7	Activities	Content and Program delivery	Quality of the training materials	7.0%	4.03
Q8	Activities	Content and Program delivery	Coverage of national/international practices/ state of the art technologies in the power sector	7.0%	3.89
Q9	Participation	Number of participants	Appropriate participation of number of participants	5.0%	3.69
Q10	Participation	Quality of class discussion	Quality of the class discussion	5.0%	4.03
Sub Total				**70.0%**	**4.05**

Weighted Average Score for the Outcomes Category is 4.08 out of a maximum of 5

Q. No.	Sub category	Parameter	Sub Parameter	Weight	Weighted average Score
			OUTCOME CATEGORY		
Q11	Short Term	Improvement in skills	Contribution of the CBPs in improvement in the skill set	2.5%	4.00
Q12	Short Term	Creating Awareness	Contribution of the CBPs in creating awareness	2.5%	4.31
Q13	Short Term	Knowledge Enhancement	Contribution of the CBPs in enhancing knowledge	2.5%	4.23
Q14	Short Term	Enhancing motivation	Contribution of the CBPs in enhancing motivation	2.5%	4.06
Q15	Short to Medium Term	Adoption of Best practices	Contribution of the CBPs in adoption of the best practices/ state of the art technologies	2.5%	3.86
Q16	Short to Medium Term	Policy formulation	Contribution of the Studies in formulation of regulations/ policies/ orders/ guidelines /approach papers	2.5%	4.00
				15.0%	4.08

TOTAL IMPACT SCORE FOR STUDIES ---- 4.01

Studies- Classification function coefficients – Fisher Discriminant Fn

❑ **Classification Function Coefficients-**

- Scoring towards the following 4 questions helped discriminate the 3 sets of respondents

  o **Q 3**---Scope of the Studies in terms of comprehensive coverage of intended aspects of the selected topic;

  o **Q 8**---Presentation, clarity and coherence of the report

  o **Q 11**---Contribution of the Studies in creating awareness about the subjects;

  o **Q 14**---Contribution of the Studies in formulation of regulations/ policies/ orders/ guidelines/approach papers

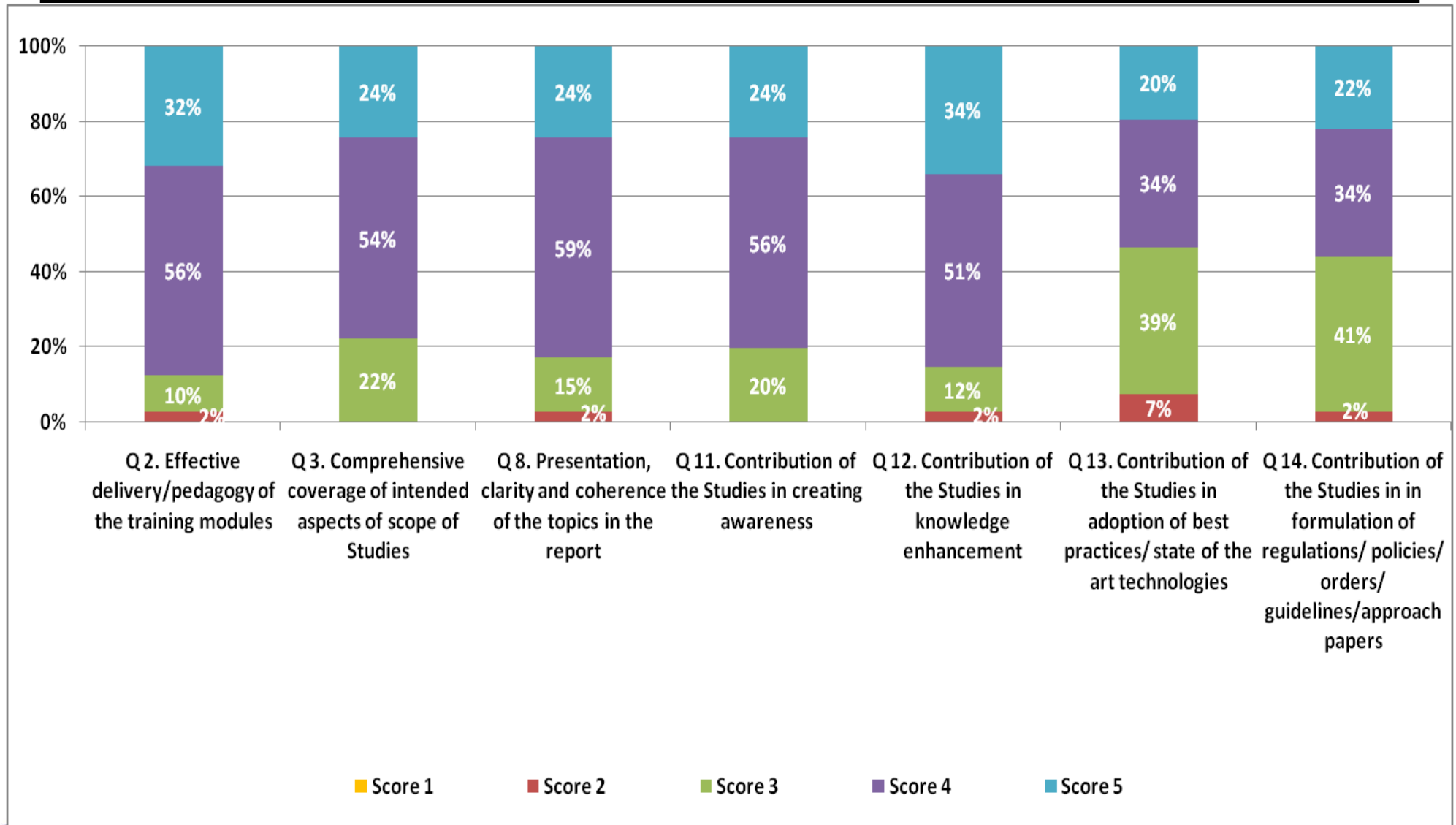|	Classification Function Coefficients		
	Outcome		
	1.00	**2.00**	**3.00**
q3	12.997	15.059	18.317
q8	13.811	16.882	19.354
q11	17.501	19.856	23.163
q14	8.298	11.155	13.806
(Constant)	-90.206	-128.092	-179.516

iMaCS

Most Important Scoring Variables- Q2, Q12, Q13, Q14

❑ From Structure matrix for Studies, it was observed that questions 2,12, 13, 14 are the most important scoring variables

SN	Q No	Description of the sub-parameter	Average Score
1	Q 2	Studies' objectives in terms of clarity, focus and relevance to the ERCs	4.17
2	Q 3	Scope of the Studies in terms of comprehensive coverage of intended aspects of the selected topic	4.02
3	Q 8	Presentation, clarity and coherence of the report	4.05
4	Q 11	Contribution of the Studies in creating awareness about the subjects	4.05
5	Q 12	Contribution of the Studies in enhancing the knowledge of the subjects	4.17
6	Q 13	Adoption of best practices/ state of the art technologies	3.66
7	Q 14	Contribution of the Studies in formulation of regulations/ policies/ orders/ guidelines/approach papers	3.76

Structure Matrix- Studies		
	Function	
Q. No.	1	2
q12[a]	.566[*]	-.030
q14	.562[*]	-.208
q2[a]	.536[*]	.365
q13[a]	.484[*]	-.409
q4[a]	.384[*]	-.062
q16[a]	.353[*]	-.060
q5[a]	.273[*]	.214
q17[a]	.242[*]	-.071
q15[a]	.239[*]	.070
q10[a]	-.068[*]	.008
q8	.421	-.626[*]
q7[a]	.256	-.567[*]
q3	.482	.483[*]
q1[a]	.346	.470[*]
q9[a]	.044	-.456[*]
q11	.385	.431[*]
q6[a]	.365	-.374[*]
q18[a]	.040	-.072[*]

Studies- Response distribution of important key variables

CBPs- Classification function coefficient

❑ **Classification Function Coefficients-**

- On the basis of importance of Classification Function Coefficients important observed questions (sub parameters) are-

  o **Q 2---**Trainers/ faculty in effective delivery/pedagogy of the training modules

  o **Q 4---** Quality of the programmes in terms of comprehensive coverage of intended topics

  o **Q 10---** Quality of the class discussion in the programmes

Classification Function Coefficients			
	Outcome		
	1.00	**2.00**	**3.00**
q2	6.823	12.651	14.077
q4	13.510	18.779	21.460
q10	20.489	16.123	22.027
(Constant)	-72.986	-96.482	-140.368

Most Important Scoring Variables- Q2, Q4, Q6, Q7

❑ From Structure matrix for Studies, it was observed that questions 2,4, 6, 7 are the most important scoring variables

SN	Q No	Description of the sub-parameter	Average Score
1	Q 2	Trainers/ faculty in effective delivery/pedagogy of the training modules	4.06
2	Q 4	Quality of the programmes in terms of comprehensive coverage of intended topics	4.03
3	Q 6	Adequacy of the infrastructure and facilities available for the training programmes	4.37
4	Q 7	Quality of the training materials provided	4.03
5	Q 10	Quality of the class discussion in the programmes	4.03

Structure Matrix- CBPs

	Function	
	1	2
q2	.618*	-.051
q4	.516*	.019
q6[b]	.484*	.098
q7[b]	.441*	.075
q14[b]	.393*	-.121
q8[b]	.323*	.227
q5[b]	.307*	-.280
q11[b]	.247*	-.217
q13[b]	.216*	.040
q15[b]	.171*	-.004
q10	.415	.879*
q12[b]	.170	.291*
q9[b]	.033	.228*
q16[b]	.108	.172*
q1[b]	.054	-.085*
q3[b]	.009	-.021*

