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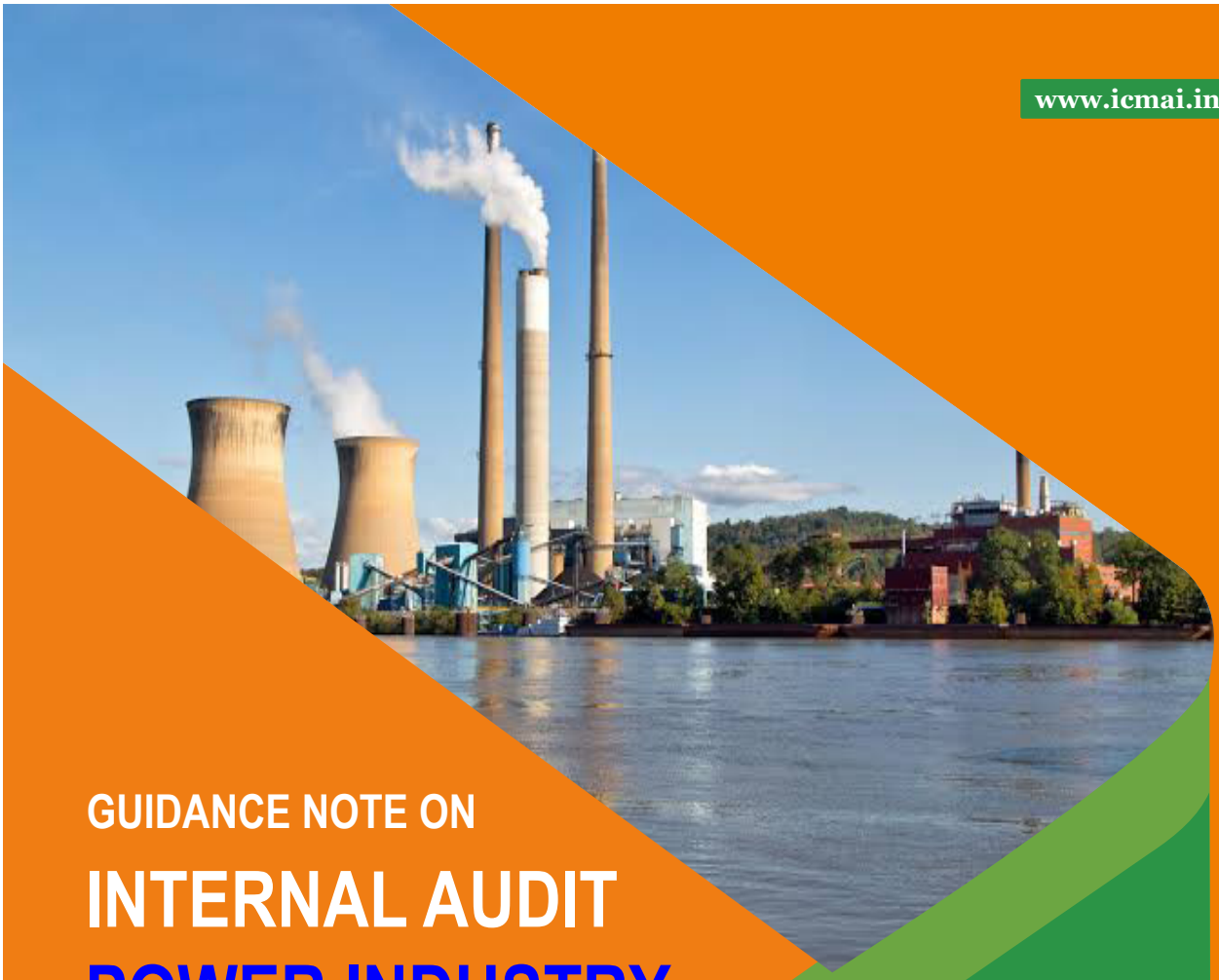

GUIDANCE NOTE ON

INTERNAL AUDIT
POWER INDUSTRY

INTERNAL AUDITING & ASSURANCE STANDARDS BOARD

THE INSTITUTE OF COST ACCOUNTANTS OF INDIA

Statutory Body under an Act of Parliament

Headquarters: CMA Bhawan, 12 Sudder Street, Kolkata - 700016
Delhi Office: CMA Bhawan, 3 Institutional Area, Lodhi Road, New Delhi - 110003

GUIDANCE NOTE ON INTERNAL AUDIT OF POWER INDUSTRY

The Institute of Cost Accountants of India

(Statutory Body under an Act of Parliament)

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THE INSTITUTE OF COST ACCOUNTANTS OF INDIA
Statutory Body under an Act of Parliament
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Behind every successful business decision, there is always a CMA

MISSION STATEMENT

"The CMA Professionals would ethically drive enterprises globally by creang value to stakeholders in the socio-economic context through competencies drawn from the integraon of strategy, management and accounng."

VISION STATEMENT

"The Instute of Cost Accountants of India would be the preferred source of resources and professionals for the financial leadership of enterprises globally."

ABOUT THE INSTITUTE

The Institute of Cost Accountants of India is a Statutory body set up under an Act of Parliament in the year 1959. The Institute as a part of its obligation, regulates the profession of Cost and Management Accountancy, enrols students for its courses, provides coaching facilities to the students, organises professional development programmes for the members and undertakes research programmes in the field of Cost and Management Accountancy. The Institute pursues the vision of cost competitiveness, cost management, efficient use of resources and structured approach to cost accounting as the key drivers of the profession. In today's world, the profession of conventional accounting and auditing has taken a back seat and cost and management accountants are increasingly contributing towards the management of scarce resources and apply strategic decisions. This has opened up further scope and tremendous opportunities for cost accountants in India and abroad.

After an amendment passed by the Parliament of India, the Institute is now renamed as ''The Institute of Cost Accountants of India'' from ''The Institute of Cost and Works Accountants of India''. This step is aimed towards synergising with the global management accounting bodies, sharing the best practices which will be useful to large number of trans-national Indian companies operating from India and abroad to remain competitive. With the current emphasis on management of resources, the specialized knowledge of evaluating operating efficiency and strategic management the professionals are known as ''Cost and Management Accountants (CMAs)''. The Institute is the 2nd largest Cost & Management Accounting body in the world and the largest in Asia, having approximately 5,00,000 students and 85,000 members all over the globe. The Institution headquartered at Kolkata operates through four Regional Councils at Kolkata, Delhi, Mumbai and Chennai and 108 Chapters situated at important cities in the country as well as 11 Overseas Centres. It is under the administrative control of Ministry of Corporate Affairs, Government of India, New Delhi.

Internal Auditing and Assurance Standards Board (IAASB)

The Institute & eminent resource persons from our profession have felt the need for the constitution of board for Internal Audit. The Present Council for the first time has nurtured the Board to formulate and issue standards, guidelines and advisory for the Internal Audit Function. The Cost Accountants have been recognized by the Companies Act, 2013 and other regulatory bodies for appointment as Internal Auditors.

First Edition: July 2015

First Edition: October 2021

DISCLAIMER:

The views expressed in this publication are those of author(s) which have been reviewed by the Internal Auditing & Assurance Standards Board of the Institute of Cost Accountants of India after taking into account the suggestions, opinions and comments of members and non-members of Institute.

Published by:

Internal Auditing & Assurance Standards Board
The Institute of Cost Accountants of India
12, Sudder Street, Kolkata - 700 016

FOREWORD OF PRESIDENT

It is our great pleasure to announce the formation of the **Internal Auditing & Assurance Standard Board (IAASB)** by the **Council of the Institute for the block year 2019-2023,** taking into consideration the Statutory Provision of the Companies Act, 2013 wherein the Cost Accountants along with other professionals have been considered for taking up the assignment of Internal Audit. As per **Section 138 (1) of the Companies Act, 2013,** such class or classes of companies, as may be prescribed, shall be **required to appoint an internal auditor**, who shall either be a Chartered Accountant or **a Cost Accountant**, or such other professional as may be decided by the Board, to conduct internal audit of the functions and activities of the company. Keeping this in mind and in line with the regulatory recognition of practicing Cost Accountants under section 138 (1) of Companies Act 2013 to be appointed as Internal Auditors, the present Council for the first time as a hall mark in the history of the Institute, has constituted the Board to formulate and issue standards, guidance notes, guidelines and advisory for the Internal Audit activities.

This Guidance Note focuses on **Internal Audit of the Power Industry**. It also provides an insight into the general framework of Internal Audit mechanism vis-à-vis sector specific issues which are prevalent in Cement Industry.

On behalf of the Institute, I do acknowledge the sincere and persistent effort of **CMA T.K. Jaganathan**, a Practicing Member of the Institute who has been entrusted for preparation of this Guidance Note as an author and also extending sincere gratitude to **CMA B.B.Gupta**, Member of IAASB for his enormous support and guidance as reviewer nominated by IAASB.

I am thankful to CMA P.Raju Iyer, Vice-President of the Institute and Chairman of the Internal Audit Assurance & Standards Board (IAASB) for their relentless support without which, the formation and smooth functioning of the Board would have proved to be difficult.

I am quite sure that the readers of Guidance Note will find it very useful in their professional life and will be benefitted to enrich their knowledge in the field of Internal Audit.

CMA Biswarup Basu

President

Date: New Delhi, 10th October, 2021.

FOREWORD OF VICE- PRESIDENT

It gives me immense pleasure to take this opportunity to present the Guidance Notes on **Internal Audit of Power Industry** prepared by "The Internal Auditing and Assurance Standards Board (IAASB)" on behalf of the **Council of the Institute for the block year 2019-2023. I do also extend my personal gratitude to the Council for formation of Internal Auditing & Assurance Standard Board (IAASB),** taking into consideration the Statutory Provision of the Companies Act, 2013 wherein the Cost Accountants along with other professionals have been considered for taking up the assignment of Internal Audit.

The present Council has felt it necessary to constitute this Board to provide an opportunity to the members of the Institute to further their skills and knowledge in the field of Internal Audit by way of imparting specific training and providing guidance notes and standards for serving the industry in both the Manufacturing as well as the Service Sector.

I am of the considered view that this Guidance Note would go a long way in strengthening and updating the professional expertise of Cost Accounting Professionals and all other stakeholders in the field of Internal Audit in delivering a far greater role and responsibilities in the years to come.

On behalf of the Institute, I sincerely thanked **CMA T.K.Jaganathan**, a Practicing Member of the Institute who has been entrusted for preparation of this Guidance Note as an author and also extending my sincere gratitude to **CMA B.B.Gupta**, Member of IAASB for his enormous support and guidance as reviewer for imparting their expert knowledge in the field of Internal Audit for finalization of this guidance note.

I am happy to be associated with board as a member and would like to extend my sincere thanks to the President of the Institute, Council Members and the members of the Internal Audit Assurance & Standards Board (IAASB) for their relentless support & effort without which, the Board would not be able to achieve its desired goals and objectives.

I wish all the success of the Board in its future endeavor.

CMA P.Raju Iyer

Vice President

Place & Date: New Delhi, 10th October, 2021.

FOREWORD OF THE CHAIRMAN

The Council of the Institute, under the able guidance and leadership of CMA Balwinder Singh, Past President had constituted the **Internal Audit Standards Board (IAASB)** in the year 2019. This was a historic decision to **promote the role of Cost & Management Accountants in the domain area of internal audit**. The objectives and functions of the Board include development & issue of standards, guidance notes, implementation guides, technical guides, practice manuals, information papers and case studies etc. and to undertake their revision, where ever necessary.

The requirement of IAASB was the need of the hour considering the inclusion of "Cost Accountants" in the scope of Internal Audit as per provisions of Companies Act, 2013 and other legislations in force.

As the business activities and operations are undergoing continuous changes, auditing today, is not confined only to verification of documents and financial transactions but may also be suitably aligned with the developments in Artificial Intelligence and data mining. To assess the organization's performance, and to ensure the overall quality, credibility, consistency and comparability of the work performed by the Internal Auditors, it is necessary to follow the prescribed standards, policies, rules, and regulations covering various sectors.

To support & enable the Cost Accountants to qualitatively perform internal audit assignments, the Board felt the need for the preparation and development of Guidance Notes on Internal Audit for General requirement as well as for specific Industry /Service Sectors.

Considering the same, the board took up the assignment of preparation of **Internal Audit Guidance Note of Power Industry** along with other Guidance Notes on Inter Audit which will be published very soon.

On behalf of the Institute as a Council Member and as a Chairman of IAASB, I sincerely thanked **CMA T.K.Jaganathan**, a Practicing Member of the Institute who has dedicated his professional knowledge and expertise in preparing this Guidance Note as an author and also extending my sincere gratitude to **CMA B.B.Gupta**, Member of IAASB for his enormous support, guidance and expertise as reviewer for finalization of this guidance note. I do also acknowledge and appreciate the support, expertise and guidance of all the members of the board for preparation and finalization of this guidance note.

I am sure that our members would find this Guidance Note as a very useful document for enriching their knowledge in Cement Industry and in furtherance to establish a lucrative career in Internal Auditing to tap the fullest potential of Internal Auditing and Assurance services.

CMA P.Raju Iyer

Chairman of IAASB

Place & Date: New Delhi, 10th October, 2021.

CONTENT

Internal Audit 1

This Chapter includes:

INTRODUCTION

India is the world's third largest producer and consumer of electricity. The national electric grid in India has an installed capacity of 370.106 GWs of 31st March 2020. Renewable power plants, which also include large hydroelectric plants, constitute 35.86% of India's total installed capacity.

India has abundant sources of power production such as thermal power, hydra, wind, solar, nuclear, biomass and industrial waste etc. Internal auditor has to understand the dynamics in the industry to analyze the business objectives of the entity and the strategies adapted by the entity to achieve those objectives and therefore needs to have a very good overall view of the dynamics of the industry. Power sector in its own have same peculiarity with respect to Power Generation, Power Transmission and Distribution of Electricity and accordingly the internal audit need special attention to these peculiarities. The Internal Auditor is also to understand specific nature of various production / utility / service units, their input output norms. Consumption norms including auxiliary power consumption, losses / wastages in each process / unit, efficiency norms, comparison and variations observed and then draw his conclusions.

1.1 OBJECTIVES OF THIS GUIDANCE NOTE

- To create understanding about Power industry
- To create understanding onprocess of electric energygeneration, transmission and distribution
- To update on recent changes in power industry
- To facilitate to conduct internal audit in an efficient manner
- To establish objectivity of approach towards consistency in audit
- To facilitate an easy approach of internal audit function of the industry

- To develop and monitor control frameworks of the industry
- To support corporate governance of power industry

1.2 SCOPE OF THE GUIDANCE NOTE

This guidance note provides the specific guidance with regard to internal audit of electric power generating, transmission and distribution companies. It also provides the guidelines and check list for the internal auditor while auditingoperation and financial areas including specific issues which are peculiar to power industry. Internal auditor should also refer the following documents while undertaking the audit:

1.3 REFERRAL DOCUMENTS

- Memorandum of Association, Articles of Association, AGM /EGM Resolutions and Board Minutes
- Organization Chart, Standard Operating Procedures, Delegation of Authority Manual, Accounts Manual, Costing Manual, Procurement Manual, Stores Manual, HR Rules, PFR, DFR, PWD Account code, etc.
- ICAI Internal Audit Guidance Note and Guidance Note on Risk Based Internal Audit
- Purchase & Works regulation, Delegation of Power and instructions and guideline of the Organisation
- Guidelines/norms for operational performance issued by organisation/ CEA/CERC/ State Regulator/ Industry norms
- General Terms and Conditions of NIT/ contract (Purchase Order/Work Order)
- Agreements executed with coal companies (FSA), railways (Tripartite Agreement), transport agency and other contractors/agents
- National Tariff Policy and Power Purchase Agreement (PPAs)
- Provisions of Companies Act/ SEBI/ Electricity Act, 2013 and other relevant statute
- Provisions/ instructions of Environment and Pollution Control Board
- Provisions of Energy Conservation Act, 2001 relating to Energy audit
- Chart of Account,AccountingPolicyand Cost Accounting Policy of the corporation
- Indian Accounting Standards, and Auditing Standards
- Statutory Audit Reports, Secretarial Audit Reports, Cost Audit Report, &Tax Audit Report
- Physical Verification Reports

Concept of Internal Audit is a dynamic one. It is experience gaining and applying the same in subsequent Audits and it should never be routine exercise. Effective Internal Audit function helps in reducing the likelihood of undesirable events through evaluation and enhancement of organisations internal controls.

Overview of Internal Audit 2

This Chapter includes:

2.1 DEFINITION OF INTERNAL AUDIT

The examination, monitoring and analysis of activities related to a company's operation, including its business structure, employee behaviour and information systems is called internal audit.

The Institute of Internal Auditors (IIA), defines internal audit as, 'Internal audit is an independent, objective assurance and consulting activity designed to add value and improve an organization's operations. It helps an organization accomplish its objectives by bringing a systematic, disciplined approach to evaluate and improve the effectiveness of risk management, control, and governance processes.

2.2 INTERNAL AUDIT OBJECTIVES

The broad objectives of Internal Audit shall be as under:

a. To review the efficacy, adequacy and application of accounting, financial and operating controls and to ensure accuracy of the books;

b. To verify that the system of internal check is effective in design and operation in order to ensure the prevention and early detection of defalcations, frauds, misappropriations and misapplications;

c. To identify areas of significant inefficiencies in existing systems and to suggest necessary remedial measures;

d. To confirm the existence of financial propriety in decisions taken and verify compliance to government and statutory requirements;

e. To review the performance of various functions in the light of performance budgeting and to suggest cost reduction measures, if any;

f. To associate with executive engineer / HoDs in undertaking surprise checks and inspections in one of their visits to the project / unit, whenever asked for.

g. To ascertain whether;

- An effective and efficient inventory management existed to ensure that inventory of stores, spares was within prescribed limits;
- Contractual obligation of the contractors/ vendors were adequate and satisfactorily met;
- Installed capacity of the generating units was optimally utilized as per norms fixed by Central Electricity Authority (CEA)/Central Electricity Regulatory Commission (CERC) /State Electricity Regulatory Commission; andtransport facility is being utilised prudently and economically as per norms.

2.3 SCOPE OF INTERNAL AUDIT IN POWER SECTOR

Internal audit shall be broad-based and will cover all the functions. Suggestive list of functions/areas to be covered (as applicable to each accounting unit) is given hereunder:

- *Functional Areas*
  - (i) Contract Management (Procurement of Material and Services)
  - (ii) Store Department
  - (iii) Finance, Accounts & Treasury
  - (iv) Corporate & Administration
  - (v) HRD and Personnel Department
  - (vi) IT & Cyber Security
  - (vii) Transportation
- *Management Areas*
  - (i) Good corporate governance
  - (ii) Efficiency improvement
  - (iii) Cost control/ reduction & Cost competitiveness

(iv) Value creation

(v) Resource utilization

(vi) Strategic planning

(vii) Risk management, etc.

- *Operational Review*
- *Other Significant areas and statutory compliances*

(i) Compliance with applicable Accounting Standards

(ii) Impairment of Financial & Non-Financial Assets

(iii) Financial & Commodity Derivatives

(iv) Related Party Transactions

(v) Accounting for Interests in Joint Ventures and Segment reporting

(vi) Accounting for Production Costs / Conversion Cost

- *Cost Audit*

2.4 INTERNAL AUDIT SAMPLING AND EXTENT OF CHECKING

Internal Audit Sampling

- Audit sampling is application of audit procedures to less than 100% of items within a population of audit relevance such that all sampling units have a chance of selection in order to provide the auditor with a reasonable basis on which to draw conclusions about the entire population.
- The use of sampling in auditing is widely adopted as it facilitates the auditors to obtain minimum amount of evidence to perform maximum level of audit. In selecting sample auditor must exercise utmost care as selection wrong sample leads to drawing wrong conclusion about the entire audit work. The audit team can follow either statistical sampling or non-statistical sampling or combination of both based on size of the business and the extent of complexity involved. Statistical sampling uses theory of probability on the other hand non-statistical sampling largely depends on auditors' experience and judgemental capacity.

Extent of Checking

The extent of check to be exercised in each area to be covered by internal audit shall be as per the terms of appointment of internal audit or keeping in view the materiality concept and the volume of work involved at the particular auditee. Auditor should give disclosure in its audit report about the coverage of audit and extent of checking. A standard coverage considered as extent of checking can be as under:

Sl. No.	Area	Coverage in each phase
I*	**WORKS INCL. O&M CONTRACTS**	
	a. Contracts with value more than ₹ 20 Lakh	100%
	b. Contracts with value ₹ 20 Lakh or less	50%
II*	**PROCUREMENT**	
	i) P.Os with value more than ₹ 20 Lakh	100%
	ii) P.Os with value ₹ 20 Lakh or less	50%
III	**BOOKS OF ACCOUNTS & BANK TRANSACTIONS**	
	i) Bank Payment Documents (for 3 complete months)	50%
	ii) Documents for Bank Receipt	100%
	iii) Documents for Adjustments	100%
	iv) Review of Bank Reconciliation Statements (BRS)	100%
IV	**ESTABLISHMENT –ACCOUNTS**	
	i) Checking of Off-Cycle Bank payments w.r.t rules and proprietary aspects (for 3 complete months other than those covered in III (i) above)	50%
	ii) Review of Employee Accounts	100%
V	**ESTABLISHMENT – HUMAN RESOURCES**	
	i) Leave Records	100%
	ii) LTC Records	50%
	iii) Documentation for Advances	50%
	iv) Ticket Booking	50%
	v) Training activities	20%
VI	**STORES**	
	i) Documentation and procedures	2 Months
	ii) Review of claims	100%
	iii) Accounting and Review of Suppliers' Accounts	100%
	iv) Review of Returnable Gate-Pass system	100%
	v) Checking suppliers' bills w.r.t policies & circulars	50%
VII	**COLONY, GUEST HOUSE AND DISPENSARY**	
	i) Proprietary Aspects	100%
	ii) Accounts	100%

Sl. No.	Area	Coverage in each phase
VIII	**AUDIT OF OPERATIONS**	
	i) Fuel Accounting records	100%
	ii) Verification of Fuel Price Adjustment	100%
	iii) Review of Monthly Operating Results	100%
IX	**INVOICING & DEBTORS FOR THE SALE OF ENERGY**	100%
X	**TAXATION AND STATUTORY COMPLIANCES**	100%
XI	**LOANS**	
	i) Domestic Loans	Test Check
	ii) Foreign Loans	100%
XII	**BONDS & DEBENTURES**	Test Check

* Auditors shall obtain from Auditee units and provide a list of all contracts entered into by the respective units with reference to LOA (PO/WO) numbers, award values and type of tender etc., highlighting those awards that have been examined by them. In this process, it is obligatory to ensure that at least 10% of the contracts awarded on nomination basis to PSUs & Govt. Depts. (Including Agencies / Bodies / Institutions, etc.) are covered. Auditors shall also give a certificate in respect of the same. For this purpose, Single Tender awards placed without calling for tenders should be considered as awards made on nomination basis.

The above list of areas is illustrative and not exhaustive which should be added or deleted by the internal auditor considering the materiality concept and the functioning areas of the particular organization.

2.5 METHODOLOGY OF AUDIT

The methodology adopted for attaining the audit objectives consist of scrutiny of records, interaction with auditee personnel, analysis of data, availability of suo-moto information, raising audit queries and discussion of audit findings with the Management.

Detailed plan must be made onhow to conduct audit and focusing on risk areas. For this purpose, the internal audit team must categorize the audit areas into low risk, moderate risk and high risk and accordingly team must be allocated with concurrent communication among the team members.

2.6 INTERNAL AUDIT PLANNING

Well planned audit is half-done. So planning is very important to complete the audit within time limit and with use of optimum resources with quality reporting. The audit plan should

flexible enough to take care of any unforeseen events and any additional auditing-in-depth activities to be done. A well-drawn audit plan in discussion with the team members will help in covering all the areas given in the audit scope, devote proper time and thought on the given assignment. It also helps in completing the audit assignment in a cost-effective manner. The entire audit work involves 4 stages i.e., (1) Planning (2) Execution (3) Reporting and (4) Tracking (Follow-up). The PERT model.

At the Planning Stage:

a. Understand the objectives of the Internal Audit Assignment

b. Understand the scope of assignment from the engagement letter

c. Understand the team required whether any cross-functional required

d. Understand the recent developments of the Statues applicable

e. Understand the recent development in the industry and technology

f. Understand the Business Processes

g. Understand the overview of the Internal Control System

h. Conduct an initial meeting with stakeholders

2.7 INTERNAL AUDIT EVIDENCE

Audit evidence helps the auditors to form a strong opinion of the control system and acts as a proof of the transaction performed. Evidence can be formal or informal, written or verbal. Evidence should be sufficient, reliable, relevant and from a right source. Types of audit evidence are: -

(1) Physical examination which means physical examining of a workplace, inventory asset etc., the auditor would like to see or seen.

(2) Documentation is the verifying documents such as sales invoice, purchase invoice, journal voucher, bank statement etc.

(3) Analytical Procedures acts as corroborative evidence and helps in forming an opinion and deciding whether an area of operation or function requires auditing in depth or not. Analytics sometimes also helps in judging the internal control system.

(4) Confirmations are mostly obtained from third parties such as banks, insurance agencies vendors or customers to establish the authenticity of the transactions

(5) Observations and

(6) Enquiries are another way collecting information from employees, management third parties etc. depending on the seriousness of the transactions and risk involved.

2.8 INTERNAL AUDIT ANALYTICAL PROCEDURES

Analytical procedures are evaluation of financial and non-financial, qualitative, and quantitative information to establish a relation between business processes, transactions. These are used to assess the risk, to conduct effective tests, to understand the efficacy or otherwise of the internal control system. In the modern-day audit big data and data analytics pay vital role performing analytical procedures. With the automated statistical calculations, data can be uploaded to the application and the system given results drive the conclusion.