CBPs- Response distribution of important key variables
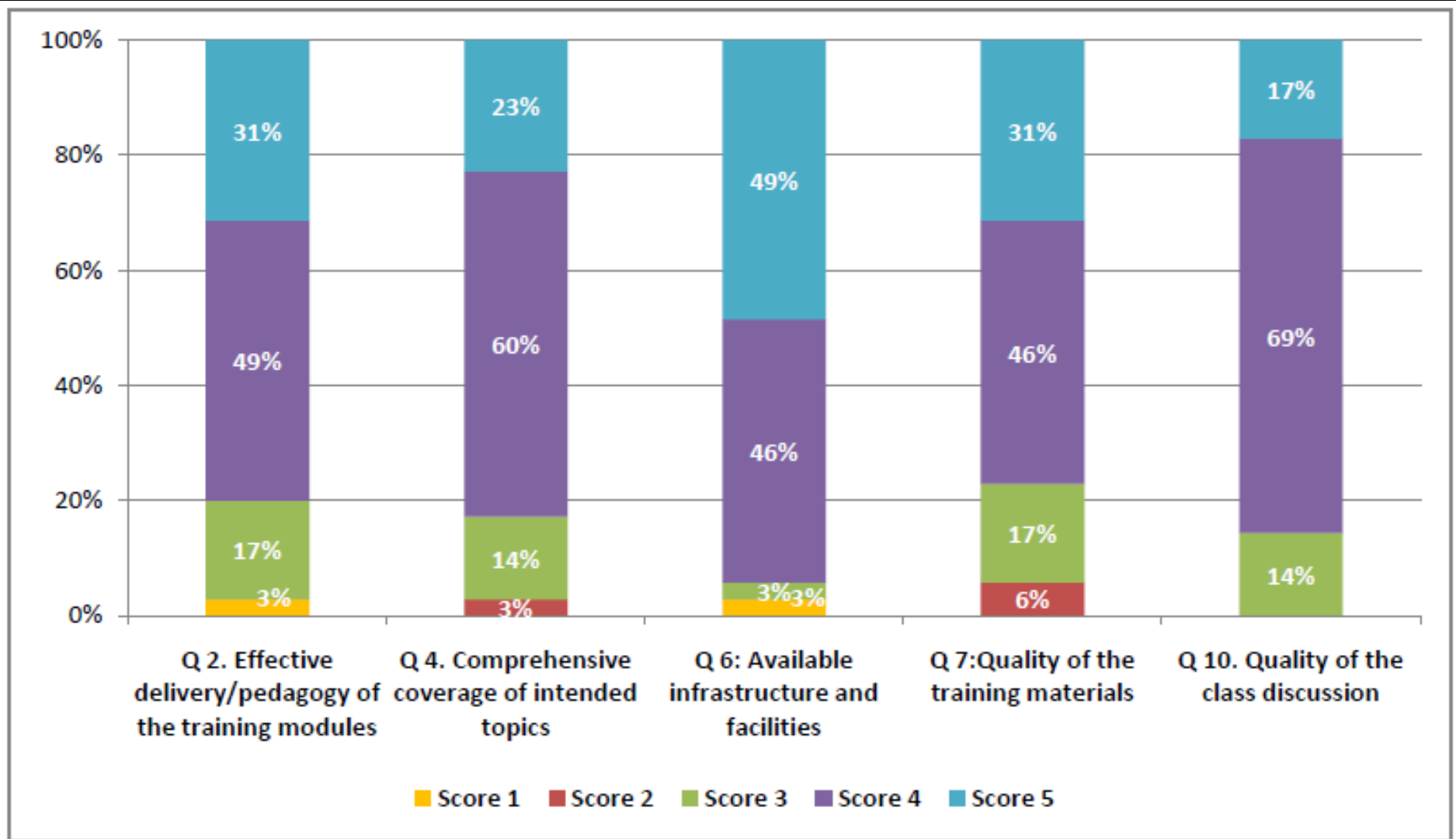
Studies and CBPs- Model Performance- Misclassification Matrix

STUDIES

Classification Results					
			Predicted Group Membership		
Outcome			1.00	2.00	3.00	Total
Original	Count	1.00	10	0	0	10
		2.00	1	14	2	17
		3.00	0	0	8	8
	%	1.00	100.0	0.0	0.0	100.0
		2.00	5.9	82.4	11.8	100.0
		3.00	0.0	0.0	100.0	100.0

91.4% of original grouped cases correctly classified.

CBPs

Classification Results					
			Predicted Group Membership		
Outcome			1.00	2.00	3.00	Total
Original	Count	1.00	8	0	0	8
		2.00	1	13	1	15
		3.00	0	1	6	7
	%	1.00	100.0	0.0	0.0	100.0
		2.00	6.7	86.7	6.7	100.0
		3.00	0.0	14.3	85.7	100.0

90.0% of original grouped cases correctly classified.

Studies and CBPs- Out of sample validation

STUDIES

S. No.	Outcome	Model Result	Classification match
1	2	2	Correct
2	2	2	Correct
3	2	1	Incorrect
4	2	2	Correct
5	2	2	Correct
6	2	2	Correct

5 out of 6 (i.e. 83.0%) of "out of sample" cases were correctly classified

CBPs

S. No.	Outcome	Model Result	Classification match
1	2	2	Correct
2	2	2	Correct
3	2	2	Correct
4	2	2	Correct
5	2	2	Correct

5 out of 5 (i.e. 100.0%) of "out of sample" cases were correctly classified

List of eighteen (18) Studies undertaken by the secretariat of FOR during the 11th plan period

SN	Name of the Study	Conducted during the Year
1	Electricity Reforms and Regulations - A Critical review of last 10 years experience	2008-09
2	Model standard of performance regulations for distribution licensees	2008-09
3	Evolving an appropriate model for distribution margin	2008-09
4	Capital cost benchmarks for distribution business	2008-09
5	Evolve an appropriate model of incentive-disincentive mechanism for Distribution Utilities	2009-10
6	Implementation of Renewable Energy Certificate	2009-10
7	Comparative Analysis of supply codes in 10 states	2009-10
8	Implementation of REC Framework- Forbearance Price and Floor Price of REC	2009-10
9	Implementation & impact analysis of time of day (TOD) tariff in India	2009-10
10	Analysis of tariff orders & other orders of the State Electricity Regulatory Commissions	2009-10

List of eighteen (18) Studies undertaken by the secretariat of FOR during the 11th plan period

SN	Name of the Study	Conducted during the Year
11	Assessment of various renewable energy resources potential in different states of RPO trajectory and its impact on tariff	2009-10
12	Standardisation of distribution franchisee model	2010-11
13	Assist the Commission for evolving parameter for generic tariff for Renewable Energy sources	2010-11
14	Assessment of reasons for financial viability of Utilities	2010-11
15	Standardisation of Regulatory Accounts	2010-11
16	Model regulations for Protection of Consumer Interest (Consumer Grievance Redressal Forum, Ombudsman and Consumer Advocacy Regulations)	2010-11
17	Evolving measures for the effective implementation of Prepaid Metering in the country	2011-12
18	Preparing incentive structure for States for fulfilling Renewable Purchase Obligation (RPO) targets	2011-12

List of three CBPs undertaken by the secretariat of FOR during the 11th plan period at Chairperson/ Member level

SN	Name of the program	Date	Year	Organised at
1	Orientation programme for the Chairperson and Members of the ERCs	29th May to 6th June	2009	IIM, Ahmadabad
2	Orientation programme for the Chairperson /Members of the ERCs with the proposed study visit to California (USA)	3rd to 10th June	2010	IIM, Ahmadabad
3	Orientation Programme for Chairperson /Members of Electricity Regulatory Commission (ERCs)	3rd to 11th June	2011	IIM, Ahmadabad

List of eighteen (18) CBPs undertaken by the secretariat of FOR during the 11th plan period at Chairperson/ Member level

SN	Name of the program	Date	Year	Organised at
1	Six-days residential capacity building /training programme for Officers of ERCs	30th June to 05th July	2008	IIT-Kanpur
2	Six-days residential training programme on "Open Access and Role of Load Despatch Centre (OA&LDC)" for Officers of ERCs	02nd to 07th February	2009	National Power Training Institute (NPTI), Faridabad
3	Five-days residential training programme on "Consumer Protection issues" for officers of ERCs	16th to 20th February	2009	CIRC at Hotel Regale Inn
4	Capacity Building Programme for Officers of ERCs, on "Various facets of regulatory issues in power sector"	3rd to 8th August	2009	IIT-Kanpur
5	Two-Days residential workshop on "DSM- load research" for Officers of ERCs	7th to 8th September	2009	NPTI, Faridabad
6	A residential training programme on "Finance and Economics" for Officers of ERCs	14th and 18th December	2009	IIM, Bangalore
7	Four-days training programme on "Regulations, Competition and Consumer Issues in the Electricity Sector" for Officers of ERCs	18th May to 21st May	2009	CIRC at Dharamshala (HP)

List of eighteen (18) CBPs undertaken by the secretariat of FOR during the 11th plan period at Chairperson/ Member level

SN	Name of the program	Date	Year	Organised at
8	Four-days residential programme on "Demand Side Management and Energy Efficiency (DSM&EE)" for Officers of ERCs	15th June and 18th June	2009	NPTI, Faridabad
9	Four-days residential training programme on "Open Access, role of Load Despatch Centers and Power Markets" for Officers of the regulatory commissions and SLDCs	2nd to 5th November	2009	NPTI, Faridabad
10	Six-days residential training programme on "Demand-side Management" for Officers of ERCs	02nd to 07th March	2009	National Power Training Institute (NPTI), Faridabad
11	Four-days residential training programme on "Legal Aspects of Power Sector Regulation: Experiences and Enforcement Issues" for Officers of Electricity Regulatory Commission (ERCs)	28th June to 1st July	2010	NLSIU, Bangalore
12	Third capacity building programme for Officers of ERCs on "Various facets of Regulatory issues in Power Sector"	23rd to 28th August	2010	IIT-Kanpur

List of eighteen (18) CBPs undertaken by the secretariat of FOR during the 11th plan period at Chairperson/ Member level

SN	Name of the program	Date	Year	Organised at
13	Residential training programme on "Protection of Consumer Interest" for Officers of CGRF, Ombudsman & Consumer Organisation	24th to 25th November	2010	NPTI, Faridabad
14	Residential training programme on "DSM & Energy Efficiency" for Officers of ERCs	16th to 18th November	2010	NPTI, Faridabad
15	Programme on Converged Indian Accounting Standards &IFRS Convergence	5th to 7th August	2010	ICWAI - Institute of Cost and Works Accountants of India
16	4th capacity building/training programme for Officers of ERCs	18th to 23rd July	2011	IIT-Kanpur
17	Training programme on "Demand Side Management" for Officers of ERCs	10th to 14th October	2011	IIT, Roorkee
18	Programme on "Protection of Consumer Interest" for Officers of CGRF and Ombudsman	21st to 23rd March	2012	NPTI, Faridabad

Study on Assessment of component-wise AT&C Losses in the State of Uttar Pradesh, Tamil Nadu and Rajasthan

Presentation to the Forum of Regulators

April 02, 2014

Structure of the Presentation

1 Background and objective of the study

2 Value addition of the study

3 Approach & Methodology of the Study

4 Component wise AT&C losses in the three States

5 Reasons for AT&C Losses

Background of the study – concept of AT&C Losses (1/4)

Definition of AT&C Losses

AT&C loss is basically the difference between energy input and energy for which revenue is realized after accounting for collection efficiency ………

AT&C loss should be calculated by subtracting the energy realized from the energy input where

energy realized should be equal to the product of energy billed and collection

efficiency (collection efficiency being the ratio of amount collected to the amount

billed).

Report on "Loss Reduction Strategies" by the Forum of Regulators (FoR)

AT&C Losses – Conceptual Framework

Aggregate Technical and Commercial (AT&C) losses and Transmission and Distribution (T&D) losses are not same.

T&D loss takes into account the losses in the T&D system including commercial loss up to the point of billing and **does not take into account the units for which revenue is actually collected or realized.**

Report on "Loss Reduction Strategies" by the Forum of Regulators (FoR)

- The Ministry of Power has initiated pilot studies on "Assessment of component-wise AT&C Losses in six States in India".

- Power Finance Corporation (PFC) Limited has been entrusted to appointment of consultant in the six States.

- The Forum of Regulators (FoR), which is a forum of all State Electricity Regulatory Commissions (SERC's) including Central Electricity Regulatory Commission (CERC) has been entrusted to monitor and review the activities of the consultant.

- Medhaj Techno Concept Pvt. Limited has been appointed by PFC to undertake the study for the assessment of component wise AT&C loss reduction studies for Uttar Pradesh, Tamil Nadu and Rajasthan

Background of the study – the objective of the study is to compute components wise AT&C losses and recommend way forward for the DISCOMs in the three states

1. What is the existing AT&C losses in the circles?

2. What are the components of the AT&C losses?

3. What are estimated component wise AT&C losses?

4. What is the estimated AT&C losses of the three States?

5. What are the critical components that requires maximum attention from the DISCOMs to reduce the AT&C losses in the future?

6. How the AT&C losses will be reduced by using component wise analysis ?

| Selection of four representative Circles | Primary survey in four representative Circles | Secondary data analysis | Forming key outcomes of the study |

- **Computation of overall AT&C losses of the four selected circles (1)**

- **Computation of component wise Technical loss (2) in:**

  - The HT system

  - The LT system through sample study

  - Extrapolate the results of the sample study on the circle to compute the overall technical loss

- **Computation of component wise Commercial loss of the selected Circles (3):**

  - Computation of **total commercial loss** of the circle by taking into account the difference between the **AT&C losses (1)** and **Technical loss (2)** of the circle

  - Assessment of sub-component wise commercial loss of the circle viz. loss due to **deficient metering**, **billing inefficiency, collection efficiency** and **theft/pilferage of energy**

Value addition of the study

Key questions faced by the decision makers in the DISCOMs, while framing strategies for reduction of AT&C losses	Overall analysis of the AT&C Losses	Component-wise analysis of the AT&C Losses	Remarks
What are components/factors involved in the AT&C losses in the DISCOM	✗	√	*The DISCOM officials may be aware of the **factors** contributing the AT&C losses in their areas, however, they will not identify these factors and areas from the analysis of the overall AT&C losses.*
What are the key areas, where the AT&C losses are higher	◪	√	
Whether the existing initiatives taken by the DISCOMs are in the right direction/ delivering the desired results	◪	√	*Analysis of total AT&C losses will provide the correct picture to the DISCOM*
How to reduce the losses in the short, medium and long timeframe and to frame more effective strategies	◪	√	*Loss reduction strategies prepared by analyzing the component wise AT&C losses will be more relevant*

No ✗   **Partially** ◪   **Yes** √

Value addition of the study

Components, where the losses are higher	

Overall analysis of the AT&C Losses

Component-wise analysis of the AT&C Losses

*The DISCOMs may be aware of the **components** responsible for AT&C losses but could not **segregate and quantify** the losses into various components scientifically from the analysis of the overall AT&C losses.*

Evaluation of existing loss reduction initiatives

Framing future loss reduction strategies
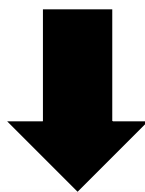
AT&C losses (MU) = 152.93
AT&C losses (%) = 46.84%

	MU	%
1. Technical loss in the HT system	13.52	4.14
2. Technical loss in the LT system	34.89	10.68
3. Commercial loss due to deficient metering	6.01	1.84
4. Commercial loss due to billing inefficiency	0.48	0.15
5. Commercial loss due to collection inefficiency	26.82	8.21
6. Commercial loss due to theft/pilferage	71.21	21.81
7. AT&C losses	152.93	46.84

JVVNL and field studies in Bharatpur circle

Value addition of the study

Components, where the losses are higher	Existing loss reduction initiatives	Components of losses to be reduced	Component-wise analysis of the AT&C Losses		
				MU	**%**
	R-APDRP	1,2,3,4,6	1. Technical loss in the HT system	13.52	4.14
Evaluation of existing loss reduction initiatives	Outsourcing services	4	2. Technical loss in the LT system	34.89	10.68
			3. Commercial loss due to deficient metering	6.01	1.84
	Vigilance check	6	4. Commercial loss due to billing inefficiency	0.48	0.15
	Revenue collection drive	5	5. Commercial loss due to collection inefficiency	26.82	8.21
Framing future loss reduction strategies			6. Commercial loss due to theft/pilferage	71.21	21.81
	Introduction of KPIs	4,5,6	7. AT&C losses	152.93	46.84

Value addition of the study

Components, where the losses are higher	Future Loss Reduction Strategies	Component-wise analysis of the AT&C Losses		
			MU	**%**
Evaluation of existing loss reduction initiatives	Medium and long term technical interventions	1. Technical loss in the HT system	13.52	4.14
		2. Technical loss in the LT system	34.89	10.68
	Short and Medium term interventions	3. Commercial loss due to deficient metering	6.01	1.84
	"Low hanging fruits" – short term commercial interventions through outsourcing, incentives	4. Commercial loss due to billing inefficiency	0.48	0.15
		5. Commercial loss due to collection inefficiency	26.82	8.21
Framing future loss reduction strategies	**Short, medium and long term initiatives** through technical (ABC, FSP, HVDS) and interventions to reduce commercial loss	6. Commercial loss due to theft/pilferage	71.21	21.81
		7. AT&C losses	**152.93**	**46.84**

Selection of representative circles

FOR methodology

A,B,C Analysis

Extrapolation

Selection criteria : Sales mix of the circles

Criteria I DISCOM wise	**Criteria II** Geographical location	**Criteria III** Agri. & Dom. Sales mix

Representative samples

Circles	DISCOM wise	Geographical location wise	Agri. and Dom. Sales Mix
A			
B	Options analysis		
…….			

11

Approach and methodology - selection of the four representative circles in the three States

Selection of representative circles

FOR methodology

A,B,C Analysis

Extrapolation

Link to other states

Step 1: Circles, which represents the sales mix of the DISCOMs

Sales mix of the DISCOMs in Uttar Pradesh (%)

States	DISCOMs	Domestic	Commercial	Agriculture	Industrial	Others
Uttar Pradesh	PuVVNL	43%	12%	21%	12%	12%
	MVVNL	42%	13%	16%	17%	12%
	DVVNL	33%	9%	26%	24%	8%
	PVVNL	34%	7%	15%	37%	7%
Total - UP		**38%**	**10%**	**19%**	**24%**	**9%**

Representative circles in Uttar Pradesh (%)

DISCOMs	Circles	Domestic	Commercial	Agriculture	Industrial	Others
PuVVNL	EDC Varanasi	38%	10%	33%	17%	2%
	EDC I Mirzapur	51%	12%	25%	5%	7%
MVVNL	EDC Bareilly	45%	11%	19%	24%	1%
	EUCD IV Lucknow	45%	11%	19%	24%	1%
DVVNL	EDC Mathura	42%	7%	19%	30%	2%
	EDC Firozabad	37%	9%	22%	26%	6%
PVVNL	EDC Meerut	37%	4%	23%	35%	1%

\# Consumer category wise sales mix of the DISCOM has been arrived by aggregating the consumer wise sales mix of all the circles in the DISCOM.

* Since, it is not possible to compare the sales mix of the circles with the DISCOMs in absolute terms, ±10%variation in sales mix for domestic, agriculture and industrial consumption have been considered.

\# Other category includes public lighting, water works, temporary supply and railway traction
* Industrial includes both LT and HT industries

Selection of representative circles

FOR methodology

A,B,C Analysis

Extrapolation

Step 2: Circles, which represents the sales mix of the Zones

Sales mix of the geographical zones in Uttar Pradesh(%)

States	DISCOMs	Domestic	Commercial	Agriculture	Industrial	Others
Uttar Pradesh	Zone I- Western Region	33%	7%	17%	39%	4%
	Zone II- Eastern Region	44%	12%	22%	12%	10%
	Zone III- Central Region	45%	11%	19%	24%	1%

Representative circles in Uttar Pradesh

DISCOMs	Circles	Domestic	Commercial	Agriculture	Industrial	Others
Zone I	EDC Mathura	38%	7%	19%	35%	1%
	EDC Meerut	37%	4%	23%	35%	1%
Zone II	EUCD IV Lucknow	45%	11%	19%	24%	1%
	EDC Orai	42%	7%	14%	28%	9%
Zone III	EDC 2 Allahabad	52%	7%	30%	7%	4%
	EDC Varanasi	38%	10%	33%	17%	2%

Link to other states

Approach and methodology - selection of the four representative circles in the three States

Selection of representative circles

FOR methodology

A,B,C Analysis

Extrapolation

Step 3: Analysis of domestic and agriculture usage

Scoring of circles as per domestic and agriculture usage

- Following scores have been assigned to each circle based on the agriculture and domestic consumption:
  - Agriculture and domestic consumption > 80% - **3**
  - Agriculture and domestic consumption between 60% - 80% - **2**
  - Agriculture and domestic consumption <70% - **1**

- Ranking of the circles has been done based on the scoring assigned to each circles i.e.
  - Circles with higher score ranked high
  - Circles with lower score ranked low

Approach and methodology - selection of the four representative circles in the three States

Selection of representative circles

FOR methodology

A,B,C Analysis

Extrapolation

Link to other states

Step 3: Analysis of domestic and agriculture usage

Uttar Pradesh

Circles	Agriculture sales (in %)	Domestic Sales (in %)	Total (in %)	Scoring
EDC Bagpat	55	35	90	3
EDC Azamgarh	20	65	85	3
EDC-2 Allahabad	30	52	82	3
EDC Faizabad	38	40	78	2
EDC Badaun	45	32	77	2
EDC Banda	34	41	75	2
EDC Gonda	26	47	73	2
EDC Mainpuri	35	37	72	2
EDC Gorakhpur	0	71	71	2
EDC Varanasi	32	38	70	2
EUDC IV Lucknow	20	50	70	2
EDC Rampur	16	54	70	2
EDC Agra	24	45	69	1
EDC Jhansi	14	55	69	1
EDC Raibareili	34	34	68	1
EDC 1 Buland	23	44	67	1
EDC Sultanpur	19	48	67	1
EUDC Moradabad	0	65	65	1
EDC Bareilly	19	45	64	1
EDC Gorakhpur	11	53	64	1
EDC Mathura	42	19	61	1
EDC Muzzafar nagar	32	29	61	1
EDC 1 Moradabad	21	39	60	1
EDC Meerut	23	37	60	1

Selection of representative circles

FOR methodology

A,B,C Analysis

Extrapolation

Link to other states

Step 4: Option analysis

Uttar Pradesh

Circle	DISCOM	Discom Wise	Zone wise	Agri & Dom. Sales mix
EUDC IV Lucknow	MVVNL	√	√	2
EDC Meerut	PVVNL	√	√	1
EDC Varanasi	PUVVNL	√	√	2
EDC Mathura	DVVNL	√	√	1
EDC-2 Allahabad	PUVVNL		√	3
EDC Saharanpur	PVVNL			3
EDC-1 Mirzapur	PUVVNL	√		2
Shahjahanpur	PVVNL			1
EDC Bagpat	PVVNL			3
EDC Azamgarh	PUVVNL			3
EDC Orai	DVVNL		√	1
EDC Ghazipur	PUVVNL			3
EDC Deoria	PUVVNL			2
EDC Faizabad	MVVNL			2
EDC Jaunpur	PUVVNL			2
EDC Badaun	MVVNL			2
EDC Gonda	MVVNL			2
EDC Basti	PUVVNL			2
EDC Gorakhpur	PUVVNL			1
EDC Meerut	PVVNL			1
EDC Rampur	PVVNL			2
EDC Sitapur	MVVNL			2
EDC Bareilly	MVVNL			1
EDC Firozabad	DVVNL			1

Approach and methodology - selection of the four representative circles in the three States

Selection of representative circles

FOR methodology

A,B,C Analysis

Extrapolation

Link to other states

Selected circles – Uttar Pradesh

EDC Meerut

The sales mix of EDC Meerut represents the sales mix of PVVNL as well as the sales mix of the Western Zone of Uttar Pradesh. The domestic and agriculture consumption of the circle is 60%, similar to the domestic and agriculture sales mix of the State.