2.9 INTERNAL AUDIT DOCUMENTATION

Audit documentation is the record of audit program, planning evidence collected, methodology followed, analysis made conclusions drawn, reply received on draft report etc. The documentation can be electronic or physical. Electronic documentation eases the work of documentation, faster communication and quicker access. Documentation can be divided into master documents and transactional documents Review of following key documents and reports will be helpful to decide scope of internal audit.

2.10 INTERNAL AUDIT REPORT CONTENTS AND FOLLOW-UP

(i) *Executive Summary* - Provide a summary of the audit assignment preferably not exceeding two pages however depending on the size of the organization.

(ii) *Audit Scope and extent of audit checking* - Clearly elaborate the audit scope, this a key to understand the areas of audit covered and extent of audit checking.

(iii) *Audit background* -Describe the background of the assignment whether routine audit or special assignment or any reason for conducting the audit.

(iv) *Audit Methodology* - Clearly explain the methodology of the audit conducted, viz. tools used, samples drawn, interactions made with officials etc.

(v) *Summary of Audit observations* - Provide a summary of audit observations of each area preferably dividing into observations of operational areas, functional areas, taxation, compliances etc., in the following format.

Sl. no.	Observation in brief	Details of observation	Response from Auditee

(vi) *Limitations* - Describe any limitations during the audit.

(vii) *Details of audit observations as Annexures* - Provide transaction-wise list of instances preferably in the form of annexure substantiating the observations mentioned.

(viii) *Recommendations for Improvement* - Based on the information and explanations received, provide recommendations for improvements in the operational areas, processes.

(ix) *Financial Impact* - Based on the above, quantify the impact in financial terms if possible and report the same in this part.

(x) *Risk grading and Dashboard* - As far as possible, understand the risks and grade them in High, Medium, and Low with color codes Red, Orange and Green respectively.

(xi) *Conclusion* - Give conclusive remarks in this section.

(xii) *Action taken report* - Please note the actions taken on the observations made in the earlier reports and their adequacy or otherwise.

Glossory of Terms in Power Industry 3

This Chapter includes:

Glossory of Terms in Power Industry

GLOSSORY OF TERMS IN POWER INDUSTRY

"Act" means the Electricity Act, 2003 (36 of 2003) as amended from time to time.

"Additional capitalization" means the capital expenditure actually incurred or projected to be incurred after the date of commercial operation of the project and admitted by the Commission after prudence check.

"ARR" means Aggregate Revenue Requirement.

"AUX"- Auxiliary energy/ power consumption in relation to a period means the quantum of energy consumed by auxiliary equipment of the generating unit / plant and transformer losses within the generating unit / plant, expressed as a percentage of the sum of gross energy generated at the generator terminals of the generating unit / all the units of the generating plant.

Auxiliary equipment: Accessory equipment necessary for the operation of a generating station. This would include fans, pumps, mills, conveyors, crushers, pipes, feeders, etc.

"Availability" in relation to transmission system for a given period means the time in hours during that period the transmission system is capable to transmit electricity at its rated voltage and shall be expressed in percentage of total hours in the given period and calculated as per the CERC formula specified in the regulations.

"Beneficiary" in relation to a

(a) '**Generating plant'**means the person buying power generated at such a generating plant.

(b) **'Transmission system'**means the person who has availed of the under these regulations. This includes a distribution licensee, a transmission licensee, a person who has setup a captive power plant or a generating company including merchant power plant or a consumer availing long-term or medium-term open access utilizing such transmission system. Short-term open access consumers will not be treated as beneficiaries;

(c) **'SLDC'**means the person who uses the services of SLDC and shall include distribution licensee, transmission licensee, a person who has set up captive power plant or a

generating company including merchant power plant or a consumer availing long-term or medium-term open access.

"CERC"- Central Electricity Regulatory Commission.

CV (Calorific Value) of Fuel: It indicates the amount of heat released with the burning of coal. The Calorific Value varies on the geographical age, formation, ranking and location of the coal mines. It is expressed as Kj / Kg or Kcal / Kg. Coal contains moisture. When coal burns the moisture in coal evaporates taking away some heat of combustion which is not available for our use. When we say Gross Calorific Value or Higher Heating Value, it is the total heat released when burning the coal. When we say Net Calorific Value or Lower Heating Value it is the heat energy available after reducing the loss due to moisture.The Heating Value determines how much fuel is required in the power plant. Higher the Calorific Value lesser the amount of the coal required per unit of Electricity. Higher Calorific value also means the cost of the coal is higher but is offset by the lower cost of logistics, storage and ash disposal.

"Collection efficiency" means the ratio of total revenue realized to the total revenue billed during the same financial year. The revenue realization from arrears pertaining to the same financial year shall be included but revenue realization from late payment surcharge and arrears pertaining to the previous years shall not be included for computation of collection efficiency.

"Commission" means the Regulatory Commission.

"Cut-off date" means 31st March of the year closing after two years of the year of commercial operation of the project, and in case the project is declared under commercial operation in the last quarter of a year, the cut-off date shall be 31st March of the year closing after three years of the year of commercial operation.

"COD" - Date of commercial operation means

(a) In relation to a generating unit, the date declared by the generating company after demonstrating the maximum continuous rating (MCR) or Installed Capacity (IC) through a successful trial run after notice to the beneficiaries,

(b) In relation to the generating plant, the date of commercial operation of the last unit or block of the generating plant;

(c) in relation of transmission system, the date of charging the transmission system or part thereof to its rated voltage level or seven days after the date on which it is declared ready for charging by the transmission licensee, but is not able to charge for reasons not attributable to the transmission licensee, its suppliers or contractors.

Contracted demand or Contracted Maximum Demand means the maximum demand the consumer intends to put on the system as described in the supply agreement between the parties.

Connected Loadmeans the aggregate of the manufacturer's rating of all the apparatus including portable apparatus on the consumers' premises which is supplied with energy at the same rate. This shall be expressed in KW or H.P. If the ratings are in KVA the same should be converted to KW by multiplying the KVA with a power factor of 0.90. If some or any of the apparatus is rated by manufacturers in HP, the HP ratings shall be converted into KW by multiplying it by0.746.

Demand Factor: It is defined as the ratio of the actual maximum demand by load to the total connected load.

$$\text{Demand Factor} = \frac{\text{Maximum demand}}{\text{Connected Load}}$$

"DC"- Declared capacitymeans the capability of generating plant to deliver ex-bus electricity in MW declared by such generating plant in relation to any time-block of the day or whole of the day, duly taking into account the availability of fuel.

Distribution Loss refer to the losses that occur in transmission between the sources of supply and points of distribution.

Energy Charts: Quantity of Electricity consumed per month shall be worked out as under:

One Shift: MD in KW x 8 hours x No. of working days between 25 and 30

Two Shifts: MD in KW x 16 hours x No. of working days between 25 and 30

Three Shifts: MD in KW x 24 hours x No. of working days between 25 and30

FSA means Fuel Supply Agreement.

FPA means Fuel Price Adjustment. It is the differential value of the fuel cost approved by the Commission in the tariff order for the respective period and the actual value of the fuel cost of allowable fuel quantity.

Firm Power: Firm power is the power intended to be always available evenunder emergency conditions.

"FOR" - Forced Outages Rate: It is the ratio of megawatt hours under forced shutdown in the reference period to the total megawatt hours that the power plant is capable of generating at full load during the entire period under reference.

Generation: This term refers to the act or process of transforming the form of energy into electric energy or to the amount of electric energy so produced, expressed in Kilowatt hours.

"GCV" - Gross calorific valuein relation to a thermal power generating plant means the heat produced in kCal by complete combustion of one kilogram of solid fuel or one liter of liquid fuel or one standard cubic meter of gaseous fuel, as the case may be.

"SHR" - Station heat ratemeans the heat energy input in kCal required to generate one kWh of electrical energy at generator terminals.

"Infirm power" means electricity injected into the grid prior to the Scheduled COD or the date of commercial operation of a unit or block of a generating plant whichever is earlier.

"IC" - Installed capacitymeans the summation of the name plate capacities of all the units of the generating plant or the capacity of the generating plant (reckoned at the generator terminals) approved by the Commission from time to time.

Load Factor: It is defined as the ratio of the average of the power requirements during a particular period to the maximum demand. In other words, it denotes the extent of utilisation of Electric Power. Load factor is improved by reduction of maximum demand which is achieved by increasing the diversity for certain installation.

$$\text{Load Factor} = \frac{\text{Average Power}}{\text{Maximum Power demand}}$$

"Licensee" means any person or persons granted license under Section 14 or exempted under Section 13 of the Act including deemed licensee.

"Licensed business" means the functions and activities, which the licensee(s) is required to undertake in terms of the licence granted by the Commission or as a deemed Licensee(s) under the Act.

"Long-term transmission consumer" means a distribution licensee or a person having a long-term lien for a period as defined in the open access regulations notified by the Commission from time to time, over an intra-State transmission system by paying all applicable charges for which appropriate agreement has been entered into with the transmission licensee.

"Market operation charges" means the charges, as approved by the Commission, to be recovered by the SLDC from the users for performing market operation functions.

"Market operation function" means functions of scheduling, dispatch, metering data collection, energy accounting & settlement, transmission loss calculation & apportionment, operation of pool account & congestion charge account, administering ancillary services & information dissemination and any other function assigned to the SLDC by the Electricity Act, 2003 or by Regulations and Orders of the Commission.

"MCR" - Maximum continuous rating in relation to a unit of the thermal power generating plant means the maximum continuous output at the generator terminals, guaranteed by the manufacturer at rated parameters, and in relation to a block of a combined cycle gas based thermal power generating plant means the maximum continuous output at the generator terminals, guaranteed by the manufacturer with water or steam injection, if applicable, and corrected to 50 Hz grid frequency and specified site conditions.

MW means Megawatt: One Megawatt (MW) is equal to 1000 Kilowatts. One kilowatt (KW) is equal to 1000 watts. Watt is the electrical unit of power or rate of doing work. It is the rate of energy transfer equivalent to one ampere flowing under a pressure of one volt at unit power factor. It is analogous to horse power or foot pounds per minute of mechanical power. One horsepower is equivalent to approximately 746watts. Kilowatt hour is the basic unit of electric energy equal to one kilowatt of power supplied to or taken from an electric circuit steadily for one hour. It is the unit which is generally referred to in the domestic consumption of electricity.

"O&M expenses" - Operation and maintenance expensesmean the expenditure incurred on operation and maintenance of the generating plant or transmission system or distribution system, as the case may be, including part thereof, and includes the following expenditure:

a. Employee cost (EC)

b. Repair and Maintenance (R & M) expenses;

c. Administration and General (A & G)expenses;

"PAG" - Plant availability factor in relation to a thermal generating plant for any period means the average of the daily declared capacities (DCs) for all the days during that period expressed as a percentage of the installed capacity in MW of the generating plantminus normative auxiliary energy consumption in MW.

"PLF" - Plant load factor for a given period, means the total sent out energy corresponding to actual generation during the period, expressed as a percentage of sent out energy corresponding to installed capacity in that period.

Power Factor: The power factor for the month shall be the ratio of Kilo-Watt- Hours to Kilo-Watt-Ampere-Hours supplied to the consumer during the month. The power factor shall be calculated upto two decimal places. The power factor of the consumer's installation shall not be less than 0.90. If the power factor falls below 0.90 during any month, the consumer shall pay a surcharge as detailed in General Conditions of HT supply of Tariff Order. For the purpose of conversion of load from KW to KVA, KW is divided by 0.85 and vice-versa. Similarly, one KVA = 1.14 HP approximately. By using these ratios, we can convert one form of Load into another.

"Revenue" means the amount billed or assessed to be billed at the applicable tariff including any fuel price adjustments in the case of a Generating Company and in the case of distribution licensees shall be inclusive of MMC, FSA or any other charges i.e. power factor surcharge, load / demand surcharge etc. for sale of power.

"Scheduled generation" for any given time or time block means the quantum of ex-bus energy scheduled by the State Load Dispatch Centre to be injected into the grid by a generating plant.

"SLDC" - State Load Dispatch Centre means the centre established by the State Government under section 31 of the Act the purposes of exercising the powers and discharging the functions under Section 32 of the Act;

"**System Operation Functions**" includes monitoring of grid operations, supervision and control over the intra – state Transmission System, real – time operations for grid control, system restoration following grid disturbances, compiling and furnishing data pertaining to system operation, congestion management,co-ordination with RLDC, black start co-ordination and any other functions assigned to the SLDC by the Electricity Act, 2003 or by Regulations and Orders.

"**System Operation Charges**" means the charges, as approved by the Commission, to be recovered by the SLDC from the users for performing system operation functions.

"T**ariff"** means the schedule of charges for generation, transmission and distribution & retail supply of electricity with terms and conditions applicable thereof;

"TSA" - Transmission service agreement means an agreement, contract, memorandum of understanding, or any such covenant, entered into between the transmission licensee and the long-term transmission consumer(s), as approved by the commission, for the use of transmission system

Tripping- The occurrence of a component failure or other conditions which requires the unit to be removed from service either manually or automatically on protections.

"UI" - Unscheduled interchanges means the unscheduled interchange of energy as mentioned in the Indian Electricity Grid Code or as defined in the Intra State ABT Regulations of HERC as may be notified from time to time;

UUPR means Unutilized Power/Low Load: It is that portion of the electrical energy during a given period which could not be produced since the maximum peak reached could not be maintained throughout the period due to having no demandor load although the unit was capable of producing of the peak level had there been a demand. It depends on the systems load factor or other external constraints over which the power plant management has no control.

"**Wheeling**" means the operation whereby the distribution system and associated facilities of a transmission licensee or distribution licensee, as the case may be, are used by another person for the conveyance of electricity on payment of charges to be determined under section 62 of the Act.

Overview of Power Industry 4

This Chapter includes:

4.1 OVERVIEW OF THE POWER SECTOR

The **power sector** in India is mainly governed by the Ministry of Power. There are three major pillars of power sector these are Generation, Transmission, and Distribution. As far as generation is concerned it is mainly divided into three sectors these are Central Sector, State Sector, and Private Sector.

Current Status of three major pillars of power sector:

GENERATION

The Overall generation (Including generation from grid connected renewable sources) in the country has been increased from 1110.458 BU during 2014-15 to 1173.603 BU during the year 2015-16, 1241.689 BU during 2016-17, 1308.146 BU during 2017-18, 1376.095 BU during 2018-19 and 1390.467 BU during 2019-20. The performance of Category wise generation during the year 2019-20 was as follows:-

Source	Increase +/ decrease (-)	By percentage
Thermal	Increased	2.59
Hydro	Decreased	15.62
Nuclear	Increased	22.66
Import from Bhutan	Increased	31.94
Renewable	Increased	8.75
Overall growth	**Increase**	**1.04**

TRANSMISSION

The natural resources for electricity generation in India are unevenly dispersed and concentrated in a few pockets. Transmission, an important element in the power delivery value chain, facilitates evacuation of power from generating stations and its delivery to the load centres. For efficient dispersal of power to deficit regions, strengthening the transmission system network, enhancing the Inter-State power transmission system and augmentation the National Grid and enhancement of the transmission system network are required. An extensive network of transmission lines has been developed over the years for evacuating power produced by different electricity generating stations and distributing the same to the consumers. The nominal Extra High Voltage lines in vogue are ± 800 kV HVDC & 765 kV, 400 kV, 230/220 kV, 110 kV and 66 kV AC line.

The transmission lines are operated in accordance with Regulations/ standards of Central Electricity Authority (CEA) / Central Electricity Regulatory Commission (CERC) / State Electricity Regulatory Commissions (SERCs), keeping in view the voltage stability, angular stability, loop flows, load flow pattern and grid security.

DISTRIBUTION

Distribution is the most important link in the entire power sector value chain. As the only interface between utilities and consumers, it is the cash register for the entire sector. Under the Indian Constitution, power is a Concurrent subject and the responsibility for distribution and supply of power to rural and urban consumers rests with the states. Government of India provides assistance to states through various Central Sector / centrally sponsored schemes for improving the distribution sector. Integrated Power Development Scheme (IPDS)Scheme approved on 20.11.2014 with a total outlay of ₹ 32,612 crore which includes a budgetary support of ₹ 25,354 crore from Govt. of India. The objectives of scheme are:

- Strengthening of sub-transmission and distribution networks in the urban areas
- Metering of distribution transformers / feeders / consumers in the urban area
- IT enablement of distribution sector and strengthening of distribution network

With a population of 1.4 billion and one of the world's fastest-growing major economies, the Indian government has initiated policies designed to conduct large-scale renewable energy auctions and promote access to oil and gas markets for foreign investors.

The strong growth of renewables in India, which now account for almost 23% of the country's total installed capacity. It also found that energy efficiency improvements in India avoided 15% of additional energy demand, oil and gas imports, and air pollution – as well as 300 million tonnes of CO_2 emissions between 2000 and 2018.

GENERATION, TRANSMISSION & DISTRIBUTION OF ELECTRIC POWER

FLOW CHART OF TRANSACTIONS IN POWER SECTOR

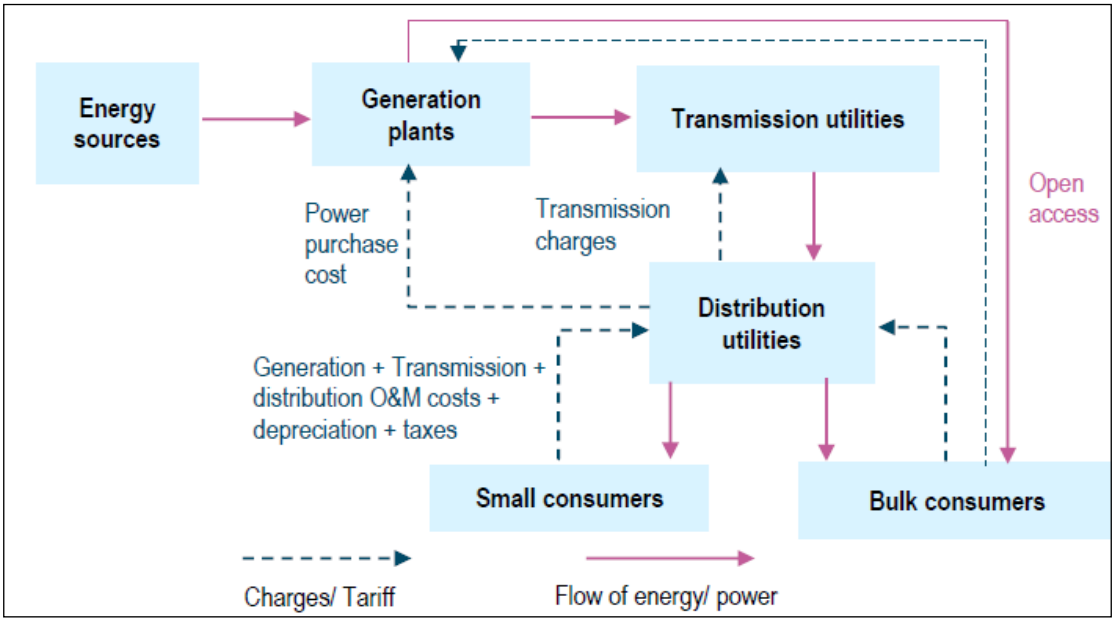


Figure 1: *Structure of the power sector*

4.2 LEGAL AND REGULATORY FRAMEWORK POWER SECTOR

Entry 38 of List –III (Concurrent List) of 7th Schedule to the Constitution enshrines the word "Electricity". Hence, pursuant to Article 246(2), the Parliament as well as the State Legislatures can enact law on the subject of electricity. Prior to our independence, the power generation and distribution of electricity was mostly in the hands of Private Electricity Supply Corporations and was limited to a few towns/ cities. After Independence, the State Electricity Boards were constituted under Electricity Supply Act, 1948 and entrusted the responsibility of generation, transmission and distribution, nationalizing the private electricity corporations.

4.3 GOVERNMENT RULES AND POLICIES

The following are the central legislations dealing with electricity prior to enactment of the Electricity Act, 2003.

1. Indian Electricity Act,1910
2. Electricity (Supply) Act,1948
3. Indian Electricity Rules1956

4. Electricity Regulatory Commissions Act, 1998.

Electricity Act 2003 has been enacted and came into force from 15.06.2003. The objective is to introduce competition, protect consumer's interests and provide power for all. The Act provides for National Electricity Policy, Rural Electrification, Open access in transmission, phased open access in distribution, mandatory SERCs, license free generation and distribution, power trading, mandatory metering and stringent penalties for theft of electricity. It is a comprehensive legislation replacing Electricity Act 1910, Electricity Supply Act 1948 and Electricity Regulatory Commission Act 1998.The Electricity Act, 2003 has been amended on two occasions by the Electricity (Amendment) Act, 2003 and the Electricity (Amendment) Act, 2007. The aim is to push the sector onto a trajectory of sound commercial growth and to enable the States and the Centre to move in harmony and coordination.

CentralGovernment prepares from time to time National Electricity policy and tariff policy for development of the power system based on optimal utilization of conventional and non-conventional energy resources. National Electricity Plan is also being prepared once in five years in accordance to the Electricity policy and tariff policy.

Power Sector can be broadly categorized into two type of industry i.e. Generation of Electricity and Supply of Electricity. Supply of Electricity is further divided into two categories according to the capacity of lines. High voltage transmission lines of the capacity 66KV voltage and above are operated and maintained by Transmission Company (TRANSCO) and transmission lines below 66KV voltage are operated and maintained by Distribution Companies (DISCOMS).

Any generating company (GENCO) may establish, operate and maintain a generating station without obtaining any license under the Act, if it complies with the technical standards relating to connectivity with the grid.

No person shall transmit, distribute or undertake trading of electricity unless he is authorized to do so by a license issued under section 14 of the Electricity Act, 2003, or is exempted from the same under section 13 of the Act.

National Load Despatch Centre (NLDC) and Regional Load Despatch Centre (RLDC) are established at the national level and the regional levels for optimum scheduling and dispatch of electricity. Optimum Scheduling and dispatch of electricity is ascertained considering various factors such as; demand and supply matrix of the electricity, transmission capacity of the power system, availability of the generation capacity and cost of power purchase and supply upto the consumer end. RLDCs shall be operated by a Government company. Until a Government Company is notified for the purpose Transmission company shall operate RLDC. No RLDCs shall engage in the business of generation of electricity or trading of electricity.

As per section 42 of the Electricity Act 2003, it is the responsibility of a distribution licensee to develop and maintain an efficient, coordinated, and economical distribution system. Further Section 73 highlights that it is essential to provide reliable and affordable electricity for all consumers.

In accordance with section 32 of Electricity Act, 2003 roles and functions of SLDC's are enumerated as under:

i. The SLDCs shall be the Apex Body to ensure integrated operation of the power system in a State.

ii. SLDCs shall:

- be responsible for optimum scheduling and despatch of electricity within a State in accordance with the contracts entered into with the licensees or the generating companies operating in that State
- Monitor grid operation.
- Keep accounts of the quantity of electricity transmitted through the State grid.
- Exercise supervision and control over the inter-state transmission system.
- Be responsible for carrying out real-time operation for grid control and despatch of electricity within the State through the secure and economic operation of the State Grid in accordance with the Grid standards and State Grid Code.

There is Centre Regulatory Commission (CERC) at the National level and State Electricity Regulatory commissions (SERC)/ Joint Electricity Regulatory Commissions (JERC) established under Electricity Regulatory Commission Act, 1998, for specifying the terms and conditions for determination of tariff and also to determine the tariff in accordance to such provisions for electricity generating, transmission and distribution companies.

In addition to routine accounting records, various cost records are required to be maintained as per Companies (Cost Records and Audit) Rules 2014. Though the cost of power is determined and approved by the Commission on Cost plus basis yet certain techno commercial parameters are required to be constantly monitored and controlled as generation, transmission and also the consumer tariff is determined and approved by the Commission considering certain norms and benchmark. Expenditure or loss beyond such norms is not a pass through expenses.

4.4 TECHNOLOGICAL DEVELOPMENTS

Renewables have outpaced fossil fuels in new power capacity additions overall since 2012. They are emerging as the default choice for new projects everywhere. Now, crucially, their continued cost decline means the world can afford to be ambitious amid the crisis. Renewables, meanwhile, align recovery measures with climate resilience, sustainable development and other medium- and long-term policy goals. Cutting carbon dioxide (CO2) emissions in line with the Paris Agreement remains as crucial as ever

Electricity costs from renewables have fallen sharply over the past decade, driven by improving technologies, economies of scale, increasingly competitive supply chains and growing developer experience. As a result, renewable power generation technologies have become the least-cost option for new capacity in almost all parts of the world. This new reality has been increasingly reflected in deployment, with 2019 seeing renewables account for 72% of all new capacity additions worldwide.

Electricity and Energy Storage

Surplus electric power can be converted to other forms of energy for storage and reconversion. The rapid increase in many parts of the world of generating capacity by intermittent renewable energy sources, notably wind and solar, has led to a strong incentive to develop energy storage for electricity on a large scale. The extent to which electricity storage can be developed will determine the extent to which those intermittent renewable sources can displace dispatchable sources, taking surplus power on occasions and bridging intermittency gaps. Also the stored electricity usually needs to be available over days and weeks rather than minutes and hours.

Electricity cannot itself be stored on any scale, but it can be converted to other forms of energy which can be stored and later reconverted to electricity on demand. Storage systems for electricity include battery, flywheel, compressed air, and pumped hydro storage. Any systems are limited in the total amount of energy they can store. Their energy capacity is expressed in megawatt-hours (MWh), and the power, or maximum output at a given time, is expressed in megawatts of electric power (MW or MWe). Electricity storage systems may be designed to provide ancillary services to a transmission system including frequency control, and this is the chief role of grid-scale batteries today.

Thermal Storage

Concentrating solar plants can capture heat from the sun and store the energy in water, molten salts, or other fluids. This stored energy is later used to generate electricity, enabling the use of solar energy even after sunset.

Pumped hydro storage

Pumped storage involves pumping water uphill to a reservoir from which it can be released on demand to generate hydro-electricity. The efficiency of the double process is about 70%. Pumped storage projects and equipment have a long lifetime – nominally 50 years but potentially more, compared with batteries – 8 to 15 years. Pumped hydro storage is best suited for providing peak-load power for a system comprising mostly fossil fuel and/ or nuclear generation. It is not so well-suited to filling in for intermittent, unscheduled and unpredictable generation.

Compressed Air Energy Storage (CAES)

CAES systems compress air using electricity during off-peak times, and then store the air in underground caverns. During times of peak demand, the air is drawn from storage and fired with natural gas in a combustion turbine to generate electricity. This method uses only a third of the natural gas used in conventional methods. Because CAES plants require some sort of underground reservoir, they are limited by their locations.

Hydrogen

The potential for creating hydrogen from wind power and storing it in the wind turbine towers for electricity generation when the wind isn't blowing. Direct current electrolysis (efficiency 80–85% at best) can be used to produce hydrogen which can, in turn, be converted to methane (CH4) via methanation. Another possibility is converting the hydrogen, along

with CO2 to methanol. Both these fuels can be stored and used to produce electricity again, hours to months later. Reconversion technologies include gas turbines, CCGT plant, reciprocating engines and fuel cells. Power-to-power refers to the round-trip reconversion efficiency. For hydrogen storage, the round-trip efficiency remains limited at 35–50%. Electrolysis is expensive and power-to-gas processes need substantial full-load hours (say 30%) to be economic. However, while round-trip conversion efficiency of power-to-power is lower than with batteries and electrolysis can be expensive, storage of the fuels themselves is quite inexpensive. This means that large amounts of energy can be stored for long periods of time with power-to-power, which is ideal for seasonal storage. This could be particularly useful for systems with high renewable penetration, since many areas have significant seasonal variability of solar, wind, and hydroelectric generation.

Flow Batteries

Among the frontrunners for large-scale stationary storage of wind and solar power are flow batteries, which consist of two tanks of liquids that feed into electrochemical cells. The main difference between flow and conventional batteries is that flow batteries store the electricity in the liquid rather than in the electrodes. They're far more stable than Li-ion, they have longer lifespans, and the liquids are less flammable. Not only that, but a flow battery can be scaled up by simply building bigger tanks for the liquids.

Electric vehicles (EV) have assumed high priority in the country. In the recent years, several large cities in India have emerged as the most polluted cities in the world and a significant share of the air pollution is coming from the automobiles. In order to address this serious problem in a holistic manner, Government of India (GoI) has launched a national mission in March 2019, the "Transformative Mobility and Energy Storage Mission". Constantly declining cost of LiBs coupled with their performance improvements and rapid innovations in the EV domain is expected to make EVs competitive in the near term in all categories: 2 Wheelers, 3 Wheelers, Cars, Buses and Goods Carriers. GoI is committed to develop the complete ecosystem around EVs including manufacturing of batteries and all other components domestically.

Environmental Issues

In order to minimize the adverse impact on the environment, the GOI had enacted various Acts and statutes. At the State level, State pollution Control Boards (SPCBs) are the regulating agencies to ensure compliance with the provisions of these Acts and statutes. Ministry of Environment and Forests (MoE&F), GOI and Central Pollution Control Board (CPCB) arc also vested with powers under various statutes. The Institute of Cost Accountants of India (ICAI) has issued Cost Accounting Standard CAS – 14 on Pollution Control Cost, which is effective from the period commencing from 1st April 2012, which provides for detailed analysis of costs incurred for control of pollution of various types, viz. Air, Water, etc.

Types of Pollution

Air Pollution

Coal ash, being a fine particle matter, is a pollutant under certain conditions when it is airborne and its concentration in a given volume of atmosphere is high. Control of dust levels in flue

gas is an important responsibility of thermal power stations. Electrostatic Precipitator (ESP) is used to reduce dust concentration in flue gases. As per MoE&F notification (September 1999) every thermal plant should supply fly ash to building material manufacturing units free of cost at least for 10 years.

Noise Pollution

Noise Pollution (Regulation and Control) Rules 2000 aim to regulate and control noise. For noise emission from equipment be controlled at source, adequate silencing equipment should be provided at various noise sources and a green belt should be developed around the plant area to diffuse noise dispersion. The TPSs are required to record sound levels in all the areas stipulated in the rules referred to above.

Water Pollution

The waste water of the power plant is the source of water pollution. As per the provisions of the Water (Prevention & Control of Pollution) Cess Act, 1977 water cess at rates specified is collected from the consumers for water utilized for the purposes specified in the Act Ibid. Compliance with the standards laid down by GOI under Environment (Protection) Act, 1986 makes the consumer eligible for concessional rate of water cess and also rebate in payment of cess.

A) Some of the important observations noticed on the issue are described below:
   1) Due to non-completion of work of up-gradation / installation of ESPs, the objective of reduction of pollution level could not be achieved.
   2) Due to failure in bringing down the water pollution to specified levels, avoidable payment of water cess is involved.
   3) Due to non-compliance of the directions of SPCB, Power companies can not avail concessional rates of water cess.

B) To save the Earth from greenhouse gases (GHG) a number of countries including India signed the 'Kyoto Protocol', which targeted reduction of emission of GHG by five percent in the developed countries. The extent to which an entity is emitting less carbon than the standard fixed in this regard gets credited for the same.Due to non-registration of the project as Clean Development project at the DPR stage, Power companies lose the potential revenue in the form of carbon credit.

Internal Auditor should look into the matter in the light of the above provisions and comment on the prudence check exercised by the power utilities.

Huge untapped Power Generation Potential

India has huge untapped Power generation potential in non-conventional energy streams which can be harnessed to the total advantage of the country. India's potential for hydro power has been assessed to be about 125,570 MW at 60% load factor. India is ranked fourth globally by underutilized hydro power potential.

In addition, there is an estimated 6,740 MW of potential for small, mini, and micro-hydro generators, and 56 sites for pumped storage schemes with an aggregate installed capacity of 94,000 MW have been identified.

The solar energy sector in India offers potentially enormous capacity, though little of this potential has so far been exploited. Solar radiation of about 5,000 trillion kWh per year is incident over India›s land mass, with average daily solar power potential of 0.25 kWh/m2 of used land area with available commercially proven technologies, As of 31 December 2019, the installed capacity was 33.73 GW, or 2% of utility electricity generation.

4.5 PROBLEMS WITH INDIA'S POWER SECTOR

India's electricity sector faces many issues, including:

1. **Inadequate last mile connectivity**. The country already has adequate generation and transmission capacity to meet the full consumer demand, both temporally and spatially. However, due to the lack of last-mile link-up between all electricity consumers and a reliable power supply (to exceed 99%), many consumers depend on diesel generators. Nearly 80 billion kWh of electricity is generated annually in India by diesel generator sets that consume nearly 15 million tons of diesel oil. Over 10 million households use battery storage UPS as back-ups in case of load shedding. India imports nearly US$2 billion worth of battery storage UPS every year As overhead lines cause distribution problems during rain and wind storms, there is a plan to lay buried cables from low voltage substations to supply cheaper emergency power in cities and towns and thus reduce diesel oil consumption by diesel generator sets and the installation of UPS systems.

2. **Demand build up measures**. Electricity-intensive industries consume the cheaper electricity (average price ₹2.5 per kWhr) available from the grid instead of running their own coal/gas/oil fired captive power plants. The captive power generation capacity by such plants is nearly 53,000 MW, and they are mainly established in steel, fertilizer, aluminium, cement, etc. industries. These plants can draw cheaper electricity from the grid on short term open access (STOA) basis, avoiding their own higher cost of electricity generation and diverting power from other consumers. Some of these idling captive power plants can be used for ancillary services or grid reserve service and earn extra revenue.

3. **Unequal electricity distribution**. Almost all households have access to electricity. However, most households find the electricity supply intermittent and unreliable. At the same time, many power stations are idling for lack of electricity demand and the idling generation capacity is sufficient to supply the needs of households lacking electricity three times over.

4. **Erratic power pricing**. In general, industrial and commercial consumers subsidize domestic and agricultural consumers. Government giveaways such as free electricity for farmers, created partly to curry political favour, have depleted the cash reserves of state-run electricity-distribution system and led to debts of ₹ 2.5 trillion (US$35 billion). This has financially crippled the distribution network, and its ability to pay to purchase power in the absence of subsidies from state governments. This situation has been worsened by state government departments that do not pay their electricity bills.

5. **Over-rated capacity**. Many coal-fired plants are overrated above the actual maximum continuous rating (MCR) capacity, to allow the plant cost to be inflated. These plants operate 15 to 10% below their declared capacity on a daily basis and rarely operate at declared capacity, undermining grid stability.

6. **Lack of timely information on load and demand**. Intraday graphs at 15-minute or more frequent intervals are required to understand the shortcomings of the power grid with respect to grid frequency, including comprehensive data collected from SCADA for all grid-connected generating stations (≥ 100 KW) and load data from all substations.

7. **Lack of adequate coal supply**: Despite abundant reserves of coal, power plants are frequently under-supplied. India's monopoly coal producer, state-controlled Coal India, is constrained by primitive mining techniques and is rife with theft and corruption Poor coal transport infrastructure has worsened these problems. Most of India's coal lies under protected forests or designated tribal lands and efforts to mine additional deposits have been resisted.

8. **Poor gas pipeline connectivity and infrastructure**. India has abundant coal bed methane and natural gas potential. However a giant new offshore natural gas field has delivered far less gas than claimed, causing a shortage of natural gas.

9. **Transmission, distribution and consumer-level losses**. Losses exceed 30%, including the auxiliary power consumption of thermal power stations and fictitious electricity generation by wind generators, solar power plants & independent power producers (IPPs), etc.

10. **Resistance to energy efficiency in the residential building sector**. Continuous urbanization and the growth of population result in increased power consumption in buildings. The belief still predominates among stakeholders that energy-efficient buildings are more expensive than conventional buildings, adversely affecting the "greening" of the building sector.

11. **Resistance to hydroelectric power projects**. Hydroelectric power projects in India's mountainous north and northeast regions have been slowed down by ecological, environmental and rehabilitation controversies, coupled with public interest litigation.

12. **Resistance to nuclear power generation**. Political activism since the Fukushima disaster has reduced progress in this sector. The track record of executing nuclear power plants is also very poor in India.

13. **Theft of power.** The financial loss due to theft of electricity is estimated at around $16 billion yearly.

Key implementation challenges for India's electricity sector include efficient performance of new project management and execution, ensuring availability and appropriate quality of fuel, developing the large coal and natural gas resources available in India, land acquisition, obtaining environmental clearances at state and central government level, and training skilled manpower.

Generation, Transmission, Distribution, Trading of Power

5

This Chapter includes:

5.1 GENERATION OF POWER

Power is a basic human need. It is one of the critical infrastructure on which sustainable economic growth depends. The power generation strategy of the Government focuses on low cost generation, optimization of capacity utilization and fuel mix with environmental concerns, controlling the input cost, technology up-gradation and utilization of non-conventional energy sources. Balancing of demand and supply of the power by managing peak and non-peak supply is a matter of continuing concern.

In this background, The Electricity Act, 2003 has brought about a fundamental change i.e. license free generation of electricity. Massive investment in generation capacity is needed to ameliorate the situation. The act provides a cost plus basis tariff determination mechanism to attract competitive investors in the field of power generation by eliminating inefficiency.

As per section 7 of the Electricity Act, 2003, though electricity generation has de-licensed but Generation Company has to fulfil, certain technical standard as specified by the CEA, before setting up of the generating plant. Beside this generating company has to complied with the directives issued by the appropriate government in the public interest or in the interest of security of the State/ Nation such as clearances of change of land use, defence permission, aviation clearance, permission of explosive etc.

Power generating plant can be categories according to its capacity, use of power produce and sources of energy uses for power generation as under:

1. **Merchant Power Plant**: The power plant which do not have long term Power Purchase Agreements (PPAs) are called as merchant power plant. They sell their power on a competitive basis to the utilities and the power traders. First Merchant power plant is *Malana Hydro Power plant* which was operational prior to the implementation of the Electricity Act, 2003. Thereafter Tata Power Company has set up *Jojobera (Jharkhand) power plant*.

2. **Captive Generation Plant**: The power plant setup by any person to generate electricity primarily for his own use is known as Captive power plant. To declare a generating plant as Captive it has to satisfy two conditions:

   (i) At least 26% of the ownership/ shareholding of the plant is with the user of electricity and

   (ii) 50% or more of the electricity generated shall be used by the generator.

   (iii) These plants have certain licensing and other relaxations such as:

      (a) No requirement of taking transmission and distribution license as is required to other Transmission and Distribution companies.

      (b) Exempted from the Cross Subsidy Surcharge.

      (c) Right to open access for the purposes of carrying electricity from the captive generating plant to the destination of use.

3. **Multi-Purpose Project:**Multi–purpose project involves many activities including power generation, irrigation, domestic water supply, food grain production, tourism development, fishing, navigation development, and sometimes even water sports and other recreational activities. Thereby it is essential that the development of the river water projects takes place in a coordinated fashion.

   Section 8(3) provides that in case of a multi-purpose scheme for the development of any river in any region. The State Government and the Generating Company will co-ordinate their activities with the activities of the person responsible for such scheme in so far as they are inter-related.

4. **Conventional energy source plant:** The generating plant which uses non-renewable source of energy as main fuel for generation of the electricity such as coal, Nuclear, Gas and known as thermal power project:

   (i) **Coal:** Coal is one of the preferred sources of power generation in India. The coal is crushed into fine powder. This powder is later burnt in suspension, which results in heat. There are thousands of water tubes surrounding the furnace, which contains demineralised water. Due to heat in the furnace, the demineralised water gets heated up and produces steam, with the help of which the turbines are rotated to generate electricity. The disadvantage of using coal for generation of electricity is that the emission of gases due to burning of coal is harmful to the environment.

   (ii) **Gas:** In case of gas based power plant, only change is instead of coal, natural gas is burnt. The heat generated from burning of gas, results in heating up of DM Water and ultimately steam, is used to turn the turbine which generates the electricity. In alternate model of generation units, instead of heating steam, hot gases from burning of natural gas are used to turn the rotor shaft of the turbine.

   (iii) **Oil**: The basic principle regarding to coal and oil is similar. In combined cycle, oil is burnt in a combustion turbine and the steam to turn the turbine. Oil power plants produce gases which are harmful to environment.

(iv) **Nuclear**: Nuclear energy is generated from fission process. It is splitting of uranium atoms. Heat is generated from fission process for producing steam. This steam is utilized for generation of electricity with the help of turbine. There is no or very miniscule emission of CO_2.

5. **Non-Conventional energy sources plant:** Generating plant which uses renewable source of energy as primary fuel such as water (Hydro), wind, Solar, Biomass etc.

(i) **Hydropower**: In this case, force of falling water, from height, is used to turn the turbine. In a hydro-electric power plant, water is stored at a height using a dam. With the help of gravity, water falls on the turbine through the pipe inside the dam. The rotor shaft of the turbine is turned with the help of force of falling water in hydro-electric power plant. When the water falls on the turbine, it results in movement and turning of the metal shaft and power is generated

(ii) **Solar Photovoltaic**: This is a renewable source of energy. The photovoltaic technology is used to convert solar energy into electricity from sunlight. The PV cell consists of silicon layer. Silicon is a semi-conducting material. When the light falls on silicon, electricity is generated. Multiple cells are used to get large output.

(iii) **Wind:** Wind is another renewable source of energy. Large spinning blades are used to utilize the kinetic energy in moving wind. This energy is transferred to rotors for producing electricity.

(iv) **Geothermal**: Geothermal energy is heat derived within the sub-surface of the earth.Water and/or steam carry the geothermal energy to the Earth's surface. Geothermal power plants, which use heat from deep inside the Earth to generate steam to make electricity. Technologies in use include dry steam power stations, flash steam power stations and binary cycle power stations.

(v) **Bio-energy:** Bio-energy refers to electricity and gas that is generated from organic matter, known as biomass. This can be anything from plants and timber to agricultural and food waste – and even sewage.When biomass is used as an energy source, it's referred to as 'feedstock'.Feedstock can be grown specifically for their energy content (an energy crop), or they can be made up of waste products from industries such as agriculture, food processing or timber production. Dry, combustible feedstock's such as wood pellets are burnt in boilers or furnaces. This in turn boils water and creates steam, which drives a turbine to generate electricity. Wetfeedstock, like food waste for example, are put into sealed tanks where they rot and produce methane gas (also called biogas). The gas can be captured and burnt to generate electricity, or it can be injected into the national gas grid and be used for cooking and heating. Bio-energy is a very flexible energy source.

6. **Hydro Power Generation:**These plants produce power from flow of water. As per the act Hydro project upto 25MW are de-licensed but for more than 25MW projects generating company intending to set up Hydro generating station, involving capital expenditure beyond the prescribed limits of CEA requires concurrence of CEA beside about 20 approval/ compliances from the Centre and 10 from State Govt. are required.

7. **Nuclear Plant:** These plants are exception of de-licensing of the generating company and requires license from Center Government. At least 51% ownership of the plant should be with the Govt. Company. Uses Uranium or Thorium as fuel.

8. **Mega Power Plant:** According to a circular issued by the Government of India dated 10th November, 1995 regarding the 'Setting up of power plants of capacity 1000 MW or more supplying power to more than one State', Government of India had set the guidelines of setting up the mega power projects of capacity 1000 MW or more supplying power to more than one State had been issued vide D.O. letter N. C.- 286/95-IPC, dated 10th November, 1995.

9. **Ultra Mega Power Plant:** Government of India through Ministry of Power launched the initiative of Ultra Mega Power Projects (UMPPs) i.e. 4,000 MW super thermal power projects (both pit head and imported coal based) in November 2005 with the objective to develop large capacity power projects in India. Power Finance Corporation Ltd (PFC) has been appointed as the Nodal Agency to facilitate the development of these projects. Various inputs for the UMPPs are tied up by the Special Purpose Vehicle (SPV) with assistance of Ministry of Power & Central Electricity Authority (CEA). CEA is involved in selection of sites for these UMPPs.

10. **Small Power Plant in Rural Area:** This is a viable option now after the passing of The Electricity Act. It is provided in the Act that an entity can take up generation and distribution in a rural area without any license from the concerned authority. This will be highly empowering to the NGO's and local developmental institutions working in the rural areas. The definition of rural area is expected to be synchronous with the Eleventh Schedule (Article 243G) of the Constitution. However final clarity regarding the rural areas will be arrived at after the rural electrification policies are out and areas to be considered as rural areas are specified by the State Government.

Duties of Generating Company

The duties of a generating company shall be to establish, operate and maintain generating stations, tie-lines, sub-stations and dedicated transmission lines connected therewith in accordance with the provisions of the Act or the rules or regulations made there under.

- A generating company may supply electricity to any licensee in accordance with the electricity Act.
- A generating company may supply electricity to any consumer subject to the regulations made under sub-section (2) of section 42(Open access for distribution areas).
- Every generating company shall Submit technical details regarding its generating stations to the Appropriate Commission and the Authority;
- Every generating company shall co-ordinate with the Central Transmission utility or the State Transmission Utility, as the case may be, for transmission of the electricity generated by it.

Tariff Determination:

The Appropriate Commission (CERC/SERC/JERC), shall determine the tariff (for generating company, transmission of electricity, wheeling of electricity and retail sale of electricity) under Sec. 62 of the Electricity Act, 2003, or shall adopt the tariff under sec. 63 of the Act if such tariff is discovered through transparent process of bidding in accordance with the provision of the Act as amended from time to time and in accordance with the guidelines issued by the Central Government. Central Govt. has issued the National tariff policy. Tariff policy lays down following framework for performance based cost of service regulation in respect of aspects common to generation, transmission as well as distribution.

(a) Return on Investment

Balance needs to be maintained between the interests of consumers and the need for investments while laying down rate of return. Return should attract investments at par with, if not in preference to, other sectors so that the electricity sector is able to create adequate capacity. The rate of return should be such that it allows generation of reasonable surplus for growth of the sector. The Central Commission would notify, from time to time, the rate of return on equity for generation and transmission projects keeping in view the assessment of overall risk and the prevalent cost of capital which shall be followed by the SERCs also. The rate of return notified by CERC for transmission may be adopted by the State Electricity Regulatory Commissions (SERCs) for distribution with appropriate modification taking into view the higher risks involved. For uniform approach in this matter, it would be desirable to arrive at a consensus through the Forum of Regulators. While allowing the total capital cost of the project, the Appropriate Commission would ensure that these are reasonable and to achieve this objective, requisite benchmarks on capital costs should be evolved by the Regulatory Commissions.

(**b) Equity Norms**

For financing of future capital cost of projects, a Debt: Equity ratio of 70:30 should be adopted. Promoters would be free to have higher quantum of equity investments. The equity in excess of this norm should be treated as loans advanced at the weighted average rate of interest and for a weighted average tenor of the long term debt component of the project after ascertaining the reasonableness of the interest rates and taking into account the effect of debt restructuring done, if any. In case of equity below the normative level, the actual equity would be used for determination of Return on Equity in tariff computations.

(**c) Depreciation**

The Central Commission may notify the rates of depreciation in respect of generation and transmission assets. The depreciation rates so notified would also be applicable for distribution with appropriate modification as may be evolved by the Forum of Regulators. The rates of depreciation so notified would be applicable for the purpose of tariffs as well as accounting. There should be no need for any advance against depreciation. Benefit of reduced tariff after the assets have been fully depreciated should remain available to the consumers.

(d) Cost of Debt

Structuring of debt, including its tenure, with a view to reducing the tariff should be encouraged. Savings in costs on account of subsequent restructuring of debt should be suitably incentivized by the Regulatory Commissions keeping in view the interests of the consumers.

(e) Cost of Management of Foreign Exchange Risk

Foreign exchange variation risk shall not be a pass through. Appropriate costs of hedging and swapping to take care of foreign exchange variations should be allowed for debt obtained in foreign currencies. This provision would be relevant only for the projects where tariff has not been determined on the basis of competitive bids.

(f) Operating Norms

Suitable performance norms of operations together with incentives and dis-incentives would need to be evolved along with appropriate arrangement for sharing the gains of efficient operations with the consumers. The operating parameters in tariffs should be at "normative levels" only and not at "lower of normative and actual". This is essential to encourage better operating performance. The norms should be efficient, relatable to past performance, capable of achievement and progressively reflecting increased efficiencies and may also take into consideration the latest technological advancements, fuel, vintage of equipments, nature of operations, level of service to be provided to consumers etc. Continued and proven inefficiency must be controlled and penalized. The Central Commission would, in consultation with the Central Electricity Authority, notify operating norms from time to time for generation and transmission. The SERC would adopt these norms. In cases where operations have been much below the norms for many previous years, the SERCs may fix relaxed norms suitably and draw a transition path over the time for achieving the norms notified by the Central Commission. Operating norms for distribution networks would be notified by the concerned SERCs.

In cases of lack of reliable data, the Appropriate Commission may state assumptions in MYT for first control period and a fresh control period may be started as and when more reliable data becomes available.

(g) Renovation and Modernatisation

Renovation and modernization (it shall not include periodic overhauls) for higher efficiency levels needs to be encouraged. A multi-year tariff (MYT) framework may be prescribed which should also cover capital investments necessary for renovation and modernization and an incentive framework to share the benefits of efficiency improvement between the utilities and the beneficiaries with reference to revised and specific performance norms to be fixed by the Appropriate Commission. Appropriate capital costs required for pre-determined efficiency gains and/or for sustenance of high level performance would need to be assessed by the Appropriate Commission.

(h) Multi Year Tariff

Section 61 of the Act states that the Appropriate Commission, for determining the terms and conditions for the determination of tariff, shall be guided inter-alia, by multi-year

tariff principles. The MYT framework is to be adopted for any tariffs to be determined 6 from April 1, 2006. The framework should feature a five-year control period. The initial control period may however be of 3year duration for transmission and distribution if deemed necessary by the Regulatory Commission on account of data uncertainties and other practical considerations.

(i) Benefits under CDM

Tariff fixation for all electricity projects (generation, transmission and distribution) that result in lower Green House Gas (GHG) emissions than the relevant base line should take into account the benefits obtained from the Clean Development Mechanism (CDM) into consideration, in a manner so as to provide adequate incentive to the project developers.

(j) Taxes & Duties

State Governments have the right to impose duties, taxes, cess on sale or consumption of electricity, these could potentially distort competition and optimal use of resources especially if such levies are used selectively and on a non- uniform basis. In some cases, the duties etc. on consumption of electricity is linked to sources of generation (like captive generation) and the level of duties levied is much higher as compared to that being levied on the same category of consumers who draw power from grid.

Generally, generation tariff is determined by the commission in two parts. Namely Energy Charge Rate (ECR) and Capacity Charge Rate/ Fixed Cost (FC). ECR are variable in nature and are directly linked to the actual power supplied and mainly constitute primary fuel cost only. In some case secondary fuel i.e. oil cost is also considered as part of the ECR. Rest of the cost of generation is considered as Fixed Cost and is allowed on the basis of availability of the plant irrespective of actual generation. These are Operation & Maintenance Expenses, Depreciation, Interest & Finance Charges, and Return on Equity etc.