EDC Mathura

The sales mix of EDC Mathura represents the sales mix of DVVNL as well as the sales mix of the Western Zone of Uttar Pradesh. The domestic and agriculture consumption of the circle is 60%, similar to the domestic and agriculture sales mix of the State.

EUDC Lucknow IV

The sales mix of EUDC IV Lucknow represents the sales mix of MVVNL as well as the sales mix of the Central Zone of Uttar Pradesh. The domestic and agriculture sales mix of the circle is 70%. Hence EUDC IV Lucknow has been selected which is within +10% variations in domestic and agriculture sales mix as compared to the State.

EDC Varanasi

The sales mix of EDC Varanasi represents the sales mix of PuVVNL as well as the sales mix of the Eastern Zone of Uttar Pradesh. The domestic and agriculture sales mix of the circle was 70%.

Selection of circles – FoR Methodology for computation of component wise AT&C losses

Formula for computation AT&C Losses

Selection of representative circles

FOR methodology

A,B,C Analysis

1. T&D Losses = (EI – EB)*100/EI

Where, EI is Units Input
EB is unit billed

2. Collection efficiency (%) = Amount Realized/ Amount Billed
3. Units Realized (UR) = Units billed x Collection Efficiency
4. AT&C losses = EI – UR
5. AT&C losses (%) = (EI – UR)*100/ EI

Extrapolation

Selection of circles – FoR Methodology for computation of component wise AT&C losses

Selection of representative circles

FOR methodology

A,B,C Analysis

Extrapolation

Formula for computation HT system loss (Technical loss) i.e. from 132 kV to 11 kV

1. Total energy received at 132/33 kV Sub-stations   = X1
2. Total energy sent out from 11kV feeders to the consumers = Y1
3. Total energy sent out to other circles/DISCOMs   =Y2
4. Total energy sent out   =YT =Y1+Y2
5. Energy lost in 33/11 kV System of DISCOM   = X1 – YT

Formula for computation LT system loss (Technical loss)

Selection of representative circles

FOR methodology

A,B,C Analysis

Extrapolation

1. A1 = 1st read of the DT meter
2. A2= 2nd read of the DT meter
3. MF1 = Multiplying Factor of the DT meter

4. B1= 1st read of all the consumers connected with the DT
5. B2=2nd read of all the consumers connected with the DT
6. MF2= Multiplying Factor of the consumer meter

7. Technical loss in the LT system = (A2-A1) X MF1 – (B2-B1) X MF2

Formula for computation Commercial loss

Selection of representative circles
FOR methodology
A,B,C Analysis
Extrapolation

1. Total commercial loss:

Commercial loss = AT&C losses – Technical loss

2. Commercial loss due to deficient metering

Actual consumption (kWh) of the consumers recorded in the field studies - Billed by the utility (kWh) of such consumers having defective meters as per the records

3. Commercial loss due to billing inefficiency

Actual consumption (kWh) of the consumers recorded as per the field studies – Provisional Billing done by the utility (kWh) of such consumers as per their records

4. Commercial loss due to collection inefficiency

Energy Billed (MU) – Energy Realized (MU)

5. Commercial loss due to theft/pilferage

Commercial loss due to theft/pilferage = Total Commercial Loss (Commercial loss due to defective metering + Billing inefficiency + Collection inefficiency)

It is not possible to compute the extent of theft/pilferage accurately in the distribution system by any formula. Therefore, the extent of energy loss due to theft of electricity is computed by deducting the component wise commercial loss mentioned from point no. (2) to (4) from the total commercial loss of the circle.

Selection of circles – "A,B,C Analysis" of the AT&C losses"

Selection of representative circles	**Based on the findings of the field studies, key factors responsible for AT&C losses are identified and segregated into three categories namely-A, B and C to identify the priority areas and to frame a set of recommendations to reduce the losses.**

Issues	Suggested interventions
	• **Commercial loss:**
	o Short and medium term interventions by metering and regularizing the un-metered agriculture consumers to reduce agriculture theft
Category A (High importance)	o Short and medium term interventions such us metering of the un-metered consumers, regular vigilance check to reduce the energy theft in unmetered connections other than agriculture
	• **Technical interventions to reduce the technical and commercial losses**
	o Segregate the agriculture load from the rural feeders and provide HT connections to the agriculture consumers
	• **Commercial loss:**
	o Short term measures to reduce the theft in the densely populated area by creating more accountability of the billing and collection staff,
Category B	o Short term measures to improve the billing and collection efficiencies
	• **Technical interventions to reduce the technical and commercial losses**
	o Medium term interventions to reduce the loss through technical interventions such as implementation of the ABC Cabling and AMI.
Category C	• **Commercial loss:**
	o Short term measures to improve the billing and collection efficiencies

FOR methodology

A,B,C Analysis

Extrapolation

Selection of representative circles

FOR methodology

A,B,C Analysis

Extrapolation

- Assumptions
  - Commercial loss in the industrial, commercial and other categories (railway traction, bulk supply, public lighting and water works) are minimum. Hence, most of the commercial loss are in domestic and agriculture categories (deficient metering, billing and collection inefficiencies and theft)
  - Sales mix of the domestic and agriculture consumers varies between the representative circles and the DISCOMs. Therefore, point estimate of the AT&C losses of the DISCOMs would not be reasonable.
  - It is further assumed that the technical loss component of the DISCOMs would remain at the same level as computed for the circles.
  - The extrapolation of the AT&C losses has been done only for the study period i.e. from June to September 2012 and not for the full FY 2012-13.

Selection of representative circles

FOR methodology

A,B,C Analysis

Extrapolation

- Extrapolation of AT&C losses on the DISCOM is based on
  - Allocation of commercial loss on the DISCOMs
  - Commercial loss factor
  - Standard deviation between the domestic and agriculture sales mix of circles than that of the DISCOMs
  - Computation of Lower and upper limits of commercial loss
  - Computation of Extrapolation factor

AT&C losses of the four representative circles in Uttar Pradesh

Particulars	EDC Meerut	EDC Mathura	EUDC IV Lucknow	EDC Varanasi
Energy input in the circle (MU) [A]	448.69	349.19	440.47	332.89
Unit billed (MU) [B]	305.30	221.96	282.40	257.23
T&D losses (%) [C] = ([A]-[B])/[A]	31.96%	36.44%	35.89%	22.73%
Revenue billed (₹ Crore) [D]	92.91	81.28	86.27	70.30
Revenue realized (₹ Crore) [E]	87.17	66.86	76.93	48.32
Collection efficiency (%) [F]=[E]/[D]	93.82%	82.26%	89.17%	68.74%
AT&C losses (%) [G] = ([A]-([B]*[F]))/[A]	36.16%	47.71%	42.83%	46.89%

Particulars	EDC Meerut	EDC Mathura	EUDC IV Lucknow	EDC Varanasi
Technical loss in the HT system (%) [A]	5.15%	5.02%	5.12%	4.98%
Technical loss in the LT system (%) [B]	10.31%	13.42%	11.60%	11.38%
Total technical loss [C]	15.46%	18.44%	16.72%	16.36%

Link

PuVVNL, MVVNL, DVVNL, PVVNL and Field studies

Component wise AT&C losses in the four circles in Uttar Pradesh

Computation of commercial loss in the four representative circles in UP

Particulars	EDC Meerut	EDC Mathura	EUDC IV Lucknow	EDC Varanasi
AT&C losses (%) [A]	36.16%	47.71%	42.83%	46.89%
Technical loss (%) [B]	15.46%	18.44%	16.72%	16.36%
Commercial loss (%) [C] = [A] – [B]	20.70%	29.27%	26.11%	30.52%

Component wise Commercial loss in the four representative circles in UP

Particulars	EDC Meerut	EDC Mathura	EUDC IV Lucknow	EDC Varanasi
Commercial loss due to deficient metering (%) [A]	0.66%	0.33%	3.42%	0.51%
Commercial loss due to billing inefficiency (%)[B]	1.82%	0.55%	5.22%	0.34%
Commercial loss due to provisional billing to metered consumers (%)[C]	2.48%	6.10%	0.32%	0.44%
Commercial loss due to collection inefficiency (%) [D]	4.20%	11.27%	6.94%	24.16%
Commercial loss due to theft/pilferage (%) [E]	11.54%	11.01%	10.21%	5.07%
Total commercial loss (%)[F]	20.70%	29.27%	26.11%	30.52%

Link to other states

Link

Extrapolation of circle wise AT&C losses on the DISCOMs

Uttar Pradesh	PVVNL		DVVNL		MVVNL		PuVVNL	
Particulars	LL	UL	LL	UL	LL	UL	LL	UL
AT&C losses	31.18%	35.31%	46.75%	49.22%	43.19%	51.37%	47.53%	58.00%

Link
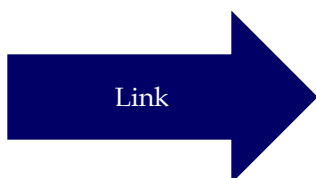
Defective meters at 33 kV System

Defective meter at Partapur S/S in EDC – Meerut

Defective meter in Sankarpur feeder in EUDC IV – Lucknow
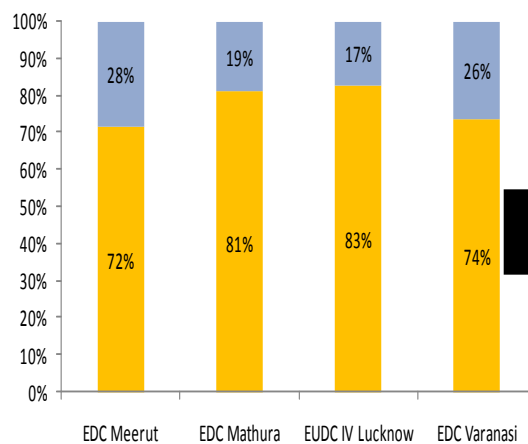
Reasons →
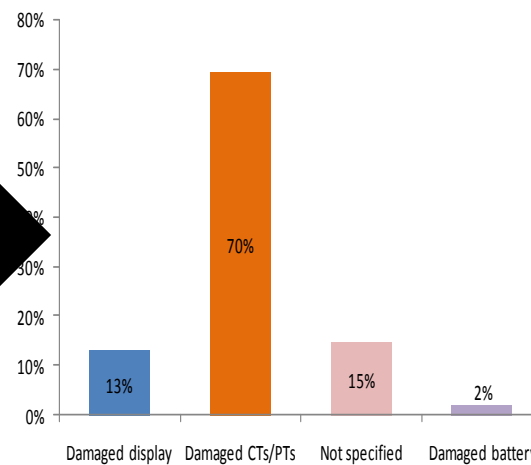
Defective meters at the retail consumer end