PECULIAR TRANSACTIONS:

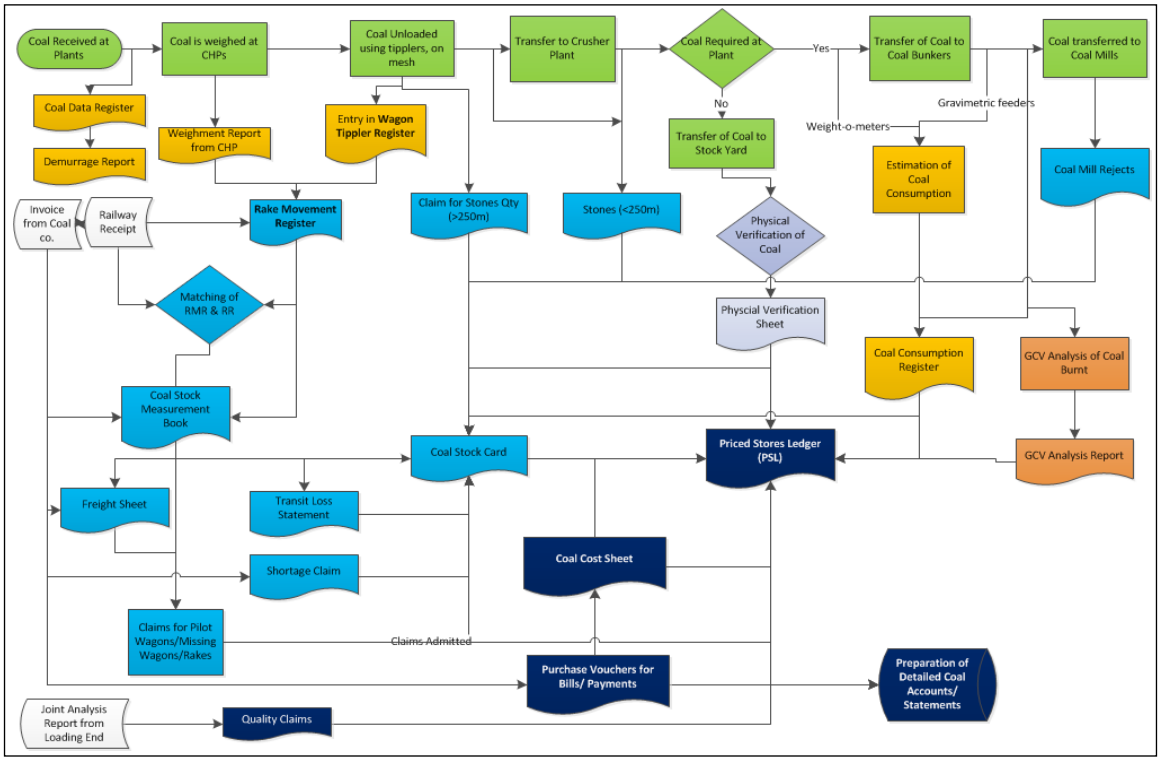
Coal and its related issues

The most commonly used fossil fuel in power generation is Coal. Coal is procured by the Generating Companies at the notified prices under a Fuel Supply Agreement (FSA) from the Coal India Ltd and its subsidiaries from the specified coal mines. In case of shortfall of the coal supply from the CIL, coal is also procured by way of import or by way of Auction or on as is where is basis. Coal is the single largest item of operating expenditure for the generating company, contributing nearly 80% of total cost of generation. This makes management and accounting of coal as the most important internal control process.

The electronic weighment (with an electronic printout from in-motion weighbridge and static electronic weighbridge) is considered to be the most reliable weighment of coal. The weighmentof coal considered to be billed from coal companies and weighment for coal receipt at Plants shall be considered primarily based on the printout of electronic weighment from in-motion and static weighbridges. After weighment, the coal is transported to Power generating station through Rail, Road or conveyor. On reaching the destination, the coal

is unloaded either at wagon tippler spot or coal yard. Again, at the time of unloading of coal at power station, weighment of coal received is done and recorded. After this, coal is transferred to bunkers and thereon to coal mills.

Process of Coal Accounting



The cost of coal received shall include the following attributable costs.

- Cost of coal / other costs as per the provisions of Fuel Supply Agreements (FSA) / invoice raised by the suppliers, such as Basic price, Royalty, High Capacity Charges, Silo loading charges, sizing and crushing charges, stowing excise duty, sales tax, GST, incentive for quantity supplied beyond certain limits, compensation for short delivery/ lifting, interest charges on delayed payment / credit on account of interest received etc.
- Railway Freight, including overloading charges, if any
- Salary of TXR and Goods Staff of Railways
- Adjustments on account of grade variations, moisture content, ash content, shortages stones etc. as per agreement in force. The quantity to be taken into stock will be as per the weighment recorded in the Coal SMB indicated as "Actual Weight" or weighment done at the Plant end, while the freight payment should be as per the "Chargeable Weight" and POL amount, DPC, DS and GST, as applicable.
- Applicable statutory levies, taxes and duties such as stowing excise duty, Sales Tax, GST, Transit permit fee, and any cess/tax/duty levied by any local authority etc.

- Transportation charges as in road transportation charges / surface transportation charges payable to coal companies
- Operating and handling charges, commission charges paid to agencies, such as payment to outside agencies for coal sampling, payments to contractors / coal agent etc.
- Any other operating expenditure incurred in connection with transportation and handling of coal, such as loading /unloading Charges, Siding, Shunting and demurrage charges etc.
- Any other cost directly attributable to coal cost, freight cost, loading and unloading cost etc.

The payment of coal cost should be governed by the provisions of the FSA, tripartite agreement for e-freight, entered into with the coal companies, Railways, Banks and/or the contract with supplier. All costs including adjustments/ deductions on account of failure to meet quantity and quality obligations, etc. should be as per the provisions of the FSA or as per any other agreement in force. The valuation of Coal Consumption shall be based on the monthly weighted average rate method as per the accounting policy.

The coal sampling and analysis are carried out at three levels starting from coal loading to coal consumption, i.e. loading point, unloading point and boiler front.

A. At the loading ends of coal companies, the Sample collection & preparation is to be carried out by CSIR-CIMFR (Council of Scientific & Industrial Research-Central Institute of Mining & Fuel Research) or Technical Service Provider appointed by CIMFR as per provisions /methodology described in the FSA. However, Standard Operating Procedures/Guidelines relating to Third Party Sampling at loading ends as circulated by Ministry of Coal, New Delhi vide notification dated 26.11.2015 which is as under: -

   i. The authorized representatives of power plant and coal company shall jointly witness the process of sample collection and preparation of the laboratory samples. The representatives shall put their signature on the sample tags in evidence of the process of sampling. All three-Independent sampler, consumer and supplier- shall also sign on the samples register maintained by the coal company at the loading end.

   ii. The samples shall be collected and prepared by the third party agency/ independent sampler as per BIS norms. Collection of samples to be ensured within free time for loading of rakes.

   iii. The coal companies shall provide adequate enabling conditions for collection, preparation and storage of coal samples at the loading ends.

   iv. The final laboratory sample shall be divided into 4 parts, Part-I of the samples is for analysis by the independent Third Party Agency at a government laboratory or NABL Accredited Laboratory as appointed by CIMFR through a transparent process. Part-2 and Part-3 of the sample are to be handed over to the coal company and the power utility respectively for their own analysis. Part-4 of the sample, called Referee sample, shall be sealed jointly by the third party agency, representatives

of the coal company and the power plant and shall be kept with the Third Party Agency under proper lock and key arrangement. The Referee sample shall be preserved for a period of 30 days from the date of sample collection.

v. Mere absence of or failure of participation by any representative of either party despite prior notice shall not be a ground to negate the sampling process undertaken.

vi. The Third Party Agency shall communicate the analysis results of the sample within 18 working days of the sample collection to the coal company and the power plant.

vii. The coal company or the power plant may raise dispute, if any, within 7 days of the submission of the result by the Third Party.

viii. In case of dispute raised within the stipulated time period, the Referee sample shall be analysed by a government laboratory.

B. At the unloading end of Thermal Power Stations, CSIR-CIMFR or Technical Service Provider (TSP) will carry out the activity of sample collection as per prevailing standard IS-436-Part1, Sec-I, 1964 specifications or as amended from time to time.

C. Coal Sampling at Boiler front is done from the raw coal feeder feeding to the coal mills to determine the quality of coal being fed into the furnace. The quality of coal burnt is an important determinant of the Station Heat Rate achieved by the generating units.

Claims and Reconciliations

Quality and quantity of coal billed and received are very important, which affect the cost of coal. Coal lost in transit due to pilferage, theft, evaporation of moisture etc. is a major cost factor of coal cost. Similarly, during stacking of coal at yard, there is loss due to moisture, fire, etc. Hence, it is very much necessary to monitor and control such losses. Generally generating companies are appointing Liaison agents for materialization and minimizing the transit loss. Coal liaisoningcontract should be carefully observed and reviewed periodically with financial prudence with cost benefit analysis since it may cost heavily on the coal cost.

Other things in coal is to be monitored are diversion of wagons, missed wagons, etc. Periodical reconciliation of coal dispatched from colliery end and coal received at power station end should be done to avoid loss to the power station. Rakes/wagons are diverted in/out by railways on account of various reasons such as wagons becoming sick en-route, urgency of coal at a different power station etc. The railways follow policy of 'wagon to wagon adjustment' i.e. a wagon of coal diverted out is adjusted by inward wagon of coal, irrespective of the quality/quantity of coal diverted out.

The power stations face large quantity of stones and boulders in the coal received. Shortage of coal and under loading may also be observed in the unweighed coal rakes. Grade slippage also occurred in many coal rakes i.e. the difference in the quality of coal billed and received. Quality and Quantity Compensation claims for stones, boulders, shortage, under loading and claims on account of short-lifting/Short supply and Performance Incentive are required to be lodged with the coal companies as per the FSA.

It is important to ensure that the electronic weighbridges installed at the Power Stations are well maintained, calibrated from time to time and fully functional with facility of electronic printout at all times for recording the coal receipts.

Similarly, transportation cost is also to be looked in to. In case of delay in unloading the rake then the free time allowed by the Railway as per the prevailing policy, demurrage charges are levied by Railway authorities.

Oil

Similarly, another costly fuel is Furnace Oil (FO) and Light Diesel Oil (LDO). Oil is similarly weighed at loading and unloading points. Consumption of oil needs careful monitoring.

Fuel Audit- Coal and Oil (Receipt, Consumption and Stock Audit)

Fuel alone accounts for 80% of the cost of generation and improvements in this area are likely to result in huge savings. Given below are the guidelines for fuel audit. While making its comprehensive audit auditors should also use their judgement and give suggestions for system improvements / cost reduction.

Auditing of Coal Bills

The audit of coal bills should concentrate on following points:

(a) The auditor should check that the advance given to the coal company is duly entered in the register prescribed for the purpose.

(b) He should ensure the IUA against advance along with the copy of relevant documents is sent to the concerned power station.

(c) The auditor at the store office should check the basis of freight payment.

(d) While checking the valuation of S.R. notes, the auditor at the power station should ensure the valuation correctly on the following aspect.

(e) The correctness of the basic rate.

(f) The correct calculation of royalty, stores excise duty, etc.

(g) Sales tax computed on the above.

(h) The deduction of freight charges on account of under loading to be specifically seen as shown in S.R.notes.

(i) Excess freight for over loading intimated by the store on S.R note is to be deducted from the coal bill.

(j) Any other recovery shown in S.R. note i.e. toll tax, etc. should be seen.

(k) After effecting all deductions from the bill as above, the correct amount of bill is to be arrived and advance payment if any, is to be adjusted from the bill.

(l) The auditor should prepare and send a consolidated statement showing the bill wise detail of the coal bills.

(m) The auditor should take quarterly review of the position of pending or awaited S.R. notes and implement the same to major store and S.E. coal office.

(n) The auditor should ensure that claims with the Railway in respect of missing wagons are promptly lodged.

Auditing of Coal related contracts

1. The contract for servicing of equipment and conveyer belts of coal handling plant, reconditioning of conveyer belt, cleaning work contract at coal handling plant, etc. are required to be placed and operated at thermal power stations as and when necessary.
2. The auditor should ensure that work specification given in the annexure is prescribed by the local authorities.
3. The auditor should ensure that the terms and conditions indicated in the annexure are fixed by the local authority and watch any variations in the prevailing terms and conditions.

Auditing of bill of coal related contracts

1. The auditor may receive such bills either in R.A.bill form or in contractor's own bill form.
2. Audit should ensure that the said billis received duly supported by "Daily work done Certificate" in the form locally prepared.
3. The seal and signature of section-in-charge or the person to whom powers are given is to be observed.
4. Audit should see that the measurement of actual work done is recorded and commensurate with the details in thecertificate.
5. The signature of contractor or his representative is to be observed by the auditor for acceptance of measurement in M.B. and on R.A. bill, if prepared.
6. The certificate in a separate form locally designed for recording of reasons of manual unloading of wagons is to be insisted by audit.
7. Audit should ensure that quantity of unloaded coal on the basis of heaps of particular size is mentioned in the order.
8. Arithmetical calculations are to be verified by the audit.
9. Rates charged in the bill are to be ensured as per rates in the order for various items.
10. Recovery of security deposit, GST, etc. as per terms of the order should be effected and net payable amount should be arrivedat.
11. The certificate as per the terms of the order wherever necessary are to beinsisted.
12. Audit should watch the linkage limit, whereverapplicable.
13. The procedure in respect of obtaining signature of head of the unit after recording and passing endorsement on M.B. may be followed as per prevailing localpractices.

Furnace Oil (FO)

Furnace Oil is used for initial igniting as well as for ignition support in case of wet coal. This oil is costly and is to be used very cautiously and judiciously. The cost of FO is around 2.5% to 3% of total cost of generation. It is therefore highly desirable that FO consumption should be monitored for effective cost control.

Record should be properly maintained for every receipt of FO consignment. Quantity of the FO and its landed cost should be properly recorded in the stores department. Transit Loss, if any, should be properly accounted for.

Similarly, records relating to issues of FO should also be properly maintained with the details such as quantity, the cost centre to which it is issued, valuation, etc. Proper metering of the issue of FO will ensure effective control over its consumption.

The guidelines for valuation of the receipts & issues of Furnace Oil are the same as explained above for coal, as per CAS6. For calculation of weighted average rates for Furnace Oil, the stock with Cost Centres should also be taken into account.

Light Diesel Oil (LDO) / High Speed Diesel(HSD)

Diesel is used for Locomotives, Dozers, Trucks and other vehicles. The cost of LDO / HSD is around 1% of total cost of generation. It is therefore highly desirable that Diesel consumption should be monitored for effective cost control and should be used very cautiously and judiciously.

Record should be properly maintained for every receipt of Diesel consignment. Quantity of the Diesel and its landed cost should be properly recorded in the stores department. Similarly, records relating to issues of Diesel should also be properly maintained with the details of issues such as quantity, the cost centre to which it is issued and its valuation.

Gas

(a) Check whether the purchase of gas has been accounted and paid for on the basis of properly authenticated meter readings and records.

(b) Compare the standard heat rate level of gas indicated by suppliers modified to local site conditions with actual heat rate achieved. Analyze and comment on variances. Comment on the follow-up with suppliers.

(c) Ascertain the number of instances of Minimum Guaranteed Off-take (MGO) charges paid to GAIL due to short consumption of gas and examine the corrective action taken to reduce such cases.

(d) Compare the standard norms of generation based on standard consumption of gas with actual generation achieved at actual consumption of gas. Highlight cases of systems losses/ deficiencies.

(e) Examine and comment on the standby arrangement made by the project to stock substitute fuels like NAPTHA / HSD.

(f) Ascertain instances of loss in generation due to grid restrictions and non-availability of gas. Examine and comment on corrective action initiated.

(g) Gas supply agreements provide for measurement of gas supply as well as computation of calorific value and provide for certain rebates. In case calorific value of gas supply is lower, examine whether the provisions are actually being implemented.

(h) Verify the method of computation of the Net Calorific Value (NCV) of gas used for the purpose of billing.

(i) Test-check the payments for pipeline maintenance and operation in accordance with the relevant contract.

(j) Examine meter records maintenance for frequency of checks and ascertain that corrective action has been taken where necessary.

Solar Energy

In case of Solar Energy Generation, the following checks are to be undertaken and reported:

(a) The Solar Panels are being regularly washed / cleaned for maximizing generation efficiency.

(b) A record is maintained for the periodic physical check of panels being undertaken to identify any damage at an early stage.

(c) Where generation is being directly fed from the solar panels / array to the grid, the energy meter at the array end and that at the feeder end are reflecting similar values for energy sent out(ESO) to the grid at each point of measurement and such readings are being entered in the register(s) maintained for the purpose. These energy meters should also be tested for accuracy at defined intervals. If there is any dispute by a beneficiary in the quantum of ESO, reason for such dispute should be mentioned in the report.

(d) Where energy generated is first captured in Storage Battery Bank which is, in turn, connected to the feeder end, the following additional checks are required to be reported:

(e) Battery Bank is being kept in cool, dry and dust free (indoor) environment which is adequately ventilated.

(f) Battery terminals are being kept clean and free from sedimentation and battery water top ups are being regularly undertaken as per records kept in this regard.

(g) The instrumentation / control panel attached to the battery bank displays desired output voltage and amperage thereby indicating sound health of the system.

Operation & Maintenance Expenses

These include Employees Cost including terminal expenses, Repair & Maintenance Expenses and Administrative & General Expenses. These are allowed by the commission as per the norms of the Commission per MW with appropriate escalation rate.

Depreciation

Depreciation is allowable on straight line method basis at the rate notified for each class of asset in the Commission's Regulation. It shall be ensured that the depreciation is computed

as per the prescribed rates each category of asset considering the date of Capitalization for new assets and the date of De-Capitalization in case of assets retired. As per the accounting policy of the company fixed assets will be depreciated on basis of useful life of the asset.

As per the accounting policy of the company fixed assets will be depreciated on basis of rate and useful life of the asset as well as the method prescribed by the respective regulators.

Interest & finance charges

These charges are allowed on the approved quantum of capex and working capital requirement at the Base rate of SBI applicable on 1st April of the respective year with appropriate margin decided by the Commission from time to time.

Power Purchase and Energy Audit

Power Purchase

In Electricity Distribution Utilities, Power Purchase Cost is a major component of cost as power is bought from various sources for the purpose of resale through Distribution Network.

A **power purchase agreement** (**PPA**), or **electricity power agreement**, is a contract between two parties, one which generates electricity (the seller) and one which is looking to purchase electricity (the buyer). The PPA defines all of the commercial terms for the sale of electricity between the two parties, including when the project will begin commercial operation, schedule for delivery of electricity, penalties for under delivery, payment terms, and termination. A PPA is the principal agreement that defines the revenue and credit quality of a generating project and is thus a key instrument of project finance. There are many forms of PPA in use today and they vary according to the needs of buyer, seller, and financing counter parties.

Key features of a Power and Energy Purchase Agreement (PPA)

A Power Purchase Agreement (PPA) secures the payment stream for a Build-Own Transfer (BOT) or concession project for an independent power plant (IPP). It is between the purchaser "off taker" (often a state-owned electricity utility) and a privately owned power producer. The PPA outlined here is not appropriate for electricity sold on the world spot markets (see Deregulated Electricity Markets below). This summary is focused on a base load thermal plant (the issues would differ slightly for mid-range or peaking thermal or hydro plants).

- Where a government agency enters into an arrangement for a private power company to establish a power plant and sell on the power to the government agency, the public agency typically enters into a PPA.
- The PPA usually takes the place of a BOT or concession agreement: in addition to obligations relating to the sale and purchase of the power generated, the PPA also sets out the required design and outputs and operation and maintenance specifications for the power plant.

Sale of capacity and energy - the power producer agrees to make available to the Purchaser the contracted capacity of energy and deliver the energy in accordance with the PPA.

Charges for Available Capacity and Electrical Output - the charging mechanism in the PPA is generally a pass through arrangement: the price charged for the power will consist of a

charge (availability charge) to cover the project company's fixed costs (including a return on equity for the project company) plus a variable charge to cover the project company's variable costs. The availability charge relates to the availability of the power plant and the variable charge is calculated according to the quantity of power supplied. The purchaser will want a guaranteed long-term output from the project and so the availability charge is typically the minimum that it will be paid, provided that the plant can be shown to make sure power available.

Third party sales - the ability to make third-party sales can enhance the finance ability of the project and cushion the purchaser against risks such as a reduction in the purchaser's monthly tariffs. This flexibility also has the advantage that, given the long-term nature of the PPA, if the market is deregulated at a later date then the PPA may not need to be completely replaced. However, purchasers are often nervous about allowing third-party sales as they want to be sure that all capacity is available to them at all times and so the PPA may include an exclusivity period during which all power producer is be supplied to the purchaser. Flexibility may need to be incorporated into the PPA to ensure that this exclusive period is not an impediment to future development/ deregulation of the electricity market. Exclusivity provisions in PPAs can create challenges for development of energy markets.

Underperformance and delays by power producer - the PPA may provide sanctions or require the power producer to pay liquidated damages if the power producer fails to deliver power as promised; in particular, if the construction of the project is not completed on schedule or does not perform as required when completed. Lenders will be concerned to ensure that liquidated damages do not have too damaging an impact on debt coverage ratios.

Force majeure or purchaser breach of contract - the power producer is usually not required to pay damages for delays resulting from events beyond its control.

Testing regime - this should be objective and designed to confirm levels of contracted capacity, reliability and fuel efficiency or heat rate, ideally certified by an independent engineer.

Termination - the PPA will need to provide for what happens on termination (whether at the end of the term of the agreement or early termination for default etc), including obligations of the power producer on hand-over of assets, calculation of buyout price for IPP (if this is contemplated), what happens to employees of power producer if IPP transferred to purchaser on termination.

Project operation - issues typically include scheduled outages and maintenance outages, operation and maintenance, emergencies and keeping of accounts and records.

Change of law - PPA should address impact on tariff in event of a change in applicable law and the mechanism for tariff adjustment. Lenders will be anxious to ensure that the cash flows of the project required for debt service are protected against changes in law

Merit Order Despatch (MoD):

The Merit Order Despatch is provided in National Tariff Policy and is a way of ranking the available sources of energy, especially electrical generation, based on ascending order of

price (which may reflect the order of their short-run marginal costs of production) together with the amount of energy that will be generated. In centralized generation management, the ranking is made so that those with the lowest marginal costs are the first ones to be scheduled to meet demand, and the plants with the highest marginal costs are the last to be scheduled. Dispatching generation in this way minimizes the cost of procurement of electricity. Sometimes generating units must be started irrespective of merit order, due to transmission congestion, system reliability, or other technical reasons.

Continuous decline of electricity production costs – in renewable power production – have caused the merit order sequence to shift, the conventional power plants have to bear the brunt. The effect is quite visible with the increasing feed-in of renewable energies (such as photovoltaic, wind energy, or biomass, and others). Fluctuating photovoltaic and wind power plants with marginal costs close to zero are advancing into the market and pushing conventional power plants toward the end of the merit order during peak load periods. The energy industry describes this phenomenon as the merit order effect (MOE) of renewable energies. Only the residual load – the remaining electricity demand that renewable energies cannot cover – must be provided by conventional power plants. The cost of generation from such conventional plants further increases as the efficiency of generation reduces considerably with a reduced load.

As the Distribution Companies are procuring power from various interstate and intrastate sources so the impact of transmission charges may become volatile depending upon the power scheduled from a particular source and the same can vary each day. In view of the schedules/revise schedules, Point of Connection (POC) charges may undergo a change in each revision and hence, many beneficiaries might end up paying higher POC charges then they are entitled to in case Merit Based Economical Despatch is not in place and it may give undue advantage to some players.

Merit Order Optimal Despatch (MOOD)

The economic load despatch i.e. the merit order optimal despatch (MOOD) is used to evaluate the plant level despatch so that the actual cost of generation and transmission for a prescribed schedule of the load could be envisaged. The objective of economic load despatch is to minimize the overall cost of generation and to supply the Economical power to the end consumer. Merit Order Optimal Despatch (MOOD) can thus be introduced to ensure the level playing field for all generators.

The CEA guidelines dated 08th June 2016 under case-II (Flexibility of utilization of Coal aggregated with one State in Generating Stations of other State's utilities) also provides that, 'The landed cost of power generated and delivered to the State transferring coal shall include corresponding fixed charges, variable charges and transmission charges at coal transferring State periphery and should be cheaper than the variable charge for the generation of electricity from the existing options of using the coal in their State power stations'.

The CEA guidelines dated 09th June 2017, regarding data formats for Merit Order Despatch Portal, also prescribe that 'Variable Cost shall be provided at State periphery.

Interstate power procurement attracts PoC Charges and Inter-State transmission losses. Presently there is no notification/ guidelines from the Government of India which provide for the nature of POC charges as a part of the fixed cost or variable cost. However, in petition No. 1070/2015 Uttar Pradesh Electricity Regulatory Commission has decided that variable charges should take into account the Transmission Charges and Transmission losses caused by each station and Fuel Adjustment Charges, if any, for the previous month for drawing the MoD stack. Maharashtra Electricity Regulatory Commission has also issued guidelines dt. 8th March, 2019 in this regard from where also the similar inference is drawn regarding the treatment of PoC charges. In view of the above PoC Charges and Inter-State transmission losses are to be considered in the marginal cost of ISGS power and other power projects located outside the State.

Distribution Companies has tied up Long term Access (LTA) agreement with the transmission companies for wheeling the power to their State from the sources outside the State. In some case such charges are including in the bidding price where the power from sources outside the State is provided at the State periphery at the contracted price.

Keeping in view the Demand Supply matrix and also the above provisions Distribution companies may relinquish the LTA, after doing cost benefit analysis, under Regulation 18 of the Central Electricity Regulatory Commission (Grant of Connectivity, Long-term Access and Medium-term Open Access in Inter-State Transmission and related matters) Regulations, 2009 to minimize the fixed cost burden and optimize the cost of power purchase.

Internal Auditor should look into the matter in the light of the above provisions and comment on the prudence check exercised by the power utilities.

5.2 TRANSMISSION OF POWER

Power Transmission Company is a service company providing access to transmit the power through their transmission network from power generator to the power distributor company. Transmission lines of 66kv and above are covered under the management of the transmission company. Power transmission is a huge capital investment infrastructure project and has become a natural monopoly and such is required to be regulated. Transmission of Power is a licensed business. The Appropriate Commission may, on an application made to it under section 15, grant a license to any person to transmit electricity as transmission licensee. If the transmission license is required for Intra State i.e. within the state, then SERC will grant the license and for transmission of power in two or more States CERC will grant license. Further Central Transmission Utility (CTU) or the State Transmission Utility shall be deemed to be a transmission licensee under the Act. Utility supplying power in more than one state is known as CTU, Power Grid is working as CTU in India. Utilities providing/ transmitting power within the State is known as State Transmission Utilities (STU). National Load Dispatch Centre (NLDC), State Load Dispatch Centre (SLDC) and Regional Load Dispatch Centre (RLDC) acts as frequency regulators in the respective area and are part of transmission network. CTUs are barred from taking Generation or trading of electricity business. However, STUs is barred from taking up the trading business only Transmission companies are generally Government companies, if Transmission Company is to be divested than the regulatory functions will be required to be separated from the transmission company.

Duties of Transmission licensees

Section 40 of the Act provides for the duties of the transmission licensees including the State Transmission licensee and the Central Transmission licensee.

It shall be the duty of a transmission licensee: -

(a) *To build, maintain and operate an efficient, co-ordinate and economical inter-State transmission system or intra-State transmission system, as the case may be;*

(b) *To comply with the directions of the Regional Load Dispatch Centre and the State Load Dispatch Centre as the case may be;*

(c) *To provide non-discriminatory open access to its transmission system for use by: -*

  (i) *Any licensee or generating company on payment of the transmission charges; or*

  (ii) *Any consumer as and when such open access is provided by the State Commission under sub-section (2) of section 42, on payment of the transmission charges and a surcharge thereon, as may be specified by the State Commission:*

All rules regarding the surcharge and cross-subsidy and exemption to the captive power plant are similar to the provisions of STU and CTU.

Other Business of transmission licensee

A transmission licensee may, with prior intimation to the Appropriate Commission, engage in any business for optimum utilization of its assets. It is also mandated that a proportion of revenue from any other business of the Transmission licensee shall be used for reducing the Charges for Wheeling of Electricity. The appropriate commission is empowered to provide for the details of the matter.

The transmission licensee shall also maintain separate accounts for each such business undertaking to ensure that transmission business neither subsidies in any way such business undertaking non encumbers its transmission assets in any way to support such business. To make the system of Open Access really meaningful it has been specifically barred from entering into contract or engaging in the business of trading of Electricity.

Transmission Tariff

CERC regulations will apply to all designated ISTS customers (DICs), ISTS licensees, National Load Despatch Centre (NLDC), regional load despatch centres (RLDCs), state load despatch centres (SLDCs) and regional power committees (RPCs). NLDC is the implementing agency (IA) for the computation of apportionment of transmission charges at various nodes or zones.

The basic principle of sharing of transmission charges among the DICs is to ensure that the YTC and related adjustments to the YTC are fully recovered. The transmission charges are to be divided into four parts – national component (NC), regional component (RC), transformer component (TC) and AC system component (ACC). The NC will be the sum of two sub-parts – NC-renewable energy (NC-RE) and NC-high voltage direct current (NC-HVDC). The RC includes RC-HVDC and reliability elements while the TC includes charges for interconnecting transformers planned for drawal of power by a state. These charges will be borne by the state. Finally, the ACC is divided into the AC-usage based component (AC-UBC) and the AC-balance component. The latter includes the balance charges for the AC transmission system after apportioning the charges for AC-UBC

The Central Electricity Regulatory Commission (CERC) has issued new guidelines for interstate transmission charges (ISTC) and losses. The calculation ISTC and loses is quite complex and need to understand the concept of interstate transmission system (ISTS) and the effect of each component stated in "Explanatory Memorandum" issued by CERC for Sharing of Inter-State Transmission Charges and Losses, thoroughly.

According to the regulation, transmission charges have four components as below: -

National Component (NC)

Regional Component (RC)

Transformer Component (TC)

AC System Component (ACC)

As observed in the Jha Committee Report that HVDC systems having control features provide flexibility and hence more stability to overall Grid, and that bipole HVDC lines have been strategically planned for not only bulk power transfer but to enhance the overall operational performance of the grid. Therefore, the Committee has suggested that 30% charges for HVDC bipole shall be shared among ISTS customers of all regions in the ratio of their LTA+MTOA (Under National Component of HVDC (NC-HVDC)) unless specifically directed otherwise by the Commission.

It is proposed that since HVDC have largely been created for bulk power transfer to a region, 70% of transmission charges of identified HVDC Transmission Systems shall be shared by DICs of receiving region (Under Regional Component of HVDC (RC-HVDC))

Brief description of the Terms used above: -

Grid: - Electric Transmission Grid evacuates power from generating stations located at various places across the country and transmits the same in high voltage to the consumers as per demand. Electric Transmission Grid keeps a balance between demand and supply of power across the country (National Grid).

Bipolar: - Bipolar dc link has two conductors; one is a positive conductor and other is negative as a return. Bipolar dc link is equal to double circuit three phase ac line.

LTA: - "long-term Access" means the right to use the inter-State Transmission system for a period exceeding 7 years.

MTOA: - Medium-Term Open Access means the right to use the inter-State Transmission system for a period equal to or exceeding 3 months but not exceeding 5 years.

DIC: - Designated ISTS Customers shall mean the users of any segments/elements of the ISTS and shall include all generators or load serving entities connected to the ISTS including generating stations, distribution licensees, State Electricity Boards (SEB), State Transmission Utility (STU), Bulk Consumer and any other entity/person.

Open Access: In order to promote competition and with the aim of one nation one grid, it would be desirable that, in whichever states the situation so permits, the State Commission shall introduce open access. Open accessallows large users of power typically having *connected load of 1 megawatt (Mw) and above* to buy cheaper power from the open market. The idea is that the customers should be able to choose among a large number of competing powers companies instead of being forced to buy electricity from their existing electric utility monopoly. To understand the concept open access, imagine a toll road

where the operator has a right to choose as to who can use the road. This will be anti-competitive and monopolistic venture. Similarly, open access would be anti-competitive and monopolistic if the Electricity Utility has these rights.

Open Access in Transmission

The Electricity Act 2003 provides Open Access in the transmission lines to promote competition in the bulk electricity market. The objective being Separation of Carriage (Fixed network like wires) from Content (Moving element like Energy).

Section 38 of the Act deals with the provision of open access to transmission and reads as follows:

"The functions of the Central Transmission Utility shall be – to provide non-discriminatory open access to its transmission system for use by (i) any licensee or generating company on payment of the transmission charges; or (ii) any consumer as and when such open access is provided by the State Commission under subsection (2) of section 42, on payment of the transmission charges and a surcharge thereon, as may be specified by the Central Commission"

Pricing Strategy for Transmission

The most appropriate pricing strategy for determining transmission pricing in a large country like India needs to balance between various objectives. Besides being simple and practical it must lead to efficient use of resources; must properly compensate the owner of the carriage business; must promote efficient use of resources. As India has newly opened up the market the Scheme must also provide level playing field to the new transmission utilities and entities using the transmission facility.

The market forces should be allowed to operate and create correct economic signals for the placement of Generation facility and new lines. The Concept based on congestion rent will not be appropriate because it incentivizes the transmission licensee to have constrains in his system. An ideal Transmission Service Charge (TSC) should be –

- Distance Sensitive
- Location Sensitive
- Direction Sensitive

The Open Access Wheeling Charges (OAWC) will encourage economic transactions, but this should not discourage transmission Charge based commitment otherwise who would invest in the National grid.

The Various methods of transmission pricing are -

- The Contract Path Method
- Incremental Postage Stamp Method

The focus of development has changed from regional to national. In transmission also the main objective is to develop a National Grid. Therefore, it is crucial that tariff design should also be based on a national pool. However, for strategic implications the design can have a regional system

The CERC Order of November 2003 provides for open Access in Inter-State Transmission. The salient features of the order are as follows-

(i) CERC will have jurisdiction to specify regulations for open access for inter-State transmission irrespective of who owns the assets. It is immaterial weather the conveyance of electricity is across the territory of an intervening State or the conveyance is within the state which is incidental to the inter-state transmission of electricity.

(ii) Existing postage stamp method of pricing to continue. It is also provided that the importing utility will pay in case of Inter-regional transaction. The CERC may modify its views on transmission pricing mechanism through consultation.

(iii) Long term customer will have allotment priority over the short term customer and within the same category the request for service of longer duration will get preference to use the transmission facility.

(iv) Nodal agency to facilitate the open Access for interstate transmission shall be CTU and RLDC. It is also provided that special energy meters shall be installed by the direct as well as the embedded customer.

5.3 DISTRIBUTION AND SUPPLY OF POWER (DISCOMS)

Electricity Distribution and Transmission Systems are considered to be natural monopoly in the power industry. However, through practical policies and regulatory reforms most of the demerits of a monopoly can be reduced to a negligible level. The Government's distribution strategy is meant to achieve distribution reforms. The focus is on system up gradation, loss reduction, theft control, consumer service orientation, quality power supply, commercialization, decentralized distribution, generation and supply for rural areas. Distribution of power is a licensed activity requires license from the State Commission.

Distributing electricity is the largest and most extensive business, requiring efficiency and attention to detail on a gigantic scale. These are issues of executive training, HR policies, and procedural constraints on decision making, financial expertise and commercial orientation. We can say essentially that the reasons for privatization in this sector are the same as in other sectors.

Rate of Sale of power approved by the Commission for the generating company or the contracted rate of power procurement is the main component of the cost of the Distribution Company and known as cost of power purchase. Transmission Company is the service providing company maintain and operating transmission lines of more the 66kv and wheeling power from the generator to the Distribution Company at the cost determined by the Commission. Cost Components of the transmission company are mainly of fixed in nature only. However, power feed at the input point and point of sale is never the same. This difference is called "Aggregate Technical and Commercial Loss (AT & C Loss)". This loss has to be analysed to quantify the Technical Loss and Commercial Loss separately. This accounting of energy in terms of quantity reconciliation is called "Energy Accounting". This is applicable to both, Transmission as well as Distribution. In addition to the above Distribution company also faces the distribution losses and collection losses on account of poor collection efficiency ratio. Normal AT&C and Distribution losses are allowed as a part of the consumer tariff by loading the same on the power sold as normal loss.

Losses of the Generating Company, transmission and distribution company beyond the prescribed norms are required to be retained by the respective company. In some case Commission after prudence check may allow to pass a part of the same to the consumer

through tariff. Gains on the techno commercial norms are required to be shared by the respective company with the beneficiary as per ration given in the Regulation.

Duties of distribution licensee

- To develop and maintain an efficient, co-ordinate and economical distribution system in his area of supply and
- To supply electricity on request in accordance with the provisions contained in the electricity Act 2003.
- In case electricity is supplied by another licensee the distribution licensee shall provide open access to the second licensee as a common carrier providing non-discriminatory open access.

Distribution Tariff

Electricity tariff is determined based on the provisions contained in (a) Electricity Act 2003 and (b) Tariff Policy notified by the Government of India. In case of generating stations within a state, tariff is determined by the respective State Electricity Regulatory Commissions.

Power to recover charges

1. The prices for the supply of electricity in accordance with tariffs fixed by appropriate commission from time to time and conditions of his license.
2. The charges for electricity supplied by a distribution licensee may include: -
   a. A fixed charge in addition to the charge for the actual electricity supplied;
   b. A rent or other charges in respect of any electric meter or electrical plant provided by the distribution licensee.

Distribution business include supply of electricity which is governed as per the Electricity Supply Code

The Electricity Supply Code shall consist of –

- To provide for recovery of electricity charges,
- Intervals for billing of electricity charges,
- Disconnection of supply of electricity for non-payment thereof
- Restoration of supply of electricity,
- Tampering, distress or damage to electrical plant, electric lines or meter
- Entry of distribution licensee or any person acting on his behalf for disconnecting supply and removing the meter,
- Entry for replacing altering or maintaining electric lines or electrical plant or meter.

Meter Reading, Billing and Collection in Distribution

This is a very peculiar feature in accounting of Distribution Companies (DisComs). The company has to be very careful while feeding the Master Data of consumers, wrong feeding of which may affect the entire billing. Correct reading of meter, its recording, checking billing history;

accurate billing to the consumer, collection, rectification of wrong billing and attending consumers complaints are important events in case of Distribution. It is important that testing should be done of sample Baseline data and meter reading, Billing & Collection, Energy Accounting etc., either from manual system or SCADA. Auditor has to make observations on metering of Distribution Transformers and Feeders as well as Feeder separation and also observations on Load flow analysis, Load projection, Load Balancing and Load Bifurcation.

Service Line Contribution / Service Line Deposits / Service connection fees

Consumers are required to deposit some amount at the time of applying for new connection. The charge for the same depends upon the connected load and others factors. Regulator decides a normative charge for the same based on connected loads of the consumer. The utility company charges to the consumer based on the normative rates and keep the same as Service Line Contribution / Service Line Deposits / Service connection fees as liability. The service line laid by the utility for giving new connections to consumers are capex in nature and the expenditure is capitalised in the books and charged depreciation on it. It is not possible to correlate the capital expenditure made and the amount paid as Service Line Contribution / Service Line Deposits / Service connection fees by consumer on case-to-case basis. The proportionate amount of depreciation on Service Line Contribution / Service Line Deposits / Service connection fees needs to be transferred from depreciation and shown as an income.

Open Access in Distribution

Open Access has widely been recognized as the most important provision under the Electricity Act 2003. The National Electricity Policy and Tariff Policy framed under the EA suggested proper implementation of Open Access framework which has the potential to enable consumers to receive power from any source of their choice.

The Central Electricity Regulatory Commission (CERC) has framed regulations on inter-State open access. At the State level; regulations have been framed by the State Commissions, phasing out open access for consumers. Transmission charges, wheeling charges and surcharge have also been determined by most State Electricity Regulatory Commissions (SERCs). The Open Access in India according to The Electricity Act is only for surplus capacity.

Section 42 of the Act deals with the provision of open access to distribution and reads as follows-

"The State Commission shall introduce open access in such phases and subject to such conditions, (including the cross subsidies, and other operational constraints) as may be specified within one year of the appointed date by it and in specifying the extent of open access in successive phases and in determining the charges for wheeling, it shall have due regard to all relevant factors including such cross subsidies, and other operational constraints (subsection (2))

Open Access Charges

If the consumer and generator mutually decide to come together for sourcing electricity, they can do it by using transmission and distribution network provided they have paid required charges to the respective entities. The key applicable open access charges are:

Energy Charges: The cost of power purchase required to be paid to the power generating company in accordance to the Power Purchase Agreement.

Cross Subsidy Surcharge

Cross subsidization is the practice of charging higher prices to one group of consumers in order to subsidize lower prices for another group. In accordance with the National Electricity Policy, consumers below poverty line who consume below a specified level may receive a special support through cross subsidy. Tariffs for such designated group of consumers are at least 50% of the average cost of supply.

A consumer who is permitted open access will have to make payment to the generator, the transmission licensee whose transmission systems are used, distribution utility for the wheeling charges and, in addition, the Cross Subsidy Surcharge. The computation of cross subsidy surcharge, therefore, needs to be done in a manner that while it compensates the distribution licensee, it does not constrain introduction of competition through open access. A consumer would avail of open access only if the payment of all the charges leads to a benefit to him. While the interest of distribution licensee needs to be protected it would be essential that this provision of the Act, which requires the open access to be introduced in a time-bound manner, is used to bring about competition in the larger interest of consumers.

Transmission charges and transmission losses

The Objective of transmission charges and transmission losses is to get the transmission system users to share the total transmission cost in proportion to their respective utilization of the transmission system. Most of the State Electricity Regulatory Commissions have determined transmission charges applicable for Open Access consumers in Rs./MW/month, except a few which have determined in Paisa/unit. Most of the Commissions have approved Transmission Charges for short term open access as 25% of the Transmission Charges applicable for Long Term Open Access. These charges are paid to CTUs/STUs.

Wheeling charges and distribution losses

These charges help the distribution company to recover the costs that it has incurred for distribution of electricity. State Electricity Regulatory Commission determines Wheeling charges and distribution lossescompensation for each voltage level (e.g. 11KV, 33 KV, etc.). Transmission and wheeling charges depend upon the point of connection of the load and the point of injection where the generator feeds the power generated into the grid. These charges are recovered by the Discoms.For example,

1. If the generator and consumer both are connected to the transmission network, then they will only have to pay transmission charges and will not have to pay wheeling charges and vice versa.
2. If the generator is connected to the transmission line and consumer is connected to the distribution line, then they will have to pay both transmission and wheeling charges
3. If the generator is connected to the distribution line and consumer is connected to the transmission line, then they will only have to pay transmission charges.

Additional surcharge

Additional surcharge is an extra charge that an Open Access consumer has to pay the utility company to recover the fixed costs towards its stranded capacity. In other words, these charges are paid to the Discoms to compensate their supply obligation. As per the National Electricity policy, additional surcharge should not be so onerous that it eliminates competition which is intended through Open Access. As per National Tariff Policy, (1)

Additional Surcharge should be applicable only if it is conclusively demonstrated that the obligation of a licensee in terms of existing power purchase agreements has been and continues to be stranded; or (2) There is an unavoidable obligation and incidence to bear fixed costs consequent to a contract, (3) Fixed costs related to network assets would be recovered through Wheeling Charges.

In addition to this, there are other open access charges too. These are Default Supply Charge, Balancing Market Charge, Open Access Application Charges and State Load Dispatch Centre Charges. These charges vary across different states.

Scheduling and System Operation Charges:

These charges are to be paid to the system operator for the work of frequency regulator NLDC, SLDC, RLDC.

Trading Margin:

As per the Agreement.

Application Fees:

One time fees as per regulations.

POLR charges:

These charges are standby charges to be paid to the Discoms for acting as provider of last resort (POLR).

Taxes:

As levied by the State Govt. from time to time.

Availability Based Tariff & Open Access

The Implementation of Availability Based Tariff has put in place The Day ahead (Scheduling) Market for entire India. Though it took some time to implement the same in all regions of India but it is great achievement and a stepping stone for further reforms in the Power Industry. Due to ABT there is a mark shift in the transmission Charge from usage based transmission Charge to Access based transmission Charge.

Revenue Audit in Power Distribution utilities

The two billing or revenue departments, i.e. L. T. Revenue Unit and H.T. Revenue Unit, are the marketing and distribution department in a power distribution company. They are responsible for billing and collection of revenue from consumers.

Audit of L.T Revenue Units:

L.T Revenue unit covers the consumers having connected loads up to 75HP / 56KW (& up to 150Hp in case of LT Category IIIB consumers) who are availing their supply of electricity in 220/440 voltage (LT) lines. Frequency of Billing is monthly & Bi-monthly.

Review of Internal ControlSystem

The functions in a LT Revenue unit / center are generally segregated into:

- Release of newservices
- Measuring the electricity consumption
- Billing the electricity consumption
- Distribution of Bills to the consumers
- Collection of dues from consumers
- Depositing the collections into bank
- Transfer of Funds to Head Office

In each of the above functions there must be a proper system of internal control to ensure that there is no scope for lapses. Internal auditor has to study the function-wise duties & responsibilities for personnel engaged in revenue units as enunciated in the Revenue Booklet and duties & responsibilities of officers.

Review of Meter Reading Books

Review of Meter Reading Books is a vital area where the application of Analytical Review procedures such as comparative analysis & trend analysis would be of much help.Important issues to focus:

- Meter changes(MC)
- Struck-up meters(MS)
- Burnt Meters(MB)
- Meters witherrors
- Reading not furnished(RNF)
- Door Lock cases(DL)
- Sluggishness / Consumption less than usage(CLU)
- Multiple meters for singleservice

Review of Billing of the ElectricityConsumed

While verifying the Billing the following factors shall be kept in view:

- Category ofBilling
- Purpose ofSupply
- Unit Rateapplied
- Applicability of FixedCharges
- Applicability of various Surcharges such as Power Factor Surcharge, Capacitor Surcharge, Surcharge on Uncollected ACD, Surcharge for delayed paymentsetc

Importance of Master Data / Basic Documents

During the course of Audit, the following documents are very vital for the purpose of Billing:

- Test Report

- Agreement with the Consumer, ifany
- Breakup of Load into Plant Load & LightingLoad
- Availability or otherwise of the Capacitors and itsrating
- Multiplication Factor of theMeter
- Existence of Terminal CoverSeals
- Pole Number, structure code of the DRT & Feedercode

Audit of LT RevenueUnit

The Audit of LT Revenue Unit will consist of three segments:

(a) **Transaction Audit:** This segment will cover all relevant transactions viz., Measurement of Energy, Billing, Accounting, Collection of Dues, and Banking of Duesetc.

(b) **Systems Audit:** This segment will cover the aspects of Review of Internal Control System, Assessment of the existing controls, suggestions on further controlsetc.

(c) **Compliance Audit:** This segment will cover the aspects of status of compliance with the guidelines / instructions / rules & regulations issued statutory & Regulatory Authorities / Management.

Audit of HT Revenue Unit

High Tension (HT) Revenue unit covers all consumers who have loads more than 75 HP / 56KW. The HT consumers will avail supply in 11KV / 33KV / 132KV voltages. Frequency of Billing is monthly.

Review of Internal Control

The auditor should ensure that the laid down system of Internal Control is being implemented properly. Since the number of consumers is less and the value of transactions is high, risk involved is also high and therefore, he should verify 100% of the billing aspects of these consumers. Further, the Internal Check should be more objective rather than the repetition of the same Check.

Important features of HT Billing

The features, which are very vital for HT Billing are

(a) Voltage of Supply (Viz., 11KV / 33KV /132KV)

(b) Contracted Maximum Demand / Recorded MaximumDemand

(c) Load Factor (for the purpose of allowing Incentive toconsumers)

(d) Restrictions on Lights & Fansconsumption

(e) Billing of Colony consumption at a separaterate

(f) Minimum off-take and Billing (in cases of consumption less than the specified level)

(g) Open Access (allowing a consumer to purchase electricity from third party using the network of thecompany)

(h) Import & Export of Electricity (in case of Billing of consumers having Captive PowerPlants)

Important areas tofocus

(a) Deration (decrease) of Loads (CMD) and its impact onbilling

(b) Enhancement (increase) of Loads (CMD) and its impact onbilling

(c) Termination of Agreement and sanction by competentauthority

(d) Lighting Load whether segregated ornot?

(e) Metering of Colonyconsumption

(f) Levy of Fuel Surcharge Adjustment and its accounting treatment as Prior-period Income / Charge

(g) Levy of Cross Subsidy surcharge & Additional Surcharge in case of OpenAccess

(h) Levy of SLDC Charges in case of Persons operating Capital Power Plants (CPPs) and export of energy to the DISCOM / StateGrid

Review of Agreements withConsumers

The service agreement with the consumer shall be reviewed at periodic intervals as there may be changes in the business of the consumer or there may be changes in the Tariff conditions / Principles of Categorization for Billing.

Periodic review of position of Loads for HT Category VI

For HT Category VI (for Townships & colonies) there is no fixed charge and the tariff is also low. It is essential to review the position of Loads for HT Category VI Consumers as there are restrictions on loads for Street lighting, Water works and Sewage works and for Non-Domestic/ commercial & general purpose. Any event of exceeding the limits would disentitle the consumer to be billed under HT Category VI.

The distribution and supply business is again divided in to two parts. One is Wire / Network business and other is Retail Supply/ Commercial business.

Distribution "Wires/ Network business" means the business of operating and maintaining a distribution system for wheeling of electricity in the area of supply of a Distribution Licensee.

"Retail Supply/ Commercial business" means the business of sale of electricity by a Distribution Licensee to its consumers in accordance with the terms of its Licence.

As per convenience, all the activities involved in the entire network system for distribution of power just before meter in the premises of consumer can be considered as Wire / Network business and all the activities from meter to billing, customer care, cash collection etc. including power (electricity-purchase & sales) can be considered as Retail Supply/ Commercial business.

Based on the concept it is certain that in near future Regulators will insist on two separate licenses of distribution and supply utility for better control.

Internal Auditor should ensure that all the expense / income due to Wire / Network business and Retail Supply/ Commercial business has been booked properly. In case of expenses which are common in Wire / Network business and Retail Supply/ Commercial business the proper allocation method is to be adopted and followed consistently.

5.4 POWER TRADING

Transaction of power where the price is negotiable and option exist about whom to trade with and for what quantum. This can be called power trading in a generic sense. Due

to development of power market a secondary market has also developed for financial transaction such as hedging and futures trading. The Electricity Act 2003, defines trading to mean-

Purchase of electricity for resale thereof and the expression "Trade" shall be construed accordingly;

The definition is very simplistic which talks about only physical trading and excludes any mention of financial trading. The secondary market for trading hopefully will be covered in the National Electricity Policy.

Opportunities for Power Trading

India has vast potential in the field of Power Trading. In short, the impact of trading can be felt in following areas.

(i) Generation of Power by hydro power stations is weather sensitive. This causes surplus in high hydro season and shortage in low hydro season. This can be leveraged by trading entities.

(ii) Demand of power is weather sensitive in general and time sensitive in metropolitan areas, this also creates opportunities for an electricity trader.

(iii) Captive Power Plants and few upcoming Merchant Power Plants have substantial surplus capacity which can leverage for trading activities.

A person who has been granted a license to undertake trading in electricity can trade in electricity.The Distribution licensee has been specifically exempted from taking a separate trading license. On the other hand, following entities have been excluded from trading in electricity:

- The National Load Dispatch Centre
- The regional Load Dispatch Centre
- The State Load Dispatch Centre
- The Central Transmission Utility
- The State Transmission Utility
- A Transmission Licensee

Power Exchange

CERC has permitted trading of electricity through power exchanges w.e.f. June 2008. As on date Indian Energy Exchange and Power Exchange of India Limited are working in this business.

Types of Power Trading:

Wholesale Trading and Retail Trading can also be separated. However, in the developed electricity market there are various types of power trading. Some of the instruments used in Trading of Electricity can be –

1. SWAP System
2. CAP System-Insurance and Hedging for Distribution Licensee
3. FLOOR System – Insurance and Hedging for Generators
4. CALLER System- Combination of CAP and FLOOR
5. Time of day Trading – PTC has introduced the concept.