Defective consumer meter in EDC
Meerut

Defective electro-magnetic meter in
EDC Mathura

Meter bypass

Energy theft through bypassing of the meter (–
EDC Mathura)

Energy theft through bypassing of the
meter in Churu Circle

Direct hooking from the pole

Energy theft from the pole
(EDC Meerut - Pallavpuram)

Energy theft from the pole
(EDC Mathura - Kosikalan)

Energy theft through illegal connection
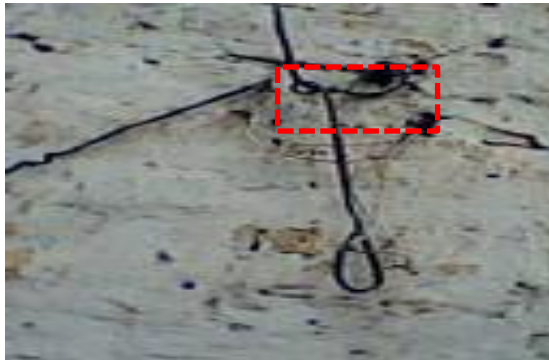
Wires connecting to illegal consumer (EUDC IV Lucknow)
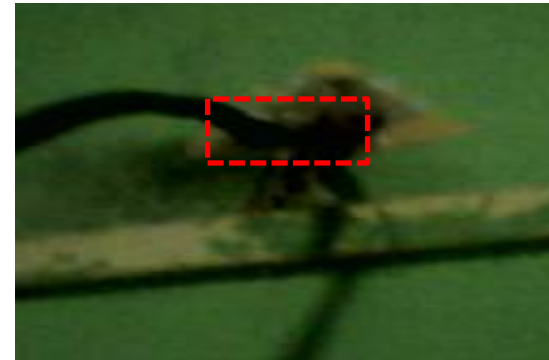
Wires connecting to illegal consumers (EDC Varanasi)

Tempered meter (with broken seal) in a consumer premises in Churu

Tempered meter (with broken seal) in a consumer premises in Churu

Thank you

MECON Limited
(A Govt. of India Enterprise)

A House of Engineering Excellence…..

Aiming Beyond…..

GLIMPSES OF MECON

- Established in 1959, India's frontline engineering, consultancy and contracting organization having multi-disciplinary experienced and dedicated Engineers, Scientist & Technologist.

- Function as Customer focused organization providing globally competitive value added Consultancy, Engineering, Turn-key Execution and Project Management Services.

- An ISO 9001:2008 company and is registered with various International financial institution like WB, ADB,AfDB and have **technological** tie-ups with world leaders.

ASSESSMENT OF COMPONENT-WISE AT&C LOSS

AGGREGATE TECHNICAL & COMMERCIAL (AT&C) LOSS
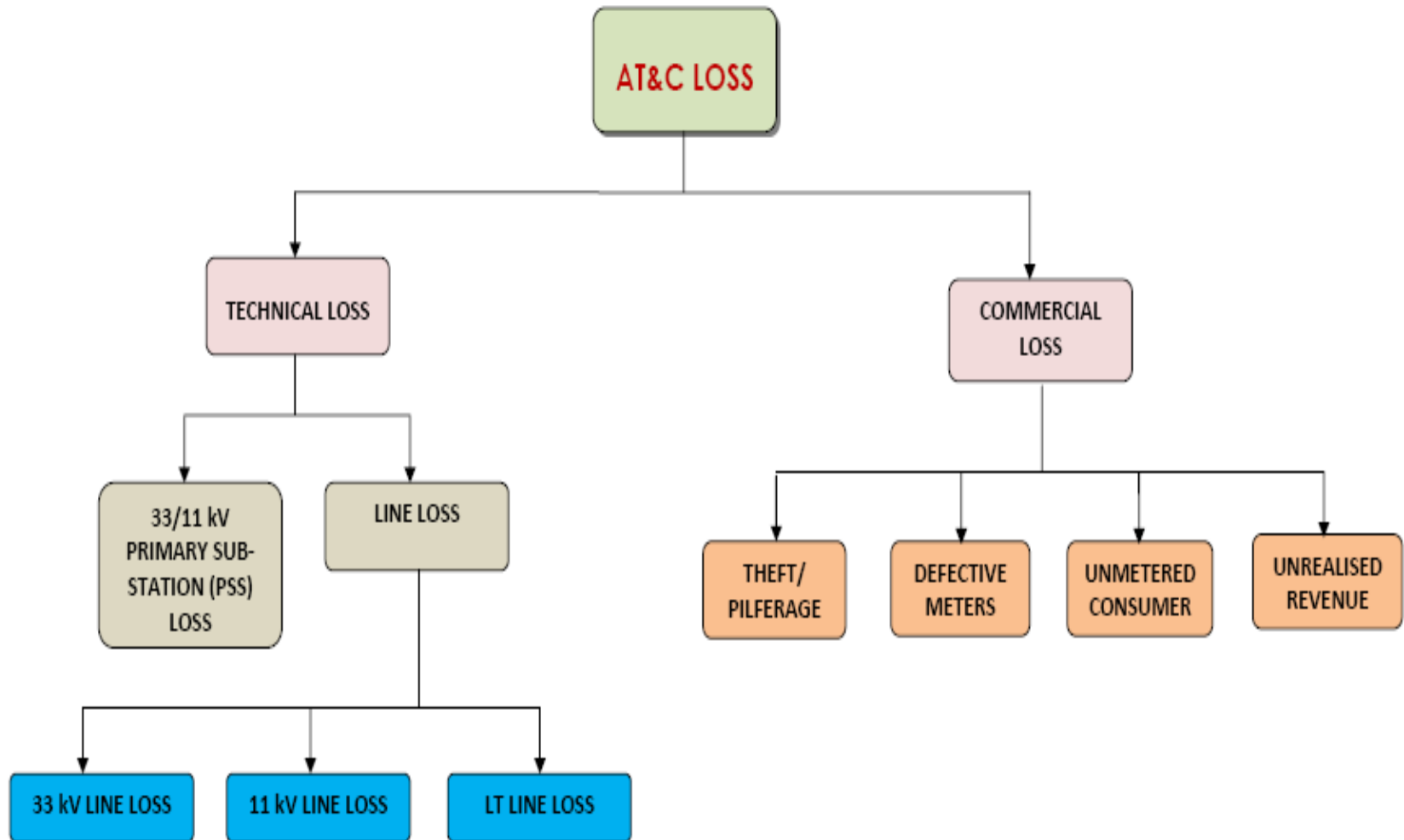
METHODOLOGY

According to the guideline of FOR we have undergone the following steps:

1. Selection of zones & circles

2. Collection of the technical data from the four selected circles

3. Computation of data for assessment of component-wise AT&C Loss

4. Extrapolation of AT&C Loss for the States

SELECTION OF ZONES & CIRCLES

Zones and Circles were selected in consultation with FOR considering following criteria :

Percentage of characteristic of load i.e. Domestic, Commercial, Agricultural, LT Industrial etc.

Percentage of metering at different voltage level, Energy input, percentage of AT&C Loss.

Sl. No	Type of Zone	No. of Circle for MP	No. of Circle for Karnataka	No. of Circle for Maharashtra
1	Zone -1	04	03	31
2	Zone -2	04	02	09
3	Zone -3	22	09	03
4	Zone -4	13	12	01
	Total	43	26	44

MECON LIMITED

A House of Engineering Excellence

SELECTED CIRCLES FOR 3 STATES :

Sl. No	Type of Zone	Name of the Circle selected for MP	Name of the Circle selected for Karnataka	Name of the Circle selected for Maharashtra
1	Zone -1	Jabalpur city	B'lore South	Amravati
2	Zone -2	Bhopal O&M	Hubli	Kolhapur
3	Zone -3	Morena	Gulbarga	Kalyan-II
4	Zone -4	Burhanpur	Chikkodi	Bhiwandi

Site Survey for Collection of Data

1. The overall energy loss has been computed from the actual meter reading by site survey of the meter installed at various locations in the system.

2. Initial and final readings of all category meters of all voltage level were collected with a interval of one month(MP & Karnataka –July'2013 and Maharashtra– September'2013) of the concerned utility.

COMPUTATION OF LOSSES

COMPUTATION OF TECHNICAL LOSS

MECON LIMITED

A House of Engineering Excellence
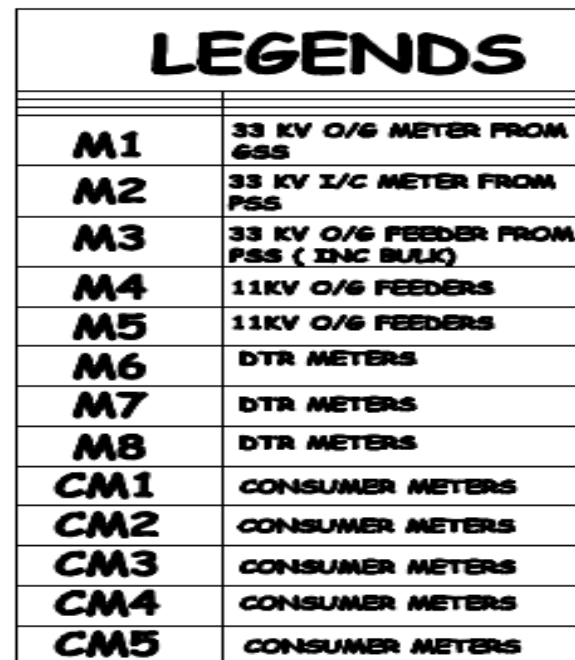
COMPUTATION OF 33 kV LINE LOSS

A House of Engineering Excellence

GRID SUB STATION (GSS)