Internal Audit of Power Industry (Functional & Management Areas) 6

This Chapter includes:

6.1 AUDIT OF WORKS AND PROCUREMENT CONTRACTS

Sl. no.	Document Checklist	Yes	No	N/A	Notes
1.	Examine whether proposals for the procurement of material or services has been timely initiated keeping in view the procurement lead time as recommended in the corporate guidelines				
2.	Examine whether an approved list of contractors / suppliers has been drawn up, reviewed and updated every year as per organization's policy				
3.	Examine the basis adopted for determining the quantities to be procured from the point of view of their availability in stores/other projects, quantity discounts etc.				
4.	Examine whether open tenders (NIT) have been floated for all cases until and unless otherwise provided for. Deviations if any have been approved by the competent authority or not				
5.	Examine whether tenders have been floated On-line as per the Corporation instructions following due tendering procedures				

6.	Examine and comment on the incidence of single tender/ nomination basis/ proprietary basis awards				
7.	Examine whether estimates have been properly made out as per the prescribed procedure				
8.	Ascertain whether reasonability of rates is established before award of contract. Financial concurrence has been obtained before procurement award				
9.	Verify whether the comparative statement which shows the evaluation of the tenders has been drawn up correctly				
10.	Examine whether deviations taken by the tenderers have been properly loaded for evaluation of the bids. Examine whether late tenders / delayed tenders have been accepted and whether post-bid letters / communications for the purpose of evaluation have been considered				
11.	Examine the cases where the lowest evaluated commercially and technically responsive tenders have been overlooked and whether the same are justifiable				
12.	Verify whether the Delegation of Powers have been followed strictly. Whether procurement proposal has been deliberately split to avoid the approval of higher authorities				
13.	Examine whether any approved qualifying requirements (QR) were set before invitation of bids / offers and whether successful bidders meet the QR completely in all respects				
14.	Verify whether instructions for release of EMDs of unsuccessful bidders have been issued immediately after approval / rejection of the award by the Competent Authority				
15.	In case of On-line tendering, whether the due amount of tender fee/ EMD has been credited in the account of the organization within the specified timeline. Whether Tax collected on the tender fee has been deposited with the appropriate authority				
16.	Verify whether initial advance, interim advance, mobilization advance and secured advance etc. have been released in accordance with provisions of the LOA and have been given with approval of Competent Authority and the same are being adjusted regularly from the running account (R/A) bills				
17.	Exception report in cases where the mobilization or any other advance was released but the supplies there against have not been received in the due course of time or adjustment has not taken place with the comments of executive agency				

18.	The method adopted for accounting of scrap generated may also be examined				
19.	• Test check running account bills submitted by the contractors to ensure: - • Bill has been verified and Approved by the Competent Authority. • Satisfactory performance certificate from the Executive in charge regarding completion of work by the contractor as per the terms of contract, wherever applicable, • Material reconciliation statement has been signed by the Corporation and Contractor without any condition, • That proper record has been maintained for controlling the materials issued to the contractor on loan and the unused material has been received back in good condition before making final payment to the contractor., • The payments are in line with rates provided in the contract and the quantity recorded in the Measurement Book, • That escalation bills are paid as per applicable indices, with reference to the formulae mentioned in LOA. • Recoveries on account of income-tax/ works tax deducted at source, • Retention of liquidated damages in case of delays, • Recovery for excess consumption of construction materials etc., • Recoveries on account of rent, electricity, hire charges on equipment and interest on the advances, if any. • Where GST or other taxes are payable extra, it should be ensured that payment is released against the Tax invoice. • Where rates are inclusive of transit insurance it should be ensured that the supplier has submitted the insurance cover. In case it is not submitted by the supplier appropriate recovery/ adjustment for the same has been made from the bill. Where the amount of transit insurance is not specified in the P.O., the rate of insurance as defined in the purchase regulation for the purpose of comparative statement can be taken as base.				

20.	Review in detail, the legitimacy of the payments on account of escalation and extra claims due to: • Changes in item rates/duties/Taxes • Changes in quantities executed • Changes in scope of work • Changes in payment terms				
21.	Verify whether the L/C charges are in accordance with the charges negotiated by Headquarter with bankers				
22.	Verify whether material lying with Contractors have been taken over in time after execution of the contract				
23.	Hire charges in respect of vehicles being used by contractors / other outside parties are to be deducted from their bills. Auditors should verify whether proper records are being maintained by sites for determining the period of use of such vehicles and whether deductions are actually being made from contractors' bills for the period of use by the contractor				
24.	Analyse the pending running account / final bills / escalation or price variation bills and comment on their pendency along with reasons				
25.	Examine whether proprietary and standardized purchases have been properly regulated as provided in the Purchase Regulations, Highlight cases of increased cost due to delay in processing of purchase indents				
26.	Check that emergency/local purchase were justified, not excessive and were made according to the prescribed procedure • Auditors should check if there are any purchase orders placed on suppliers which have not been executed by them. Auditors should comment on the follow-up action being taken by the unit concerned. Auditors should also comment on action taken for procurement of the items not supplied by parties on whom PO's have been placed from other sources along with details of additional cost incurred and penal action taken against defaulting suppliers. • Examine whether Guarantee/ Warrantee registers are appropriately maintained and claims for defective material are being timely lodged with the suppliers.				

Checklist

Sl. no.	Document Checklist	Yes	No	N/A	Notes
1.	Examine the EMD Payable and the mode of payment with the BG/DD's Register.				
2.	Verify and ensure that the quantity of materials purchased is commensurate with actual field requirement to ensure that there is no over stocking /stock-out				
3.	Verify the correctness of the name of the supplier mentioned in the bill with that as per Purchase Order				
4.	Verify the Purchase Order No. & Date mentioned in the bill with that as per Purchase Order				
5.	Verify the material specification mentioned in the bill with that as per Purchase Order				
6.	Cross verify the contents of Delivery Challan i.e. the details of material dispatched, with that as per invoice/bill				
7.	Obtain a copy of Stores Received Book which is duly attested in token of acknowledgement for goods received and cross verify the receipt of material at stores with the material dispatched as per Delivery Challan				
8.	Abnormality in quantity purchased with respect to physically available stock in stores is to be verified upon for proper analysis				
9.	Verify the correctness of rates claimed in the bill for material supplied with the agreed rates				
10.	Abnormality in rates claimed is to be verified in depth into with reference to previous purchases of similar material and correctness of such rates is to be verified				
11.	Verify whether the agreed delivery terms are compiled by the supplier				
12.	Verify whether the bill has put for payment as per the due dates for Payment				
13.	Whether price variation rate claimed as per the approved orders				
14.	Are the rates claimed with reference to contract/ agreement and subsequent amendments?				
15.	Is the sanction for purchases made in accordance with Delegation of Powers?				
16.	Verify whether there is a budget provision for the material intended for				

17.	Is the indent placed before approved suppliers/ tenders?				
18.	Are the suppliers in registered suppliers' list possess recognition from Competent Authority for standard in quality				
19.	Are tenders called for in respect of material intended for purchase?				
20.	Is the bill limited to the quantities as per purchase order/agreement?				
21.	Is the penalty clause and calculation thereon included in the bill for delayed supplies?				
22.	Is the copy of check measurement certificate from competent authority enclosed to LOA application?				
23.	Is a statement of advance payments and recoveries from suppliers prepared and attached to LOA application for necessary adjustments in bill/ payment?				
24.	Is a copy of bank guarantee submitted by supplier enclosed for verification and necessary action				
25.	Are the rates of centralised items purchased in line with the Purchase Orders of Corporate Office				
26.	Are the purchases supported by indents from the field or with a Management decision? • Whether the cash discount clause is properly taken into account for payments being made within stipulated time. • Review of process of Tendering and Ordering system • Review of procedure for purchase (refer Purchase Manual) • Review of Internal Control System in the Stores • Audit of Pricing of Issues &returns • Review of valuation of Inter-stores transfers • Review of ABC analysis, Age-wise analysis • Review of levels of inventory • Periodic physical Verification of Inventory				

6.2 AUDIT OF STORES DEPARTMENT

Sl. no.	Document Checklist	Yes	No	N/A	Notes
1.	Whether inventory is maintained keeping in view various levels of inventory i.e. Maximum level, minimum level and re-ordering level. Monitoring and control of inventory is done by scientific methods or not such as ABC analysis etc				
2.	Comment whether proper records are being maintained relating to receipts, issues and balance of materials. The materials must be properly segregated and stored. Proper codification of all items of materials is to be done so as to identify each item with its specification and description separately				
3.	Whether the issues from stores are to be properly valued so as to assess the consumption of the material. Various methods of valuation are in existence such as LIFO, FIFO, Weighted Average, etc. Most of the organizations follow the Weighted Average Method for pricing of issues. Similarly, proper records must be maintained for returned materials and its disposal				
4.	Materials being received at site are acknowledged through Goods Received Note (GRN) and taken into physical inventory in the Stores (prior to quality clearance). On quality clearance, material is booked into stock available for issue, i.e., Store Receipt Voucher (SRV) is generated. Auditors should examine and comment upon delays in carrying out both the subsequent movements				
5.	Examine and comment on cases pending quality clearance for more than six months				
6.	Examine and comment on old cases of material-in-transit lying as an open item in GR/IR clearing				
7.	Review and comment on the reasonableness of number of old cases of materials rejected upon inspection where advances have been released. In case of rejected material whether Inspection and other related cost have been recovered from the contractor. Reporting.				
8.	No surplus of store of one item is adjusted against shortage of other item. Shortages and surplus of store has been properly accounted for as per the departmental instructions				

9.	Whether Quantity ledger maintained in the store department has been reconciled with the value ledger maintained in the Finance Department at the end of each financial year. Delay and deviation if any should be reported				
10.	Comment on investigations pending along with the reasons				
11.	Auditors have to verify that whether the unit is following the policy/guidelines for Disposal of Obsolete/limited shelf life/ unserviceable spares / stores				
12.	Verify whether Surplus and Scrap Identification and Disposal Committee (SSIDC) has been constituted as per guidelines and whether such SSIDC is functioning regularly. Also examine the action taken by site on the report of the committee				
13.	Comment on the layout and maintenance of the store i.e. whether the store items are will arranged and place in the allocated bins. Bins are provided with identity tag indicating the brief description of the material and stock code				
14.	Examine whether the quantity ledger of the stock item is immediately updated after issue of SMB or SR. Exception should be reported				
15.	Whether a register is being maintained for the disputed items which could not be taken on the books due to any reasons. Whether payments has already released for such material if so what action has been initiated for the refund/ adjustment thereof				
16.	Whether periodic physical verification of Inventory is being done and variation if any are being reported and accounted for				
17.	Whether aging and analysis of the stock is being done regularly. What action has been initiated for the expeditious disposal of such inventory? Reasons of the stock items become obsolete should be reported				
18.	Whether the inventory lying in store including MAS is being shared regularly with the other users of the project and also with other projects				
19.	Whether physical verification of the T&P is being done at the end of each financial year and shortage/ surpluses if any are being accounted for				
20.	Whether inter-unit or inter store transfer of material, which must be properly documented and recorded				

6.3 AUDIT OF FINANCE, ACCOUNTS AND TREASURY DEPARTMENT

Review of General Ledger and Sub-Ledger

Sl. no.	Document Checklist	Yes	No	N/A	Notes
1.	Review and comment on old/odd balances appearing in the General Ledger and Sub-ledger				
2.	Examine whether the accounting treatment followed by the unit for accounting of mandatory spares, furniture, fixture and scrap is proper, reasonable and in line with the accounting policy				
3.	Examine whether the company is regular in depositing undisputed statutory dues including Provident Fund, Investor Education and Protection fund, Employees' State Insurance, Income-tax, GST and any other statutory dues with the appropriate authorities				
4.	Examine whether bank balances being maintained by the unit are in excess of normal requirements of the unit				
5.	Inter-unit / Inter-Company transfer advice report is being taken regularly by the unit and the advices are being regularly followed up by the unit. Periodic reports duly followed up and verified are to be maintained by the units. Auditors should examine and comment on the same				
6.	Auditors shall verify whether Units are obtaining confirmation and prepare statements of reconciliation of balances as on 31st December of the financial year under advances, claims, deposits, creditors and debtors, and materials in transit / under inspection and with contractors/ fabricators. Whether adjustments in the Books of Accounts upon such confirmation/ reconciliation have been made				
7.	Auditors should verify and indicate whether Contingent Liabilities are appropriately quantified as per the laid down procedure				
8.	Verify whether the payment of any liability unpaid for more than three years has the approval of the Head of Project				
9.	Verify Bank reconciliation is being done regularly				

10.	Ascertain whether all relevant Accounting Standards are being followed by the unit and comment on the same				
11.	Check whether all repairs and maintenance are entered in log books/registers maintained for vehicles, office equipment's, air-conditioners etc				
12.	Check all purchases (furniture, office equipment, printing and stationery) have been made in accordance with the prescribed norms and procedure				
13.	physically the stocks of printing and stationery				
14.	Check the records maintained for the use of vehicles and ensure that log book for each vehicle is maintained properly, consumption of fuel, oil parts etc. are in accordance with norms and that repairs are not excessive. Fuel consumption is checked after every refilling of fuel tank				
15.	Check that recovery of charges for private use of vehicles is being made in accordance with the rules				
16.	Check that proper records are maintained for electricity and water bills, telephone and telex bills etc. and are correctly certified for payment with reference to consumption /use				
17.	Proper classification, as Revenue or Capital Expenditure, is very important because while approving the tariff proposal, the State Electricity Regulatory Commission (SERC) considers each head of expense as to whether the expenditure incurred is within reasonable limits. The SERC analyses details given by the power utility in its tariff petition and prescribes operational as well as financial norms. For instance, SERC specifies operational norms for coal consumption, specific oil consumption, auxiliary power consumption, etc. Similarly, it also specifies financial norms for power utility like Repairs and Maintenance as specified % age of asset base. If any capital expenditure is wrongly booked as revenue expenditure, then the utility may lose the revenue on account of depreciation as well as return on its equity as well as will be put to loss on account of disallowance of excess expenditure. Auditor should comment on its appropriateness				

18.	Verification of Capital Expenses incurred vis-à-vis Delegation of Powers and Indian GAAP. The following are basic principles to be considered by the Internal Auditor, while doing the audit of Capital Expenditure • Ensure that the expenditure has enduring benefit. • Ensure that the Capital Expenditure has proper Budget allocation. • Ensure that the Capital Expenditure incurred is within the Delegation of Powers to the respective authority. • Ensure that the instructions issued for capitalization are properly beingadhered.				
19.	Ensure that for Turnkey works (both fully and partial) the cost of asset is accounted in the respective divisions books (even though the amounts spend by the consumers) and the corresponding credit is shown as Consumer Contribution for CapitalWorks				
20.	With regard to the Fixed Assets Register, internal audit should verify the following: • Examine whether segregation of assets leading to the main classification has been properly done. • Whether depreciation has been charged at applicable rates on all assets. • Verify whether physical verification of fixed assets has been done in accordance with the system laid down in this regard. • Whether adjustments on account of discrepancies observed on physical verification and additions / sales / adjustments have been properly reflected in conformity with CARO, 2003 or amended from time to time. • Whether procurement and other related costs have been properly identified with the respective assets				

Checklist for Audit of Borrowings and Grants-in-Aid

Sl. no.	Document Checklist	Yes	No	N/A	Notes
1.	Verify the Funding options available for the project (capital expenditure), if Internal Accruals are insufficient then only borrowings would be justified				
2.	Ensure that the conditions attached to borrowings are not prejudicial to the interests of the company				
3.	Ensure that the conditions attached to borrowings are not prejudicial to the interests of the company				
4.	Ensure that all the loan covenants are appraised to the Board for according proper sanction				
5.	The following factors are very vital for any borrowing: a) Rate of interest (simple or compounding); b) Tenure of the loan; c) Moratorium period; d) Put / call options attached; e) Documentation charges & commitment charges; f) Pre-payment charges; g) Interest on overdue instalments; h) Penal interest for failure to adhere to certain conditions				
6.	Ensure that the Policy framework for inter-corporate borrowings formulated by the Investments/ Borrowings committee of the management is duly adhered to				
7.	While selecting a funding agency ensure that the recommendations of the Committee / Board are followed				
8.	In case of Borrowings in Foreign Funding agencies (ECBs) ensure that the provisions of Foreign Exchange Management Act and the guidelines of Reserve Bank of India are followed				
9.	EnsurethatAS-11on"AccountingforForeignExchange Transactions"iscompliedwithwhile accounting for the Borrowings in foreign exchange and their end use				
10.	In case of Grants-in-aid check whether the same is treated as Equity and the procedure for issue and allotment of shares is duly followed. Documentation, Hypothecation/ pledging of assets and creation of charge etc.				

11.	Servicing the Borrowings (Payment of Interest / Principal);				
12.	Payment terms and other conditions attached thereto. Issue and allotment of Equity, if envisaged;				
13.	Adherence to conditions attached with the Grants-in-aid;				
14.	Compliance with Accounting Standards.				

Checklist for Audit of Projects & Construction Activities

Sl.no.	Document Checklist	Yes	No	N/A	Notes
1.	Verify the Project Feasibility Report and examine the following factors: a) Total Project Cost (including pilot project cost); b) Total Resources required and available; c) Composition of Resources into Equity and Borrowed funds; d) Ensure that the IRR of the project is more than the Cost of Capital of the Company; e) Ensure that the project with shortest pay back has been selected; f) Ensure that the Risks associated (e.g. inflation, availability of materials etc.) are also properly factored; g) Ensure that the projections prepared reflect the inherent assumptions underlying the project; h) Ensure that the Net Present Value from the project is positive; i) Ensure that the Moratorium period for the project is properly negotiated and is reflected in the payment schedule; j) Ensure that correct Corporate Tax rate is applied for arriving at the Profits after Tax (not just MAT rates)				

2.	Verify the prudence in the Selection of Funding Agency: a) Ensure that a comparison chart is prepared listing out the various conditions and their financial impact; b) Verify the loan covenants to ensure the options for conversion of Debt to equity; c) Verify the Documentation for Borrowing of funds and the charges created along with the hypothecation / pledging of assets; d) Verify the loan sanction letter and the drawing schedule; e) Ensure that drawing of funds is as per the schedule and there are no over / under drawing of funds; f) In case of levy of commitment charges enquire about the reasons for non-drawing of funds and ensure that the same is also capitalized as part of finance charges				
3.	Ensure that Performance guarantee is insisted and EMD is forfeited in case of failure to execute the project as promised				
4.	Ensure that the statutory Deductions / obligations like EPF, workmen compensation etc., are to the Contractor's account				
5.	Ensure that in case of composite contracts of Purchase of equipment and erection thereof proper treatment of Service Tax (by claiming applicable abatement) and VAT (treatment of works contracts provisions) are properly done duly referring to latest circulars / notifications / advanced rulings by appropriate authorities				
6.	Ensure that the omissions pointed by the Quality Control (QC) Wing are rectified by the contractor or else applicable recovery has been affected				
7.	Ensure that Performance Guarantee period clause is also insisted.				
8.	Project feasibility study based on the need of the project.				

9.	Project finalisation and selection of contractors / partners for execution.				
10.	Selection of sources of funding (equity / borrowings) and mobilisation of resources as well.				
11.	Project implementation which involves allocation of works contracts				
12.	Review of progress of works (both Financial and Physical progress)				
13.	Coordination with the funding agencies				
14.	Documentation with the Contractor like execution of Performance bank guarantee & insurance cover for the works				
15.	Check-measurement of the works done / in progress				
16.	Passing of bills for payment (part &final)				
17.	Adherence to QC recommendations				
18.	Compliance with statutory obligations for various deductions & adherence to conditions of the agreement				

Checklist for Audit of Expenditure

Sl.No.	Document Checklist	Yes	No	N/A	Notes
1.	Purpose of the Expenditure and the benefit derived there from (from the view point of propriety)				
2.	Proper Sanction for incurring such expenditure and the procedure laid down in the Organisation manual / instructions issued from time to time				
3.	Delegation of Powers would place some limitations on the quantum of expenditure for each authority, which shall also be observed. In case of deviations ensure that the same has proper ratification				
4.	In case of expenditure involving of statutory payments, Delegation of Powers would not generally interfere				
5.	Simultaneously the conditions / restrictions lay down under Tax laws in respect of Cash Payments and Withdrawing of cash shall also be observed				
6.	Classification of Expenditure under different heads of account shall also be observed, as misclassification would have an impact on the profitability of the company				

Checklist for Resource utilization, Cost control/Reduction & Cost Competitiveness

Sl.No.	Document Checklist	Yes	No	N/A	Notes
1.	Purpose for which the funds are received and spent				
2.	Check whether the amount fell due at the time of payment				
3.	Ensure that at the time of making a request for funds check whether the bills are received and the expenditure is incurred pending payment				
4.	In case of payments which are not covered by the LOC ensure that the same is to meet the exigencies (such as statutory payments on account of a court decree etc.) only but not for regular on account payments				

Checklist for Audit of Investments

Sl.No.	Document Checklist	Yes	No	N/A	Notes
1.	Check whether there is a Board Resolution authorizing the Investment of funds and for the disposal of the investments.				
2.	Ensure that the mode of investment sanctioned by the Board and the pattern of investment are the same.				
3.	Ensure that the guidelines for inter-corporate investments / borrowings are adhered to while making any inter-corporate investments.				
4.	Check whether the latest quotes for the securities to be invested are obtained.				
5.	At the time of investment ensure that the quotes obtained are valid (as the quotes are valid for a limited period of time, say, 24 hours / 36 hours, etc.).				

6.	Before investing ensure that the options available for investing are ranked based on the following criteria:
	a) Maturity date;
	b) Rate of return(annualised);
	c) Put / Call options attached;
	d) Yield To Maturity(YTM);
	e) Net Present Value;
	f) Internal Rate of Return(IRR);
	g) Flexibility of investment into small lots;
	h) Lock-in period;				

7.	In case of Investments out of earmarked funds, ensure that the return from the investments is also re-invested.				
8.	Any amount that could not invested [difference between the amount available for investing and the amount invested (in lots)] is placed under a short-term deposit including the return thereof on the deposit				
9.	Ensure that the Premium paid on Securities redeemable at face value is being amortised over the life of the security				
10.	Ensure that the discount accrued on securities redeemable at face value is recognised as income considering the prudence convention				
11.	Ensure that securities in physical (printed document) mode are under the safe custody of an Authorised Officer of the company				
12.	In case of securities in Dematerialised (Demat) mode the instruction slips are under the control of an Authorised Officer of the company and the same are verified during the annual physical verification				
13.	In case of securities for which online transactions (purchase & sale) are permitted ensure that the Transaction Password is under the control of an Authorised Officer of the company and the same is changed periodically				
14.	Check whether the SMS alert / Email alert system is activated for every transaction of purchase / sale of investments and for dividend / interest declared /paid				
15.	Verify that the SMS alerts / Email alerts received on account of purchase and sale of investments are saved for future reference				
16.	Ensure that the income from investments prior to the date of acquisition is reduced from the cost of the investment				
17.	Costs incurred for acquisition of securities such as stamp duty, Security Transaction Tax, Brokerage and commission, if any, are also capitalized on purchase of investments				
18.	On sale of investments, costs incurred are reduced from the proceeds and thereafter the profit / loss on sale is computed				
19.	Investments in equity are valued at cost or fair market value whichever is lower				

6.4 HRD AND PERSONNEL DEPARTMENT

Audit of HR and Personnel Section would cover the following aspects:

- Verification of Establishment Records (PRSSection)
- Review of Internal Control System
- Review of system of periodic appraisal of performance of employees
- Pre / Post-check of pay fixations
- Post-check of pay fixation anomalies
- Review of system of allocation of duties& responsibilities
- Review of system of rotation of duties
- Review of personnel policies implementation

Audit Checklist

Sl.No.	Document Checklist	Yes	No	N/A	Notes
1.	Verify the Register of Incumbency with reference to sanction number and items maintained				
2.	Verify the Register of Charge Transfer Certificates (CTCs) and change returns maintained for all the officers and other employees				
3.	Verify the Register of Service Books maintained for all the staff				
4.	Verify the Calendar of Increments-to-date				
5.	Verify the FCR for pension payments maintained up-to-date and register of life certificates for pensioners maintained				
6.	Verify the pay bills with reference to sanctions, emoluments drawn with reference to rates applicable and whether the claims are supported by sanction of leave, increments, pay slip, CTCs, change return, LPC etc. Wherever required				
7.	Verify the Service Registers for the accuracy of pay fixation made with reference to orders in force				
8.	Verify the TA bills to see whether the claims admitted are in accordance with the rules				
9.	Check whether cross-reference to the original pay bills is made whenever supplementary claims are made				

10.	a) Verify the Register of Long Term Loans maintained for loans sanctioned by Board; b) Check whether the Register of Recoveries towards long-term loans is maintained.				
11.	Check whether the Rules and Regulations prescribed for sanction of long-term loans are fulfilled				
12.	Check whether proper entry is made in the records to ensure prompt recovery of festival, education and other short term advances				
13.	Verify the pension, and gratuity sanctioned with the register to ensure that the fixations are in accordance with the rules prescribed				
14.	Verify the Register of Superannuation up-to-date and superannuation notices issued in time				
15.	Verify the register of recoveries to be made as per the inspection reports of AG and Internal Audit maintained and recoveries are observed				
16.	Verification of Establishment Records (PRS Section)				
17.	Review of Internal Control System				
18.	Review of system of periodic appraisal of performance of employees				
19.	Pre / Post-check of pay fixations				
20.	Post-check of pay fixation anomalies				
21.	Review of system of allocation of duties & responsibilities				
22.	Review of system of rotation of duties				
23.	Review of personnel policies implementation				

6.5 AUDIT OF GENERAL ADMINISTRATION DEPARTMENT

Verification of Appointments / Roster Register

Verify whether all the appointments are as per the appointment letters issued by Corporate Office and are within the time allowed for joining and if there is any delay, permission letter from higher authorities. In the case of contract appointments agreements has to be verified. Whether records are maintained cadre-wise as well as employee-wise and the service registers has to be maintained by duly entering all the information time to time.

(i) Incumbency Register: Verify cadre-wise appointment details like Date of joining, Date of leaving/retiring from the current place of working and the No. of vacancies due to above transfers and retirements.

(ii) Verification of Probationers Register**:** The following are to beverified

(a) List of probationary employees in eachdepartment;

(b) Date of commencement of probation;

(c) Date of completion;

(d) Date of passing of qualifying tests.

6.6 IT DEPARTMENT

Almost all the business undertakings in all the sectors are in the process of implementation of an E.R.P for the automation of the Book Keeping and Accounting, Stores, HRD and other areas. Power sector is not an exception. Actually, in most of the power sector undertakings, billing activities and consumer account maintenance are already under computerized environment.

In Information Systems Audit, more emphasis is on the areas of Controls such as:

- AccessControls
- InputControls
- ApplicationControls
- OutputControls
- Security Controls
- Disaster Recovery andManagement

The above controls are explained briefly in the following paragraphs.

1) **Access Controls**: These controls are the systems and procedures for accessing the Information Systems (SAP / BMS) of theCompany.

2) **Input Controls**: These controls are the systems and procedures for the input of the data into the Information Systems (SAP /BMS).

3) **Application Controls:** These controls are the systems and procedures for processing the data that is available in the Information Systems(BMS).

4) **Output Controls:** These Controls are the systems and procedures for getting the output of the data / information from the Informationsystems.

5) **Security Controls**: These Controls are the systems and procedures for protecting the Information systems and related Assets from variousthreats.

6) **Disaster Recovery and Management**: This part deals with the preparedness of the Organisation for any event of Disaster and Recovery of Data and Management of the Information Systems in Disaster and Restoring the InformationSystems.

Checklist for Audit of Information Systems and Electronic Data Processing:

Audit of Access Controls

Sl.No.	Document Checklist	Yes	No	N/A	Notes
1.	Enquire about the access options available to each user of the system (SAP / BMS, etc.)				
2.	Ensure that the Number of Users and the Number of Logins are matching and in case of unmatched Logins check whether the accounts are active and if so ensure that those accounts are immediately de-activated				
3.	Is there a register containing the UserId's and the details of the users along with the privileges attached to their account?				
4.	Is there a document containing the Approved Privileges matrix for each user department?				
5.	Check whether the privileges attached to a user account are in line with the duties & responsibilities assigned to the user considering the job profile of the user.				
6.	Ensure that there is a system of auto time out in case of no use of the system for a specified period.				
7.	Verify whether there is a System of de-activation of user accounts in the event of no use for a specified period.				
8.	Verify whether the accounts of all users who were transferred / expired / resigned / retired are de-activated.				
9.	Is there a system of mandatory password / PIN change immediately after the account has been first accessed?				
10.	Is there a system of compulsory password / PIN change after an interval of specified period (say for every 3months)				
11.	Ensure that the log is generated for all login attempts (both successful & unsuccessful) along with the IP address of the computer with date & time of attempt.				
12.	Check whether there is a system of verification of user access log at periodic intervals and action is initiated in cases of unauthorized attempts.				
13.	Ensure that this user access log file is not accessible for the users of the information systems and the Systems Security Administrator can only access it and all the previous log files are saved separately				

14.	Ensure that the applications / software / operating systems installed in the computers of the company are legally valid and the source application is under proper security (under the control of the head of the unit in a secured vault)				
15.	Check whether the unused user Id and password / PIN are under Safe Custody of the Systems Administrator and the same are covered under the Annual Physical Verification of Assets / Stocks. In case of missing User Ids and Password / PIN ensure that the same are de-activated immediately				

Audit of Input Controls

Sl.No.	Document Checklist	Yes	No	N/A	Notes
1.	Ensure that the Data Input is through an application / program only.				
2.	Whether the log for users accessing the Data Server is generated and the same is reviewed by the Data Base Administrator (DBA).				
3.	Ensure that Data Entry & Data Modifications are not permitted for data captured through Spot Billing Machines (SBM) / AMR Devices / Card Readers / Scanners				
4.	Check whether there is a check to ensure that the Data ported from the SBM / AMR is not over written with another set of data either manually or through SBM or through an application				
5.	Ensure that Modifications to Data ported from the SBM / AMR has valid authorisation from the concerned Officer responsible for readings and the Data Base Administrator				

Audit of Application Controls

Sl.No.	Document Checklist	Yes	No	N/A	Notes
1.	Check whether Data Integrity Controls are deployed in the application to reject any junk / unwanted data				
2.	Check whether the application has Boundary Controls to test the reliability of the application at the lower and upper boundaries of any logic				

3.	Check whether the Conditions laid down in the Tariff Order and the General Terms and Conditions of Supply and the Instructions issued from time to time are properly incorporated in the programming logic. (For instance, relation between the purpose of supply and the Category, Relation between the Voltage of supply and the Tariff, Load and the Category of Billing as some categories cannot exceed certain load limits)				
4.	Ensure that Exception Handling is commensurate with the complexities of the Tariff Conditions				
5.	Check whether there is a provision for generating Exceptions available to the user based on given criteria				
6.	Ensure that there is proper documentation for the conditions in Tariff and the corresponding Business Logic in the Application, which should be validated jointly by an Officer responsible from the User Department and the Chief Programmer				
7.	Is there a system of testing the Controls vis-à-vis the Tariff conditions with Test data and check whether such Test data and results are available for verification?				
8.	Check whether the application is tested with Test Data on every occasion of modifications to the application either with the introduction of new conditions or at the time of modification of Tariff				
9.	Check whether the module consisting of Tariff (Viz., unit rate, Fixed Charges, Surcharge etc.) is not accessible by any officer from the User department / IT wing except the Chief of the User Department for the Company with the written authorisation from the Director concerned				
10.	Ensure that data entry is not permitted in the Application Development Section / Wing of the IT department				
11.	Whether the source code of the application available with the company? Whether the vendor support for up-gradation and maintenance of the application is in live condition?				
12.	Ensure that the periodic updates (in the form of patches) are also stored separately				

Audit of Output Controls

Sl.No.	Document Checklist	Yes	No	N/A	Notes
1.	Ensure that the outputs are available for printing only				
2.	In the event of outputs are allowed for saving the data ensure that the data is in a tamperproof condition (may be by converting into a PDF document)				
3.	Ensure that while generating the bill for the second and subsequent time the bill must bear a caption that it is a duplicate copy				
4.	Ensure that the outputs generated are saved for future reference and there is no need for the generation of fresh outputs for the old data				
5.	Ensure that in case of generation of Account copy / Balance confirmation from the Application a disclaimer shall also be included as a footnote that any omissions / errors observed may be informed for correction				
6.	Ensure that the Outputs (for consumer ledger) shall include two segments where the first segment will indicate the transactions of billing and dues and the second segment will indicate the Memoranda items such as ACD due, etc				
7.	Ensure that the monthly Disconnection List will exhibit both the Current Dues and the uncollected portion of ACD separately				

Audit of Security Controls

Sl.No.	Document Checklist	Yes	No	N/A	Notes
1.	When the Application can be accessible from a remote terminal check whether a log is generated for the same				
2.	Check whether the Application can be accessible through Internet. Are there any controls to place restrictions on accessing the application through Internet?				
3.	Check whether a Firewall is activated on all the Terminals in the Network				
4.	Ensure that the IS environment has proper security and intrusion detection system and persons having proper authorisation shall only be permitted				
5.	Ensure that there is a proper fire protection system (using Carbon Dioxide only) is in place				
6.	Ensure that the Fire extinguishers are refilled on the due date, even if so far not used				

7.	Check whether the Fire extinguishers are within the accessible reach of the users				
8.	Check whether the Server Room is protected from Dust, Heat, Magnetic Interference and Electro-magnetic Radiation				
9.	Ensure that beverages, water and any other liquids are prohibited in the server room				
10.	Ensure that all the output modes (including backup using Memory cards, Pen drives, Optical Disks, Tapes etc.) other than display & printing are de-activated on all other terminals in the network except at a central location where regular backups are taken				
11.	Ensure that all the backup devices (such as Optical Disks, Pen drives, Memory Cards / chips etc.) brought by the users are not permitted inside the IS environment and the same are retained at the security stage only and check that any deviations from the same are properly documented				
12.	Ensure that Terminals having access to ECS, EFTS and Internet Banking are placed in a closed chamber, which is under lock & key. As far as possible ensure that Biometric Security Systems are deployed on such computer apart from regular user Id and Password /PIN				
13.	Check whether there is a proper documentation for all the transactions made through ECS / EFTS / Internet Banking with automatically generated Transaction Number and the Name of the Officer doing the transactions and the Authorisation for the same				
14.	Ensure that there is a record for all unsuccessful attempts for making transactions through ECS / EFTS / Internet Banking along with the No. of attempts and the quantum of funds involved				

Disaster Recovery and Management

1) Ensure that backup of the data is taken at periodic intervals.

2) Check whether the backup has been tested before being placed in a safe vault.

3) Check whether the backup is placed at an offsite location.

4) Is there any record maintained where a log file is maintained for the frequency of backup taken and place of storage of the backup data?

6.7 COLONY/ GUEST HOUSE / TRANSIT CAMP / FIELDHOSTEL/ TRAINING INSTITUTE

Whether the Guests, employees of the company and any other company, etc. stays in the Guest House/Transit Camp/Field Hostel as per the norms of the company or not and whether the recovery is being collected and deposited or not.

6.8 TRANSPORTATION

Log book of the vehicles should be verified and examine that;

- It has been issued by the authorized person and kept and maintained in the prescribed format by the authorized persons only.
- Whether the journey has been performed with the due approval of the competent authority.
- Mileage of the vehicle is computed on the tank to tank basis.
- Personal journey and the excess fuel consumption is recovered from the responsible person.
- Log books are filled on daily basis. Cutting and overwriting has not done.

6.9 REVENUE AUDIT

Sl.No.	Document Checklist	Yes	No	N/A	Notes
1.	Verification of Estimates issued for new connections as per the various guidelines issued by SERC/ Company				
2	Verify the Finalization of HT Final Bill and timely and proper accounting of the service connection deposits received by the Company				
3	Verification of estimates issued for Shifting of Connection and timely and proper accounting thereof				
4	Review of release of new connections in CRAM module, timely release of H-3 forms and ensuring whether the first LT bills were issued within prescribed time frame.				
5	Check/Verify All Debit/credit adjustment and bills given to Open Access/CPP/Wind farm/Solar consumers and also debit/credit Adjustments given at Division / Sdn Offices for other reasons				
6	Verification of Cross Subsidy surcharge / additional surcharge/ wheeling charges recovered from Open Access Consumers, ParallelOperation Charges recovered fromEHT/HT consumers and their accounting entries in Trial Balance				
7	Verification of bills issued to the HT Consumers/ Seasonal Consumers/Temp. Billing/YMC Bill issued to the seasonal consumers.				
8	Review of PRT 125 (Age) and verification of arrears of more than two billing cycle, Status of Physical Disconnection and Re-connection charges recovered thereon.				

9	Verification of Supplementary bill payment and DPC thereon				
10	Verification of bill issued under for malpractice / theft and revisions of theBills and register maintained.				
11	Verification of SD recoverable /recovered from Consumers and verify calculation of Interest on SD in case of HT Consumers.				
12	Review of meter reading program (from 20th to 10th of next month) visactual reading and significantdeviation if any to be reported in				
respect of timely billing.					
13	Verification of Consumers complaint Register in relation to timely resolution of the same				
14	Verification of matters of Civil suits, Time Barred cases and LokAdalatmatters. Whether proper legal actions are taken or not?				
Timely recovery of instalments given in LokAdalat etc.					
15	Verification of Final bills of Temporary connection and recovery thereof andWhether proper billing/ assessment!LT ledger/records has been maintained or not? Whether bills are finalized in time or not as per rules?				
16	Verification of Electricity Duty charged in consumers bills as State Electricity Duty Act				
17	Review of old faulty meter consumption with replaced meterConsumption.				
18	Verification of Return of ElectricityDuty				
19	Verification of all types of Subsidyclaims raised to Government				
20	Monitoring and regularization of excess drawl beyond contract demand				
21	Report on Online Consumer Billing with GPS on status in case of LT Consumers and report for not doing Online Consumer Billing with GPS on Status				
22	Audit of New LT Consumers' Files and correctness of all its MasterData, including tariff related				
Data and timely billing thereof					

23	Verify and audit whether proper tariffhas been applied to the existing newand additional load consumers andwhile category change due to				
Extension/ Reduction of Load.					
24	Audit the consumers whosebilling demand has continuously exceeded.				
26	Cases of recovery of Burnt Meter Charges and under recovery, if any.				
27	Audit of the activities of cash Window.with special emphasis on timelydeposit of Cash/ Cheques collected inthe Bank Account.				
28	To verify the timely submission of BCDCR and Bank Statements to theDivision Offices.				
29	Audit of collections through Post Offices, Gram Panchayats andCollection Agencies with reference totimely collection and deposit of the				
Same in Bank Account.					
30	To verify Debit Adjustment against Dishonoured cheques and collectionsAgainst the same and recovery of bank, charges from consumers.				
31	Report on Online Consumer Billing with GPS on status in case of LT Consumers and report for not doing Online Consumer Billing with GPS on Status				
32	Report on Billing through Automatic Meter Reading (AMR) (in case of HT Consumers) and report for not doing AMR Billing				

Operational Review Performance Audit

7

This Chapter includes:

7.1 AUDIT OF WORKS AND PROCUREMENT CONTRACTS

Steps for Operational Review Performance Audit

(a) From the monthly generation data, review and comment on the actual physical parameters – Availability Factor, Generation, Plant Load Factor, Auxiliary Power Consumption percentage, Heat Rate from each source (coal, oil, gas) and Specific Oil Consumption in the case of coal stations, with referenceto budget, previous year's actuals and tariff parameters.

(b) ENERGY SENT OUT: Test check the figures of energy sent out and auxiliary power consumption with reference to the logbooks maintained at respective places. Verify calibration reports of various meters. Also Verify whether the energy sent out report has been jointly signed by the buyer representative.

(c) Auditors should comment on any unusual change in the pattern of specific fuel consumption, after consulting with sitethe reasons offered for such change.

(d) Compare the maintenance schedules in terms of number of days as planned with actual maintenance as done. Examine the adverse variances and corrective action taken in these cases.

(e) Examine and comment on the control maintained by the project over replacement of high value spares and replaced items as indicated in the respective log-books. Examine whether the actual life of spares is as per the norms given by the supplier. Examine and comment upon the corrective/recovery action taken by the unit in case of deficiencies.

(f) Comment on the rationality of the inventory level maintained in store and sub stores. Examine records maintained in the sub-stores and comment on abnormalities.

7.2 KEY PERFORMANCE INDICATORS AND CERC NORMS

S.no.	Particulars	As per CERC Regulation 2019-24	Computation of Loss on account of under achievement of the parameter
1	SHR (Kcal/Kwh)	For 200/210/250 MW2430 For 500MW 2390 Adjustment for Electric driven Feed pump will be done as per norms	[{SHR*Actual Gross Generation/ Actual GCV}-Actual Coal Consumption]*Actual Rate of Coal per MT
2	Aux. Cons. (%)	200 MW series 8.50% 300 MW and above- 8.00% 5.75% (in case of Steam driven BFP)	[{Normative Aux.%-Actual Aux.%}*Actual Gross Generation (Kwh)*Rate of Sale of Power]
3	ROE	15.50%	
4	O&M Norms (Rs. Lakhs/MW)	200-250 MW Sets-32.96 300-350 MW Sets-27.74 500 MW Sets-22.51 600 MW Sets-20.26 800 MW Sets- 18.23	Normative O&M Expense-Actual O&M Expenses Allowable expenses at the time of true up should be added in the normative expenses
5	Initial Capital Spares (% of capital cost)	4%	Loss of depreciation and holding cost for carrying more capital spares then the norms
6	Sp. Oil cons.	0.50 ml/KWh	[{Normative oil consumption-Actual oil Consumption}*Actual Rate of oil]
7	Coal stock	50 Days	Loss of holding cost at the rate of allowable IWC on the higher quantum of stock/ receivable/ spares then the norms
8	Oil stock	2 Months	
9	Receivable	45 days	
10	O&M	1 Month	
11	Maintenance Spares (% of O&M Cost)	20% thermal plants 15% for hydro plants	

AT&D losses level - Collection efficiency ratio

7.3 RENEWABLE SOURCE OF ENERGY

Renewable source of energy (As per CERC Regulation, 2020 Dt. 23.06.2020)

Particulars	Wind Energy Power Project	Biomass gasifier based Power Project	Small Hydro Plant	Solar PV Power Project	Biogas Power Project
Life (Years)	25	25	40	25	25
Capital Cost Cr./MW	Market trend	5.93	Below 5 MW 7.80 5MW to 25 MW 9.00 In HP, UK, WB, J&K,Ladakh and North East States 11.00		11.86
PLF/CUF%	22% to 35% depending upon wind density	85	In States other than below 45 In HP, UK, WB, J&K. Ladakh and North East States 30	21	90
AUX%		10	1	0.75	12
Fuel Cons. (Kg/Kwh)	NA	1.25			3
O&M cr./MW	Market trend	0.61	0.24 to 0.42 depending upon the size and State of the Project	Market trend	0.61

Auditor should comment on the actual performance of the organization in view of the industry benchmark/ above norms with quantification of loss on account of under achievement of the performance parameter.

Internal Audit of Significant Areas 8

This Chapter includes:

8.1 COMPLIANCE WITH APPLICABLE ACCOUNTING STANDARDS

Accounting Standards are the written form of statements which consists of rules, principles and guidelines to be used consistently and uniformly for the preparation and presentation of financial statements by a business entity. These Accounting Standards lay down the accounting policies and practices explaining as to when and how the financial transactions should be measured, recognized and disclosed in the books of accounts of an entity. The application of Accounting Standards (AS) not only ensures the transparency, reliability and consistency but also sets the formal boundaries within which the financial transactions should be reported by any business entity.

While preparing financial statements it is management's responsibility to prepare and present the financial statements in compliance with the relevant applicable accounting standards. In the event of any deviation, it is the responsibility of the auditor to provide adequate disclosures in their audit report to make the users of financial statements aware about the matter.

Those laws and regulations to which an entity is subject constitute the legal and regulatory

Framework. ... **Non**- **compliance** with laws and regulations may result in fines, litigation or other consequences for the entity that may have a material effect on the financial statements.

8.2 IMPAIRMENT OF NON-FINANCIAL ASSETS

Indian Accounting Standard (Ind AS)36, Impairment of Assets prescribes the procedures that the entity should apply to ensure that its non-financial assets are carried at no more than their recoverable amount. A Non –financial asset is carried at more than its recoverable

amount if its carrying amount exceeds the amount to be recovered through use or sale of the asset. If this is the case, the asset is described as impaired and Ind AS 36 requires the entity to recognise an impairment loss.

The impairment standard covers a variety of non-financial assets, including:

- Property, plant and equipment,
- Intangible assets and goodwill, and
- Investments in subsidiaries, associates and joint ventures.

Whenever possible, an impairment test is performed for an individual asset, unless the asset does not generate cash flows that are largely independent. Otherwise, assets are tested for impairment in Cash-Generating Units(CGUs).

Impairment testing is required when there is an indication of impairment. Annual impairment testing is required for goodwill and intangible assets that either are not yet available for use or have an indefinite useful life. This impairment test may be performed at any time during the year, provided that it is performed at the same time each year.

An impairment loss is generally recognised in the statement of profit and loss, except where required to be recognised in reserves. Reversals of impairment are recognised, other than for impairments of goodwill.

8.3 FINANCIAL AND COMMODITY DERIVATIVES

A derivative is a product whose value is derived from the value of one or more basic variables, called bases (underlying asset, index or reference rate), in a contractual manner. The underlying asset can be equity, forex, commodity or any other asset.

The emergence of the market for derivative products, most notably forwards, futures and options, can be traced back to the willingness of risk-averse value chain participants of an asset to guard themselves against uncertainties arising out of fluctuations in asset prices. Through the use of derivative products, it is possible to partially or fully eliminate price risks by locking–in asset prices. By locking-in asset prices, derivative products minimise the impact of fluctuations in asset prices on the profitability and cash flow situation of risk averse participants.

Types of derivatives:

- **Forwards**: A forward contract is a customised contract between two entities, where settlement takes place on a specific date in the future at today's pre-agreed price.
- **Futures**: A futures contract is an agreement between two parties to buy or sell an asset at a certain time in the future at a certain price. Futures contracts are special types of forward contracts in the sense that the former are standardised exchange traded contracts.
- **Options**: Options are of two types – calls and puts. Calls give the buyer the right but not the obligation to buy a given quantity of the underlying asset, at a given price on or before a given future date. Puts give the buyer the right, but not the obligation to sell a given quantity of the underlying asset at a given price on or before a given date.

- **Swaps**: Swaps are private agreements between two parties to exchange cash flows in the future according to a prearranged formula. They can be regarded as portfolios of forward contracts. The two commonly used swaps are:
  - **Interest rate swaps**: These entail swapping only the interest related cash flows between the parties in the same currency
  - **Currency Swaps:** These entail swapping both principal and interest between the parties, with the cash flows in one direction being in a different currency than those in the opposite direction.

In July 2020, the Ministry of Power (MoP) approved the introduction of electricity forward contracts and derivatives market in India. The distribution utilities, renewable generators, and open access consumers leverage the green market to buy-sell green energy besides also fulfilling the Renewable Purchase Obligation (RPO) targets.

8.4 RELATED PARTY TRANSACTIONS

When transactions are entered into between independent enterprises, the consideration therefore is determined by market forces. However, when associated enterprises deal with each other, it is possible that the commercial and financial aspects of the transactions are not influenced by external market forces but are determined based on internal factors. In such a situation, when the transfer price agreed between the associated enterprises does not reflect market forces and the arm's length principle, the profit arising from the transactions, the consequent tax liabilities of the associated enterprises and the tax revenue of the host countries could be distorted.

(a) Related Party means related party as defined under sub-section 76 of section 2 of the Companies Act, 2013 (18 of 2013).

(b) "Normal" Price means price charged for comparable and similar products in the ordinary course of trade and commerce where the price charged in the sole consideration of sale and such sale is not made to a related party. Normal price can be construed to be a price at which two unrelated and non-desperate parties would agree to a transaction and where such transaction is not clouded due to the proximity of the parties to the transaction and free from influence though the parties may have shared interest.

(c) The basis adopted to determine Normal price should be classified as under:

  (i) Comparable uncontrolled price method

  (ii) Resale price method;

  (iii) Cost plus method;

  (iv) Profit split method;

  (v) Transactional net margin method;

  (vi) Any other method, to be specified.

(d) In respect of related party transactions or supplies made or services rendered by a company to a company termed "related party relationship" and vice-a-versa, records shall be maintained showing contracts entered into, agreements or understanding reached.

(e) These records shall also indicate the basis followed for arriving at the rates charged or paid for such goods or services so as to enable determination of the reasonableness of such rates in so far as they are in any way related to goods or services.

The particulars of all the Related Party Transaction entered into with the approval of the Audit Committee / Board of Directors / Shareholders shall be entered into the Register of Contract or Arrangements in which Directors are interested, maintained by the Company and all the compliance related thereto shall be done by the Company Secretary as per the provisions of the Companies Act, 2013 and Listing Regulations

All entities falling under the definition of related parties shall abstain from voting (at the Board Meeting or at Annual General Meeting or by passing of resolution through Postal Ballot), when such matter is put up for consideration/approval irrespective of whether the entity is a party to the particular transaction/ contract / arrangement or not.

Any Related Party Transaction entered into without obtaining the prior approval of the Audit/ Board/ Shareholders (respective authority/ies) may be ratified, subject to the applicable provisions of the Companies Act, 2013 and the Listing Regulations, if post review of the said transaction / contract, the appropriate authority is satisfied, that the said Related Party Transaction is not detrimental to the interest of the Company.

The Policy on Related Party Transaction shall be disclosed on the website of the Company and a web link thereto shall also be provided in the Annual Report.

8.5 ACCOUNTING FOR INTERESTS IN JOINT VENTURES AND SEGMENT REPORTING

A joint venture is a contractual arrangement whereby two or more parties undertake an economic activity, which is subject to joint control. **Control** is the power to govern the financial and operating policies of an economic activity so as to obtain benefits from it.

In respect of its interest in jointly controlled assets, a venture should recognise, in its separate financial statements, and consequently in its consolidated financial statements:

(a) its share of the jointly controlled assets, classified according to the nature of the assets;

(b) any liabilities which it has incurred;

(c) its share of any liabilities incurred jointly with the other ventures in relation to the joint venture;

(d) any income from the sale or use of its share of the output of the joint venture, together with its share of any expenses incurred by the joint venture; and

(e) any expenses which it has incurred in respect of its interest in the joint venture.

Operating Segments: The core principle of Ind AS 108 is that "An entity shall disclose information to enable users of its financial statements to evaluate the nature and financial

effects of the business activities in which it engages and the economic environments in which it operates".

Ind AS 108 defines an operating segment as a component of an entity:

(a) that engages in business activities from which it may earn revenues and incur expenses (including revenues and expenses relating to transactions with other components of the same entity);

(b) whose operating results are reviewed regularly by the entity's chief operating decision maker to make decisions about resources to be allocated to the segment and assess its performance; and

(c) for which discrete financial information is available

Aggregation criteria

Operating segments often exhibit similar long-term financial performance if they havesimilar economic characteristics. For example, similar long-term average gross marginsfor two operating segments would be expected if their economic characteristics weresimilar. Two or more operating segments may be aggregated into a single operatingsegment if aggregation is consistent with the core principle of this Ind AS, the segmentshave similar economic characteristics, and the segments are similar in each of thefollowing respects:

(a) the nature of the products and services;

(b) the nature of the production processes;

(c) the type or class of customer for their products and services;

(d) the methods used to distribute their products or provide their services; and

(e) if applicable, the nature of the regulatory environment, for example, banking, insurance or public utilities.