M1 — 33 KV O/G FEEDER METER FROM GSS

M3 — 33 KV I/C FEEDER AT HT BULK

M2 — 33 KV I/C FEEDER METER TO PSS

33/11 kV PRIMARY SUB-STATION (PSS)
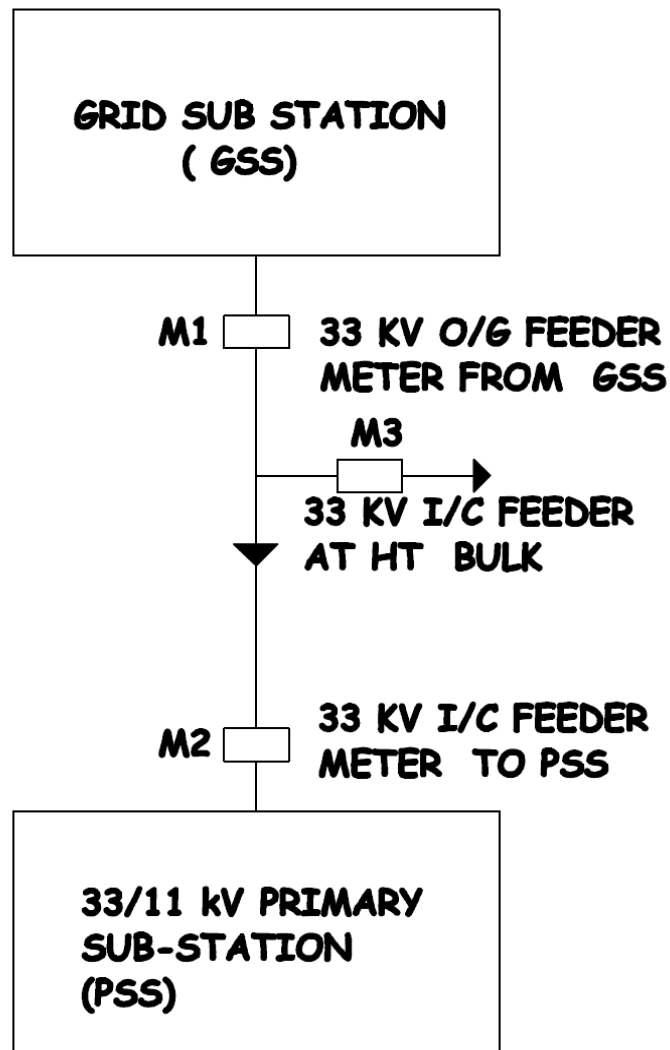
33 kV line loss

= Σ(33 kV O/G Feeder meter reading at GSS (M1))
– Σ((33 kV I/C meter reading at PSS (M2)) +33 kV I/C meter reading at HT Bulk (M3)))

Sl. No	Name of the State	Description (For 4 Selected Circles)		
		33 kV side Input Energy in MU	33 kV Line Loss in MU	% of 33 kV Line Loss w.r.t. 33 kV side Input Energy
1	Madhya Pradesh (33KV)	317.833	6.133	1.930
2	Karnataka(selected circle)	135.226	3.783	2.797
3	Maharashtra(selected Circle)	228.697	4.090	1.788

COMPUTATION OF 33/11 KV PSS LOSS

33 Kv O/G FEEDER FROM PSS

M1 M2

33/11 Kv (PSS)

M3 M4 M5
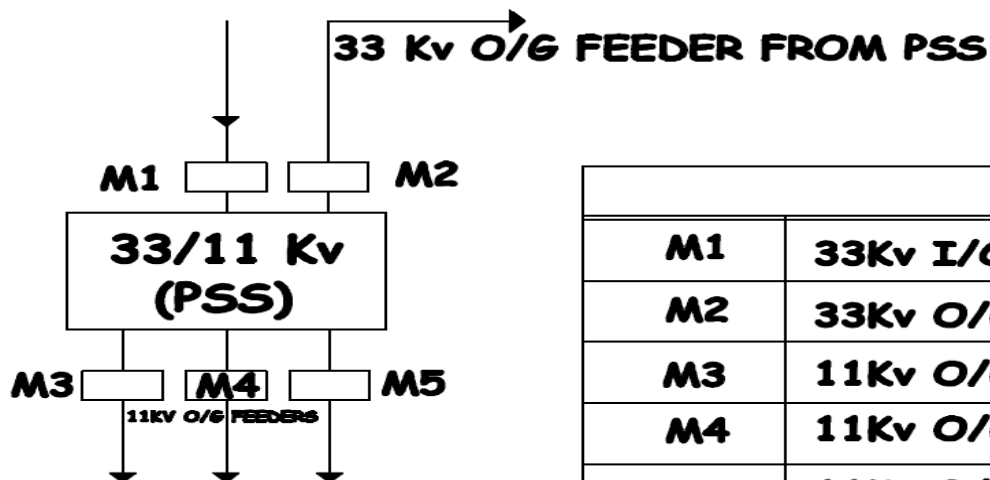
11KV O/G FEEDERS

INDEX	
M1	33Kv I/C FDR METERS TO PSS
M2	33Kv O/G FDR METERS FROM PSS
M3	11Kv O/G FDR METERS FROM PSS
M4	11Kv O/G FDR METERS FROM PSS
M5	11Kv O/G FDR METERS FROM PSS

PSS LOSS

= Σ{(33 KV I/C FEEDER METER READING TO PSS (M1) – 33 KV FEEDER METER READING FROM THAT PSS(M2)) – ΣAll 11 KV O/G FEEDER METERS' READING FROM THAT PSS (M3+M4+M5))

Sl. No	Name of the State	Description (For 4 Selected Circles)		
		33 kV side Input Energy in MU	33/11 KV PSS Loss in MU	% of PSS Loss w.r.t. 33 kV side Input Energy
1	Madhya Pradesh	317.833	2.643	0.832

COMPUTATION OF 11 kV LINE LOSS

33/11 kV PRIMARY
SUB-STATION
(PSS)

M5

M6 M7

DTR 1 DTR 2

11 KV O/G FEEDER -2

DTR 3

M8
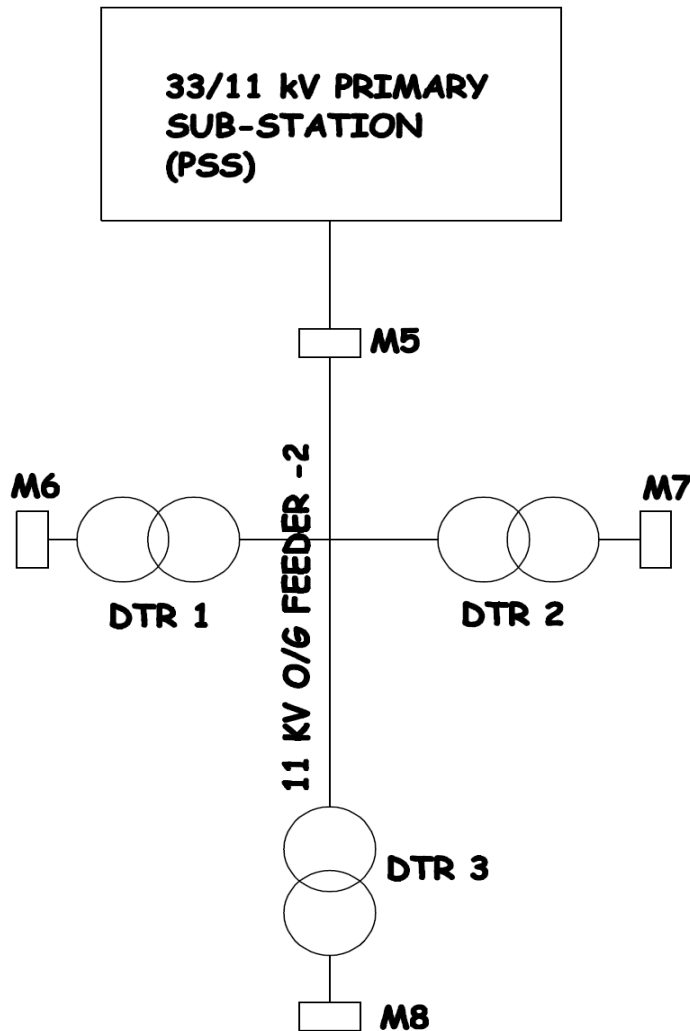
11 kV line loss

= Σ(11 kV O/G Feeder meter reading at PSS (M5)- ΣAll DTRs' meter reading connected to that 11 kV feeder (M6+M7+M8))

Sl. No	Name of the State	Description (For 4 Selected Circles)		
		33/22/11 kV side Input Energy in MU	22/11 kV Line Loss in MU	% of 22/11 kV Line Loss w.r.t. 33/22/11 kV side Input Energy
1	Madhya Pradesh (33KV)	317.833	15.597	4.907
2	Karnataka (11KV)	777.442	39.31	5.056
3	Maharashtra (11KV&22KV)	444.35	19.54	4.40

COMPUTATION OF LT LINE LOSS

33/11 kV PRIMARY
SUB-STATION
(PSS)

DTR 1   DTR 2

DTR 3

M8

CM1   CM2   CM3   CM4   CM5

A House of Engineering Excellence
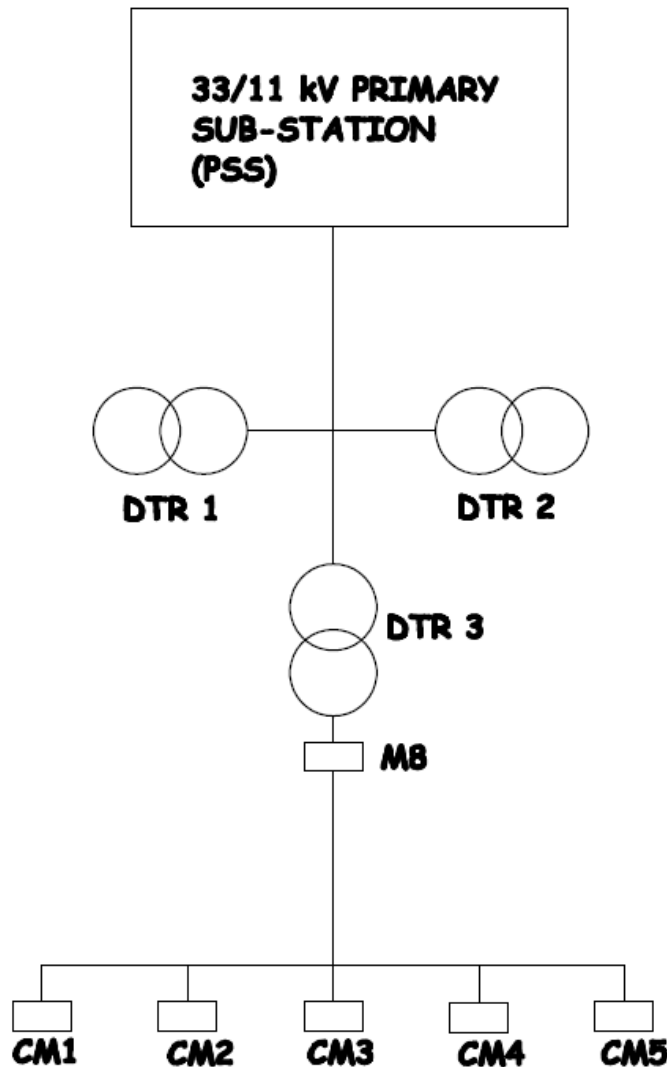
LT line loss

= Σ (11/0.44 KV DTR meter reading (M8)- ΣAll consumers' meter reading connected to that DTR (CM1+CM2+CM3+CM4+CM5))

Sl. No	Name of the State	Description (For 4 Selected Circles)		
		33/11/22 kV side Input Energy in MU	LT Line Loss in MU	% of LTLine Loss w.r.t. 33/22/11 kV side Input Energy
1	Madhya Pradesh (33KV)	317.833	24.289	7.642
2	Karnataka (11 kV)	777.442	51.638	6.64
3	Maharashtra (22 &11 KV)	444.35	25.72	5.79

COMPUTATION OF COMMERCIAL LOSS

A House of Engineering Excellence

- **Commercial Loss may be found out as**

  = {AT&C Loss} – (Technical Loss)

  = {(1 – Billing Efficiency x Collection Efficiency) x 100} – (33kV Line Loss + 11 kV Line Loss + LT Line Loss + PSS Loss)

- **Commercial Loss comprises of the following components :**

  a) Energy Loss due to Unrealized Revenue

  b) Energy Loss due to Defective Meters

  C) Energy Loss due to Unmetered /Average billing Consumers

  d) Energy Loss due to Theft/ Pilferage

COMPUTATION OF LOSS DUE TO UNREALIZED REVENUE

- **Commercial Loss due to Unrealized revenue may be found out as**

  a) Energy billed at a particular circle for a particular time.

  b) Energy collected that particular circle against above mentioned billing.

  C) Unrealized revenue is the difference between Billing and collection.

COMPUTATION OF LOSS DUE TO UNREALIZED REVENUE

MECON LIMITED

A House of Engineering Excellence

Sl. No	Particulars	Unit	Particular month	Description
1	Energy Input	MU	a	33/22/11 kV Level
2	Metered Energy Sales	MU	b	
3	Energy Billed	MU	b	
4	Energy Loss in MU	MU	c = a - b	Energy Input in MU - Energy Billed in MU
5	Revenue Billed	Rs. lac	d	
6	Revenue collected	Rs. lac	e	Against Billed Amount (Without any arrear)
7	Billing Efficiency	%	f= (b/a)*100	Metered Energy in MU / Total energy in MU
8	Collection Efficiency	%	g=(e/d)*100	Revenue collected in Rs. Lakh / Revenue billed in Rs. Lakh
9	% of AT&C Losses	%	h = (1- f*g)*100	[1-(Billing Efficiency x Collection Efficiency)] x100
10	AT&C Loss	MU	i = h*a	[Energy Loss (MU) + Unrealized Revenue MU)] or (Input Energy x AT&C Loss as wrt Input Energy)
11	Unrealized Revenue	MU	j= i-c	AT&C Loss in MU - Energy Loss in MU
12	% of Unrealized Revenue wrt input energy	%	k=(j / a)*100	

COMPUTATION OF LOSS DUE TO UNREALIZED REVENUE

Sl. No	Name of the State	Description (For 4 Selected Circles)		
		33 /11/22 kV side Input Energy in MU	Loss due to Unrealized Revenue in MU	% of Loss due to Unrealized Revenue w.r.t. 33/11/22 kV side Input Energy
1	Madhya Pradesh (33KV)	317.833	21.173	6.662
2	Karnataka (11 kV)	777.442	22.456	2.888
3	Maharashtra (22 &11 KV)	444.35	23.26	5.23

COMPUTATION OF LOSS DUE TO DEFECTIVE METER

A House of Engineering Excellence

- **Commercial Loss due to defective meter may be found out as**

  - a) Found out total no of Defective meter in a Circle from DESCOM.
  - b) Identified sample Defective meter consumer.
  - C) Replacement of defective meter by a new meter.
  - d) Recorded initial & final reading of meter.
  - e) Difference of energy between field study and DESCOM.

COMPUTATION OF LOSS DUE TO DEFECTIVE METER

Sl. No.	Description	Data	Remarks
a	Consumption As per field study	a	
b	As per billing record of the DISCOM	b	
c	**Loss due to Defective meter billing**	**c = a-b**	
d	**% of loss w.r.t billing record of the DISCOM**	**d = (c / b)* 100**	
e	Total no of Consumer	e	Data from DESCOM
f	Total Defective Meter Consumer	f	Data from DESCOM
g	**% of Defective meter w.r.t Total consumer**	**g = (f / e)*100**	
h	Total Billing of Circle in MU	h	Data from DESCOM
j	**Total Billing due to Defective meter in MU (Considering equal % of billing)**	**j =(g*h)/100**	
k	**Total Loss due to Defective meter billing**	**k = (j*d)/100**	
l	**% of loss w.r.t Input Energy**	**l = (k/i)*100**	i= Input energy (33/22/11KV Level)

COMPUTATION OF LOSS DUE TO DEFECTIVE METER

Sl. No	Name of the State	Description (For 4 Selected Circles)		
		33 /11/22 kV side Input Energy in LU	Loss due to Defective meter in LU	% of Loss due to Defective meter w.r.t. 33/11/22 kV side Input Energy
1	Madhya Pradesh (33KV)	317.833	3.981	1.252
2	Karnataka (11 kV)	777.442	0.483	0.062
3	Maharashtra (22 &11 KV)	444.35	1.75	0.39

COMPUTATION OF LOSS DUE TO UNMETERED/AVERAGE BILLING

A House of Engineering Excellence

- **Commercial Loss due to Unmetered/Average billing consumer may be found out as**

  a) Found out total no of Unmetered/Average billing consumer in a Circle from DESCOM.

  b) Identified sample Unmetered/Average billing consumer .

  c) Installed a new meter.

  d) Recorded initial & final reading of meter.

  e) Difference of energy between field study and DESCOM.

COMPUTATION OF LOSS DUE TO UNMETERED/AVERAGE BILLING

A House of Engineering Excellence

Sl.No.	Description	Data	Remarks
a	Consumption As per field study	a	
b	As per billing record of the DISCOM	b	
c	**Loss due to Unmetered/Avg. billing consumer**	**c = a-b**	
d	**% of loss w.r.t billing record of the DISCOM**	**d = (c / b)* 100**	
e	Total no of Consumer	e	Data from DESCOM
f	Total Unmetered/Avg. billing consumer	f	
g	**% of Unmetered/Avg. billing consumer w.r.t Total consumer**	**g = (f / e)*100**	
h	Total Billing in MU	h	Data from DESCOM
j	Total Billing due to Unmetered/Avg. billing consumer in MU (Considering equal % of billing)	**j =(g*h)/100**	
k	**Total Loss due to Unmetered/Avg. billing consumer**	**k = (j*d)/100**	
l	**% of loss w.r.t Input Energy**	**l = (k/i)*100**	i= Input energy (33/22/11KV Level)

COMPUTATION OF LOSS DUE TO UNMETERED/AVERAGE BILLING

A House of Engineering Excellence

Sl. No	Name of the State	Description (For 4 Selected Circles)		
		33 /11/22 kV side Input Energy in MU	Loss due to Unmetered/Average billing consumer in MU	% of Loss due to Unmetered/Average billing consumer w.r.t. 33/11/22 kV side Input Energy
1	Madhya Pradesh (33KV)	317.833	10.742	3.380
2	Karnataka (11 kV)	777.442	15.534	1.998
3	Maharashtra (22 &11 KV)	444.35	0.72	0.162

COMPUTATION OF LOSS DUE TO THEFTING/PILFEREAGE

A House of Engineering Excellence

- **Commercial Loss due to Thefting /Pilferage may be found out as**

  - Loss due to **Thefting /Pilferage** =

  - AT&C loss – (Technical + Commercial Loss)

  - Technical loss = 33KV,22KV,11KV,LT line & PSS loss

- Commercial Loss= Loss due to Unrealized revenue, Defective meter and Unmetered/Avg. billing

MECON LIMITED

COMPUTATION OF LOSS DUE TO THEFTING/PILFEREAGE

Sl. No	Name of the State	Description (For 4 Selected Circles)		
		33 /11/22 kV side Input Energy in MU	Loss due to Thefting/Pilfe rage in MU	% of Loss due to Thefting/Pilferage w.r.t. 33/11/22 kV side Input Energy
1	Madhya Pradesh (33KV)	317.833	23.240	7.312
2	Karnataka (11 kV)	777.442	33.32	4.28
3	Maharashtra (22 &11 KV)	444.35	31.76	7.15

MECON LIMITED

ASSESSMENT OF COMPONENT-WISE AT&C LOSSES FOR MADHYA PRADESH

A House of Engineering Excellence

SL. NO.	NAME OF THE CIRCLE/STATE	FORMULA	33 KV INPUT ENERGY (MU)	% OF TECHNICAL LOSS DUE TO				% OF COMMERCIAL LOSS DUE TO				% OF AT&C LOSS
				33 KV LINE	33/11 KV PSS	11 KV LINE	LT LINE	THEFT/ PILFERAGE	DEFECTIVE METERS	UNMETERED/ AVG. BILLING	UNREALIZED REVENUE	
			(A)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	
A	JABALPUR CITY	COMPUTED DATA	98.946	2.446	0.824	5.070	8.323	3.561	1.723	0.036	5.574	27.558
B	BHOPAL O&M		122.586	1.516	0.686	4.250	6.044	2.277	1.175	3.940	6.538	26.426
C	MORENA		63.106	2.211	1.074	5.293	8.577	25.609	1.284	8.130	6.487	58.666
D	BURHANPUR		33.196	1.384	0.930	6.114	9.737	2.303	0.077	2.248	9.530	32.324
E	SUBTOTAL		317.833	7.557	3.514	20.727	32.681	33.75	4.259	14.354	28.129	
F	MP STATE (MU)		3244.498	245.19	114.01	672.49	1060.33	1095.02	138.18	465.72	912.64	
G	MP % LOSS w.r.t. Input Energy			1.930	0.832	4.907	7.642	7.312	1.252	3.380	6.662	33.917

MECON LIMITED

ASSESSMENT OF COMPONENT-WISE AT&C LOSSES FOR KARNATAKA

A House of Engineering Excellence

Sl. No.	Name of the Circles	Formula	11 kV Input Energy (MU)	Technical Loss (MU)		Commercial Loss (MU)			Unrealized Revenue (MU)	Total Loss	(%) Loss
				11 kV	LT	Theft/ Pilferage	Defective Meters	Unmetered & Others			
A	Bangalore South	Computed Data	423.90	20.26	23.34	8.50	0.20	0.01	11.69	63.990	15.096
B	Hubli		113.809	6.64	10.81	9.268	0.057	3.526	0.265	30.567	26.853
C	Gulbarga		123.305	6.29	10.708	6.817	0.159	7.486	7.674	39.134	31.737
D	Chikkodi		116.428	6.12	6.78	8.739	0.067	4.512	2.827	29.050	24.951
E	Sub-Total (MU)	E = (A+B+C+D)	777.442	39.31	51.638	33.324	0.483	15.534	22.456	162.741	
	Karnataka state(MU)		3655.10	184.814	242.773	156.671	2.271	73.032	105.576	765.118	20.935
G	Karnataka State (%) Loss	w.r.t. Input Energy)		5.06	6.64	4.29	0.06	1.99	2.89		20.94

MECON LIMITED

ASSESSMENT OF COMPONENT-WISE AT&C LOSSES FOR MAHARASHTRA

A House of Engineering Excellence
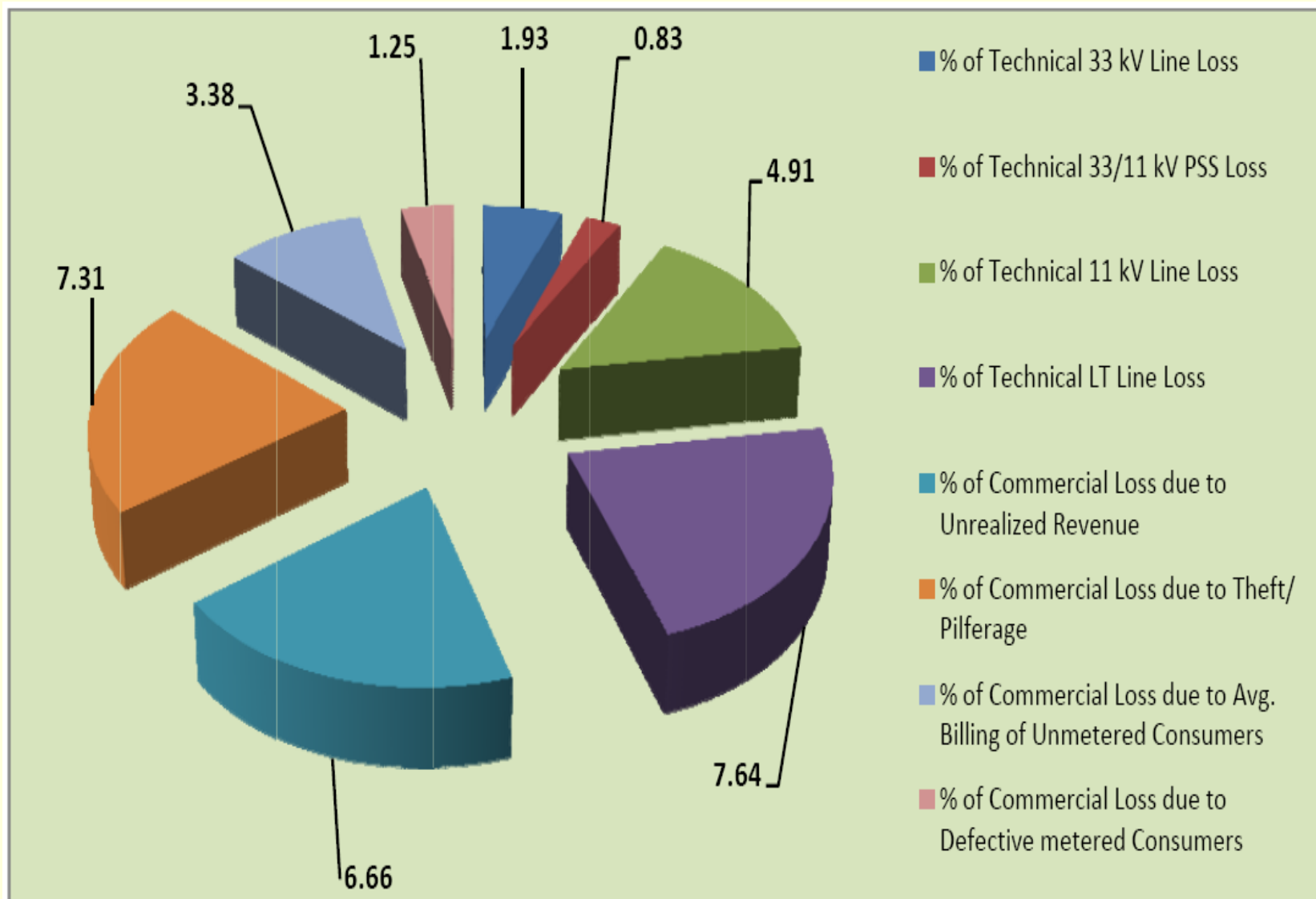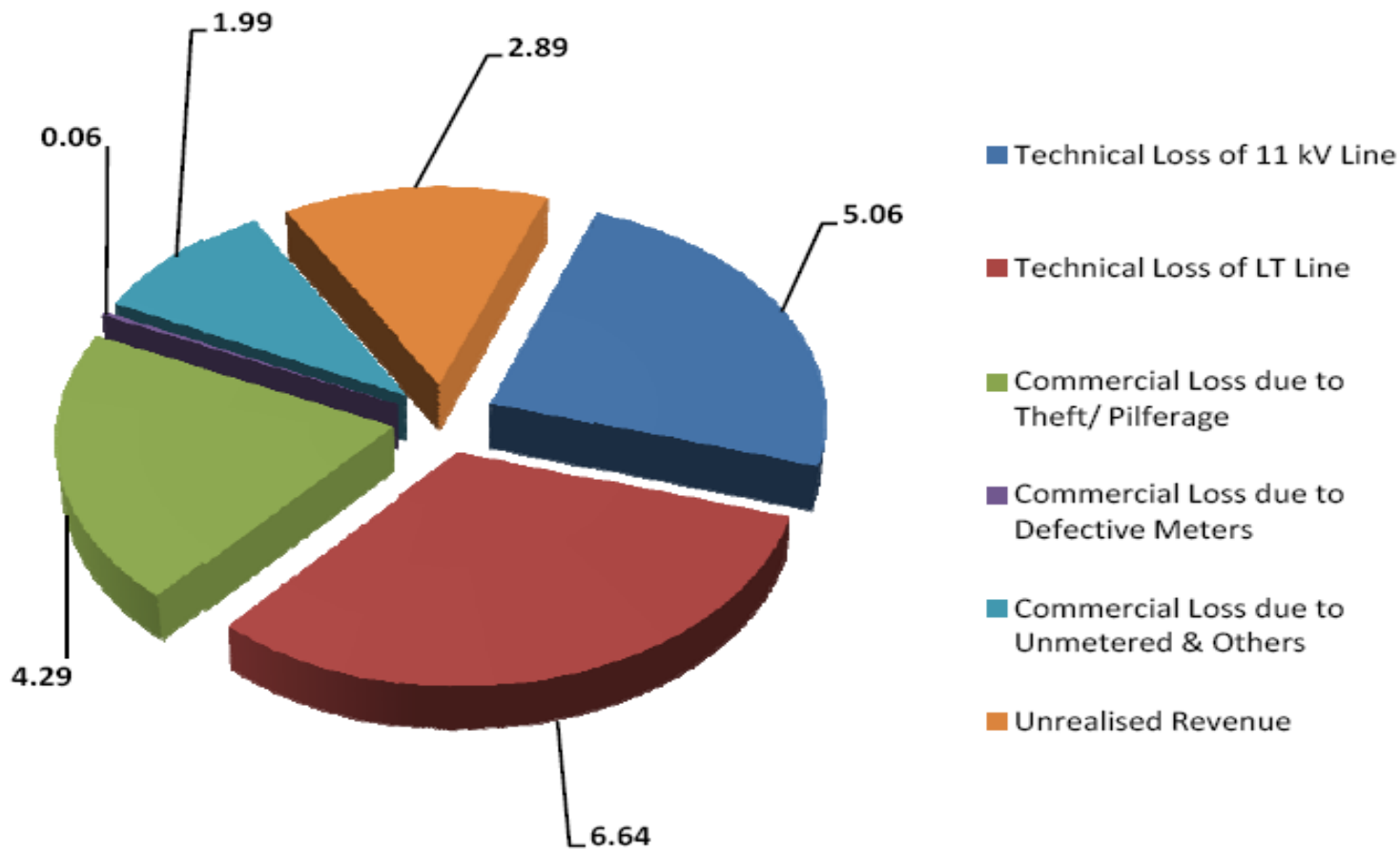
Sl. No.	Name of the Circles	Formula	22/11 kV Input Energy (MU)	Technical Loss (MU)		Commercial Loss (MU)			Unrealized Revenue (MU)	Total Loss	(%) Loss
				HT	LT	Theft/ Pilferage	Defective Meters	Unmetered & Others			
A	Amravati (11kV)	Computed Data	92.00	4.758	5.685	10.912	0.217	N.A	2.305	23.877	25.953
B	Kolhapur (11 kV)	Computed Data	186.907	8.181	10.090	10.629	0.817	0.716	9.882	40.314	21.569
C	Kalyan-II (22 KV)	Computed Data	165.442	6.605	9.253	10.911	0.713	N.A	11.070	38.552	23.302
E	Sub-Total (MU)	E = (A+B+C+D)	444.35	19.54	25.72	31.76	1.75	0.72	23.26	102.74	
	Maharashtra State (MU)		7735.55	340.24	447.75	552.90	30.41	12.46	404.87	1788.62	23.12
G	Maharashtra State (%) Loss	w.r.t. Sl. Input Energy		4.40	5.79	7.15	0.39	0.16	5.23		23.12

% OF COMPONENT-WISE AT&C LOSSES FOR MADHYA PRADESH

A House of Engineering Excellence

1.25   1.93   0.83

3.38

4.91

7.31

7.64

6.66

- ■ % of Technical 33 kV Line Loss
- ■ % of Technical 33/11 kV PSS Loss
- ■ % of Technical 11 kV Line Loss
- ■ % of Technical LT Line Loss
- ■ % of Commercial Loss due to Unrealized Revenue
- ■ % of Commercial Loss due to Theft/Pilferage
- ■ % of Commercial Loss due to Avg. Billing of Unmetered Consumers
- ■ % of Commercial Loss due to Defective metered Consumers

COMPONENT-WISE AT&C LOSSES FOR KARNATAKA

Pie chart legend:
- Technical Loss of 11 kV Line
- Technical Loss of LT Line
- Commercial Loss due to Theft/ Pilferage
- Commercial Loss due to Defective Meters
- Commercial Loss due to Unmetered & Others
- Unrealised Revenue

Values: 1.99, 2.89, 0.06, 5.06, 4.29, 6.64

COMPONENT-WISE AT&C LOSSES FOR MAHARASHTRA

MECON LIMITED

A House of Engineering Excellence

- Technical Loss 11 kV Line
- Technical Loss LT Line
- Commercial Loss Due to Theft /pilferage
- Commercial Loss Due to Defective Meters
- Commercial Loss Due to Unmetered Consumers
- Unrealised Revenue

Values: 0.16, 0.39, 5.23, 7.15, 4.40, 5.79

CONCLUSION

1. FINDINGS

2. CORRECTIVE MEASURES

FINDINGS

Major Components of AT&C Losses of Distribution System for the State of Madhya Pradesh are as follows :

i) Technical Loss components of Distribution System are mainly Low Tension (LT) Line Losses.

ii) Commercial Loss components of Distribution System are due to theft and pilferage of energy and inefficient collection System.

iii) Seasonal variation of load should be considered for more accurate result for assessment of different components of AT& C Loss.

CORRECTIVE MEASURES

There are various considerations and corrective measures suggested to reduce the AT&C losses of the Distribution System. With the implementation of the following corrective measures the Distribution system can become healthy and a profit making centre :

a)   LT Loss reduction can be achieved by considering HVDS and upgradation of existing network.

b)   Theft and pilferage of energy of Distribution System can be reduced by introducing insulating conductors i.e.; Aerial Bunched conductor and increasing the regular vigilance activities.

c)   Utility should conduct Energy Accounting & Audit to be carried out on regular basis for accurate measurement of the Component-wise AT&C Losses of the Distribution System.

MECON LIMITED

A House of Engineering Excellence

Thank You !