An entity shall report separately information about an operating segment that meets any of the following quantitative thresholds:

(a) Its reported revenue, including both sales to external customers and intersegmentsales or transfers, is 10 per cent or more of the combined revenue, internal andexternal, of all operating segments.

(b) The absolute amount of its reported profit or loss is 10 per cent or more of thegreater, in absolute amount, of (i) the combined reported profit of all operatingsegments that did not report a loss and (ii) the combined reported loss of alloperating segments that reported a loss.

(c) Its assets are 10 per cent or more of the combined assets of all operatingsegments.

Operating segments that do not meet any of the quantitative thresholds may be considered reportable, and separately disclosed, if management believes that information about the segment would be useful to users of the financial statements.

8.6 PRODUCTION COSTS / CONVERSION COST

Broadly speaking all generation costs can be categorized into two groups depending on the point in time at which those costs are incurred: at the time of the investment decision or at the time of the production decision. The costs associated with the investment decision are usually called fixed or investment costs and the costs incurred only at the time of generation are called variable or generation costs.

Fixed costs are the cost of equipment, land, financing, project management, grid connection, and construction of the power plant. These are usually expressed per unit of installed capacity (per kW or per MW). Fixed costs are regarded as "sunk costs", because once the plant is erected and fixed costs are incurred they cannot be recuperated. The plant may be sold or scrapped at some point but such a transaction usually yields only insignificant revenue.

Variable costs consist of fuel cost, operation and maintenance expenses and carbon dioxide emission charges, if applicable. They are typically calculated per unit of electricity generated (per MWh). Only variable costs play a role when it is necessary to decide whether to use an existing plant to produce electricity or not. Fixed costs are irrelevant to this production decision for the precise reason that they are sunk. For the investment decision, in contrast, both fixed and variable costs matter, as we will see further on.

Quasi-fixed costs. There is a third category that lies between fixed and variable costs, sometimes called quasi-fixed costs, which includes cost of labour; staff can be hired or fired after the investment decision at discrete points in time but not for every single production decision. In electricity generation, such quasi-fixed costs are small enough not to merit separate treatment and are subsumed in variable costs.

Cost structure of generation technologies. Electricity generation technologies vary dramatically in their cost structure. Some plants, such as nuclear, wind and solar power, have virtually zero variable costs: once they are built, they produce electricity virtually for free. This is in stark contrast to fossil fuel-based power plants. For example, variable costs (fuel costs and emission charges) comprise approximately 40% of the total costs of a coal-fired power station and as much as 60% of a gas-fired combined cycle plant. In general technologies with low CO2 emissions, which tend to be the technologies that use no fuel, are also those where fixed costs make up a higher percentage of total costs.

The cost of generating electricity from certain technologies (wind, solar, nuclear) comprise almost only investment costs, while the cost of others (coal, gas) comprise significant variable costs.

Most power stations are designed to run for 20 to 60 years (also called the "technical lifetime" of a power plant). Thus, even though fixed costs are incurred at the time of investment, for analytical purposes it makes sense to translate the fixed costs incurred in annualized terms, i.e. calculate the cost of constructing the station per year of its technical lifespan. This metric is known as Annualized Fixed Costs (AFC) or equivalent annual cost. AFC is calculated by converting fixed costs at the time of investment into an annuity.

Cost Audit of Power Industry 9

This Chapter includes:

Generation, transmission, distribution and supply of electricity (Power)regulated by the relevant regulatory body or authority under the Electricity Act, 2003 (36 of 2003); is coveredby Companies (Cost Records and Audit) Rules, 2014. Generation of electricity is covered under CTA Heading- 2016, and for transmission, distribution and supply CTA Heading not applicable. Every company specified in item (A) (Regulated Sector) of rule 3 shall get its cost records audited in accordance with these rules if the overall annual turnover of the company from all its products and services during the immediately preceding financial year is rupees fifty crore or more. and the aggregate turnover of the individual product or products or service or services for which cost records are required to be maintained under rule 3 is rupees twenty-five crore or more.

"**Electricity activities**" means any act, process, procedure, function, operation, technique, treatment or method employed in relation to generation of electricity from any source of energy, and includes transformation, transmission, distribution, or supply of electricity by any mode, or medium, and further includes intermediate and allied activities thereof;

"Cost records"means '*books of account relating to utilization of materials, labour and other items of cost as applicable to the production of goods or provision of services* that provides data/information to calculate the cost of production, cost of sales and margin of each of the products/activities of the company on monthly or quarterly or half-yearly or annual basis are considered part of the cost records. It includes statistical, quantitative and other records which enable the company to exercise, as far as possible, control over the various operations and costs to achieve optimum economies in utilization of resources and these records shall also provide necessary data which is required to be furnished under the rules.

The cost records shall be maintained in such manner so as to enable the company to exercise, as far as possible, control over the various operations and costs with a view to

achieve optimum economies in utilization of resources and these records shall also provide necessary data which is required to be furnished under these rules.All such cost records and cost statements, maintained under these rules shall be reconciled with the audited financial statements for the financial yearspecifically indicating expenses or incomes not considered in the cost recordsor statements so as to ensure accuracy and to reconcile the profit of all product with the overall profit of the company and the variations, if any, shall be clearly indicated and explained.

Elements to be considered

- Separate cost statement shall be prepared for each major utility
- Separate cost statement shall be prepared for different kind of materials or fuelssuch as coal, lignite, gas, naphtha, bagasse, etc. (for indigenous and importedmaterial separately). In case of imported materials or fuels, detailssuch as FOB price, freight, insurance, other landing charges etc. shall be indicatedin a separate statement.
- Any adjustment for incentives or penalties or other charges (like GST etc.)charged by the supplier in the current year bills relating to material or fuelreceived during previous year(s) shall be excluded from current year cost andindicated by way of a foot note.
- Where the company has its own facilities or mines to produce coal, lignite, etc.
- Cost of raising such material shall be worked out in detail.
- Separate plant-wise and unit-wise cost statement shall be prepared for each type of generation viz. Hydro-electric, Thermal, Atomic, etc. and forcaptive consumption, power sold within the country and the power exported.
- Separate Cost Statement shall be prepared in for cost oftransmission and cost of distribution. Cost oftransmission shall be and shall be prepared for each major zonesand areas.
- If the company enters into a wheeling arrangement for transmission, necessary payment or receipt may be recorded as separate item under the relevant cost statement.

9.1 GENERATION OF POWER (Thermal or Hydroelectric or Gas Turbine or Atomic or Wind or Solar, etc.)

Quantitative Information

Sl. No.	Particulars	Unit	Current Year	Previous Year
A1	Installed Capacity			
2	Minimum power to be purchased under PPA			
3	Planned Outage			
4	Forced Outage			
5	Plant Availability			

6	Loss due to backing down			
7	Reserve Outage			
8	Partial Unavailability Factor			
9	Power Generated			
10	Plant Load Factor			
11	Auxiliary Power Consumption			
12	Free supply, if any, to employee and office			
13	Net Power Generated			
14	Add Power Purchased, if any			
15	Power Available for Transmission			
16	Station Heat Rate (Kcal or KWH)			
B1	Gross Fixed Assets at the end of the year/ period	₹ Lakhs		
2	Net Fixed Assets at the end of the year/ period	₹ Lakhs		
3	Date of Commissioning			

9.2 TRANSMISSION OR DISTRIBUTION

Quantitative Information

Sl. No.	Particulars	Unit	Current Year	Previous Year
A1	Surge Impendence Loading (SIL) or Rated Voltage			
2	Power received from generating units includingpurchased, if any			
3	Loss in transmission or distribution			
4	Self-Consumption for employees and office			
5	Net Power Transmitted or Distributed			
6	Length of Transmission or Distribution lines			
B1	Gross Fixed Assets at the end of the year/period	₹ Lakhs		
2	Net Fixed Assets at the end of the year/period	₹ Lakhs		
3	Date of Commissioning			

Supply (consumer servicing and billing, etc.)

Quantitative Information:

Sl. No.	Particulars	Current Year		Previous Year	
A1	Installed Capacity				
2	Power Received				
3	Power Supplied :	Number of consumer	Unit	Number of consumers	Unit
	(a) Domestic				
	(b) Commercial				
	(c) Industrial				
	(d) Public Lighting				
	(e) Agriculture				
	(f) Others				
	Total (a to f)				
4	Losses				
5	Area Covered (square KM)				
B1	Gross fixed assets at the end of the year/period (₹/Lakhs)				
2	Net fixed assets at the end of the year/period (₹/Lakhs)				
3	Date of Commissioning				

9.3 GENERATION OF ELECTICITY

Cost Centres in case of Generation

Following cost centres can be identified for the purposes of maintenance of cost records.

Production Cost Centre

Boiler

Crushed coal gets converted into pulverized coal (i.e. fine powder form). Pulverizing is done with the help of crushers & lubricants in coal mill. This pulverized coal is used in boilers. The boiler is a steam generator, which plays an important part in generation of electricity. It is huge tabular steel structure consisting of furnace, super heater, re-heater, air heater and economizer etc. Furnace is a rectangular chamber, where pulverized coal is burnt in suspension in combination with air supplied in correct quantity by the fans. Demineralized water is circulated through number of tubes surrounding the furnace due to which the water gets heated & steam is generated at a 350°C, which is further heated up to 530°C in the super heater.

Turbine & Generator

Steam at a temperature of 530°C & a pressure of about 140 kgs / cm is let out from the Boiler and is sent to turbine where its heat energy is converted into mechanical energy. The turbine shaft drives the rotor of the generator to produce electricity.

After being used in the turbine, the steam is passed through condenser where it gets converted into water. Raw water is used to cool the steam and takes away the heat of steam coming out of Turbineexhaust. In this process, temperature of cooling water increases and such hot water is taken back to the lake, where it gets cooled through natural cooling process, so that the same can be used again.

9.4 UTILITY UNITS / COST CENTRES

Coal Handling Plant

Raw coal is received through various modes such as Rail, Road, and Conveyor Belt etc. from different coalfields. Coal received through Rail is weighed and thereafter the same gets unloaded with the help of tipplers. Coal received through Road is weighed on weighbridge and then gets unloaded at CHP yard. Similarly, coal received through conveyor is weighed on electronic Weight O Meter fitted with the conveyor belt. All such coal received through various modes is fed to coal crusher and then can be stacked in the CHP yard or fed directly to coal bunker by means of conveyor belt.

Demineralization Plant

Raw water, which is pumped out from the dam is very much contaminated & is not suitable for any use as it is. It requires certain processing, which is done in this plant. This raw water is chemically treated with the help of materials & chemical like Alum, Lime, Bleaching Powder, $KMNO_4$ etc. to remove the impurities & then it gets filtered with the help of sand to make it more pure.

Filtered water is converted into Demineralized water which becomes suitable for use in Boilers as well as Hydrogen Generating Plant. This demineralization process takes place with the help of chemicals like Acids, Alkalis & Resin, etc.

Internal auditor has to look into the controls placed for monitoring of chemical consumption.

Hydrogen Generating Plant

D.M. Water is used for the generation of Hydrogen Gas. This gas gets filled-in cylinders, which can be further used in generator cooling.

Fuel Oil Handling Plant

Oil is used as secondary fuel for the boilers & is required for the initial startup&during low load operation. Fuel oil is received in rail/ road tankers and supplier to the burners in the boiler through the pipeline.

Ash Handling Plant

Coal after burning in the furnace is partly converted into clinker ash which is collected in hoppers below the furnace from where it is periodically removed. Rest of the ash is carried

with flue gases to the Electrostatic Precipitators where it is separated out & collected in the hoppers from where it is evacuated periodically. Finally, only clear flue gases are let out to the atmosphere through the chimney & the rest of the ash is converted into slurry with the help of water, which is carried to a distant open area.

Service Cost Centres

Service Units are the departments that give support & service to the main production units. Certain Service units provide the service to the specific production units while others provide the service to more than one production units. Service Units are identified as under:

(a) Boiler Maintenance

(b) Turbine Maintenance

(c) Electrical Maintenance

(d) Workshop &Garage

(e) Civil Maintenance

(f) Testing

(g) Instrumentation Control

(h) Stores

Records required to be maintained for Internal Audit:

Apart from basic financial records, required to be maintained such as Cash Book, Ledger, Trial Balance, Profit and Loss Account, Cost Accounting Records are also required to be maintained, which includes technical details such as Installed Capacity, Plant Load Factor (PLF), Planned Outage, Forced Outage, Plant Availability, Daily generation of Power, Auxiliary Power Consumption, Station Heat Rate, etc.

(a) **Material consumption records:** All details relating to receipts, issues and balances of all types of materials are required to be maintained. The valuation of receipts and valuation of issues are to be done in accordance with Cost Accounting Standard (CAS) – 6 issued by the Institute of Cost Accountants of India (ICAI). The details of CAS-6 are discussed in detail in Chapter 19 on "Audit of Operational Activities".

(b) **Salaries and Wages:** Records containing details such as direct labour, indirect labour, cost of office staff, management remuneration, idle labour time, etc. should be available.

(c) **Service Department Expenses:** Details relating to costs incurred for service departments and details of quantity of services provided by various service departments to production and other departments should be available. Examples of service departments are stores, laboratory, welfare measures, safety implementation, transport, dispensary, school, crèche, township, etc.

(d) **Details relating to Utilities:** Utilities such as Water collection, Water Treatment, Steam, Coal Handling Plant (CHP), Oil Handling Plant (OHP), etc. with quantities of input and output of each utility and costs incurred for each utility.

There is strong growth opportunity in power generation led by growth in the Indian economy, increasing propensity for electricity consumption and urbanization. The Indian private sector has shown strong interest in power generation.

9.5 TRANSMISSION OF ELECTRICITY

The process of movement of power from the power station to other location through transformers and transmission lines is called as Transmission. There is movement of high voltage electricity in transmission.

Process of Transmission

Step up transformers are used to increase the voltage of generated power at generation plant and Step down transformers are used to reduce the voltage of transmitted power at the substation. The substations further step down the voltage of electricity. Transmission lines are very tall because they carry high voltage electricity. Transmission towers, underground cables, transformers, circuit breakers, insulators are the important assets used in process of transmission.

Cost Centres in Transmission

Following can be identified as Cost Centres for the purposes of maintenance of cost records in Transmission Activity:

Production Cost Centres

Transmission Line Maintenance

This cost should specify in detail the quantity and cost of material used for transmission line maintenance, direct costs of labour and other direct expenses incurred in connection with such line maintenance.

Sub-Station Maintenance

This cost should specify in detail the quantity and cost of material used for sub-station maintenance, direct costs of labour and other direct expenses incurred in connection with such maintenance.

Service Cost Centres

Administration

These costs should include the cost relating to salary of administrative staff and all other expenses relating to administration of transmission office.

Other (General) Repairs and Maintenance

Any expenses on other repairs and maintenance other than transmission lines and sub-stations such as repairs of general assets will be included in this cost centre.

Internal Control Records to be maintained in Transmission utilities

In addition to routine accounting records, various cost records are required to be maintained as per Companies (Cost Records and Audit) Rules 2014. Some of technical details required to be maintained are relating to voltage management, energy accounting and transmission losses and inventory.

9.6 DISTRIBUTION OF ELECTRICITY

Introduction

Transmitted electricity is distributed to the individuals. Distribution lines carry electricity to the end users. The consumption of power is recorded by the meters at the premises of the users. Step Down transformers are used to bring down the voltage of electricity for the purpose of distribution.

This process consists of the distribution lines and substations. Consumers can be classified as domestic consumers and commercial consumers. There is fluctuating demand of power and the power system has to adjust to the fluctuating demand of power.

Load management is important function of the distribution process. Meter reading calculates the cumulative value of energy consumed. For industrial consumers the details of energy consumed and the maximum demand of power are recorded during meter reading. Now-a-days new electronic system is introduced to read the meters.

Studies have revealed that for DISCOMs about 80% of the expenditure is towards Power Purchase Cost and the balance 20% constitutes for Employees Cost, Repairs & Maintenance and Administrative expenditure.

Whenever it is observed that the percentage of metered sales is low compared to the total electricity consumed it leads to maximum emphasis on Audit of Revenue Units, the scope of Audit is enlarged in a befitting way to improve Revenue / stoppage of Leakage of Revenue.

Today, the electricity distribution sector in India is currently in the worst shape, plagued by high network and financial losses in almost all states. There is an urgent need to bring in new technologies and systems to arrest these leaks. The Restructured Accelerated Power Development and Reforms Programme (R-APDRP) (see: http://www.apdrp.gov.in/) introduced by the GoI was aimed at reducing the network losses to 15%. Part-A of the program is aimed at creating IT Infrastructure and automation systems within utility operations, which until its introduction was largely missing in most of the distribution utilities in the country. And part B is aimed at strengthening the physical network. The R-APDRP is still under implementation and completion is expected during the 12th Five Year Plan. Once completely implemented, the program would provide a strong foundation for evolution to Smart Grids in the power distribution segment.

Latest programme launched by Government of India is Integrated Power Development Scheme (IPDS). This scheme contains following components:

- Strengthening the sub-transmission and distribution networks in urban areas

- Metering of distribution transformers / feeders / consumers in the urban areas
- IT enablement of distribution sector and strengthening of distribution net work

The proposed amendment to Electricity Act, 2003, in the form of draft Electricity Act (Amendment) Bill, 2020 is aimed at providing legal clarity related to the adoption of public-private partnerships and franchising in the distribution segment. The Bill newly defines distribution sub-licensee that means an entity appointed by distribution utility to distribute electricity on its behalf in a stipulated area with the permission of local regulatory commission. Despite the appointment of sub-licensee, distribution utility shall continue to be licensee, and therefore, eventually responsible for ensuring quality and reliable service in its licensed area.

For the distribution sector, Smart Grids will mean the introduction of Demand Response programs, managing the expected introduction of electric vehicles and integrating distributed energy resources in a way that can help the DisComs balance local supply and demand and reduce peak time consumption. For this to happen, Advanced Metering Infrastructure (AMI) will be required as well as reliable communication infrastructure. Building to Grid (B2G) or development of "Green Buildings" which can be incentivized to manage their consumption and even distributed energy resources to match grids conditions will also play their part in helping DisComs to manage supply and demand.

Cost Centres in Distribution

Following can be identified as Cost Centres for the purposes of maintenance of cost records in Transmission Activity:

Production Cost Centres

Distribution Line Maintenance

This cost should specify in detail the quantity and cost of material used for distribution line maintenance, direct costs of labour and other direct expenses incurred in connection with such line maintenance.

Sub-Station Maintenance

This cost should specify in detail the quantity and cost of material used for sub-station maintenance, direct costs of labour and other direct expenses incurred in connection with such maintenance.

Service Cost Centres

Administration

These costs should include the cost relating to salary of administrative staff and all other expenses relating to administration of distribution office.

Other (General) Repairs and Maintenance

Any expenses on other repairs and maintenance other than distribution lines and sub-stations such as repairs of general assets will be included in this cost centre.

Internal Control Records to be maintained in Distribution utilities

In addition to routine accounting records, various details are also required to be maintained for the purposes of cost records as per Companies (Cost Records and Audit) Rules 2014. Some of technical details required to be maintained are relating to voltage management, energy accounting and distribution losses and inventory.

Appendix - I

Central Electricity Authority (CEA) - Information to be submitted by Generation and Transmission Units. (To cross verify whether the internal data is similar to the data submitted)

Statistics and Return Standards

LIST OF FORMATS, FREQUENCY(IES) AND TARGETDATE(S)			
Title of format	**Frequency of data furnishing**	**Format No.**	**Target Date (By)**
Generation of Electricity	Annual	1	30-Jun
Transmission of Electricity	Annual	2	30-Jun
Distribution of Electricity	Annual	3	30-Jun
Trading of Electricity	Annual	4	30-Jun
Details of actual sale and purchase of Gross Electrical Energy	Annual	5	30-Jun
Installed Electricity Generating Capacity	Annual	6	30-Jun
Details of electricity generating capacity added	Annual	7	30-Jun
Details of electricity generating sets retired from service	Annual	8	30-Jun
Details of durations of electricity generating sets	Annual	9	30-Jun
Details of fuel consumption	Annual	10	30-Jun
Details of step-up transformers in service at the power stations and various sub-stations as on 31.03.20..	Annual	11	30-Jun
Details of step-down transformers in service as on 31.03.20..	Annual	12	30-Jun
Details of distribution transformers in service as on 31.03.20..	Annual	13	30-Jun
Details of transmission and distribution lines as on 31.03.20..	Annual	14	30-Jun
Details of electricity consumers, connected load andConsumption	Annual	15	30-Jun
Details of manpower	Annual	16	30-Jun
Training Facilities/ Training Capacity in the Power Sector (Man-days of year)	Annual	17	30-Jun
Details of theft of electricity	Annual	18	30-Jun
Statistics on electrical accidents	Annual	19	30-Jun
Reasons for electrical accidents	Annual	20	30-Jun

Annual data of HV/ EHV industry having electricity demand of 1 MW or above	Annual	21	30-Jun
Daily Operational Data of Thermal Power Stations and Nuclear Power Stations	Daily	22	1030 hrs
Daily Operational Data of Hydro Power Stations	Daily	23	1030 hrs
Monthly Operational Data of Thermal Power Stations and Nuclear Power Stations	Monthly	24	7th day
Monthly Operational Data of Hydro Power Stations	Monthly	25	7th day
Data for fixation of annual targets of electricity generation for year 20---20---	Annual	26	30-Nov
Regional Power Supply Position (Daily Operation Report)	Daily	27	0900 hrs
Provisional Power Supply Position	Monthly	28	5th day
Revised Power Supply Position	Monthly	29	18th day
Daily data regarding loss of generation on account of shortage of coal, gas and unrequisitioned liquid Fired capacity	Daily	30	0900 hrs
Monthly Data regarding Loss of Generation on account of shortage of coal, gas, unrequisitioned liquid fired capacity &backing down due to system constraints	Monthly	31	10th day
Data for load generation balance report (LGBR)	Annual	32	End February
Unscheduled Interchange (UI) Status	Monthly	33	10th day
Details of Power Traded by the Trading Company	Monthly	34	10th day
Progress of capacitor installation programme	Monthly	35	20th day
Daily Coal Report	Daily	36	1500 hrs.
Coal Report	Monthly	37	15th day
Generation Loss due to fuel shortage	Monthly	38	7th day
Report of Monthly Average Ash percentage	Monthly	39	7th day
Report of Quarterly/Annual Average Ash Percentage (by weight) in coal received	Quarterly	40	30th day after the end of quarter
Proposed Coal Allocation for Short Term Linkages For Thermal Power Stations	Quarterly	41	40 days before the commencement of the Quarter
Monthly Fuel Supply Data of Gas Based Thermal Power Stations	Monthly	42	15thday
Monthly Fuel Supply Data of Liquid Fuel Based Thermal Power Stations	Monthly	43	15thday
Monthly Fuel Supply Data of DG Power Stations	Monthly	44	15th day
Fuel-Oil Data	Monthly	45	15th day
Status of Progress of Villages Electrification and Irrigation Pump-sets Energisation	Monthly	46	3rd day
District wise status of progress of village Electrification and energisation of Pumpsets	Monthly	47	3rd day

District wise Monthly Progress of Inhabited Village Electrification	Monthly	48	3rd day
District-Wise Monthly Progress of Energisation of Irrigation Pumpsets	Monthly	49	3rd day
Villages electrified in various population groups and the population covered as on……..	Monthly	50	3rd day
Metering Status for the Month--------- year ---------	Monthly	51	3rdday
Details of Failure of Distribution & Power Transformers in the Month ---, Year 20--------	Monthly	52	3rdday
Reliability Index at Customer Level for the Month ---, year------	Monthly	53	3rdday
Reliability Indices (11 KV Feeders) for the Month----, Year-----	Monthly	54	3rdday
Financial Turn Around of Power Distribution for the Financial Year---	Annual	55	30thApril
Aggregate Technical & Commercia l(AT & C) Losses for the Financial Year----------	Annual	56	30thApril
Fuel Data of Fossil Fuel Based Thermal Power Stations for the month 20----	Monthly	57	20thday
Heat Rate Data of Coal / Lignite Based Thermal Power Stations for Month-----Year	Monthly	58	20thday
Heat Rate Data of Combined Cycle Gas Turbine Power Stations for Month ------ 20 ------	Monthly	59	20thday
Monthly Environmental Data of Thermal Power Plants	Monthly	60	20thday
Monthly Peak Hours Generation Data by Coal / Lignite Based or Combined Cycle Gas Turbine (CCGT) Power Stations	Monthly	61	7thday
Generating Company Data for Financial Study	Annually	62	30thJune
Transmission Company Data for Financial Study	Annually	63	30thJune
Power Distribution Company Data for Financial Study	Annually	64	30thJune
Monthly Abstract of Ash Generation and Utilisation	Monthly	65	20thday.

Annexure II (Statement of Specific Applicability of formats)

Title of Format	Format No.	Genco	Transco	Discom	Traders	SEBs/ Licens-ees/ Elecy. Deptts.	RLDCs	SLDCs	RPCs	CPPs/ Indus-tries
Generation of Electricity	1	Y				Y				
Transmission of Electricity	2		Y			Y				

Distribution of Electricity	3			Y		Y				
Trading of Electricity	4				Y					
Details of actual sale and purchase of Gross Electrical Energy	5	Y		Y	Y	Y				
Installed Electricity Generating Capacity	6	Y				Y				
Details of electricity generating capacity added	7	Y				Y				
Details of electricity generating sets retired from Service	8	Y				Y				
Details of derations of electricity generating sets	9	Y				Y				
Details of fuel consumption	10	Y				Y				
Details of step-up transformers in service at the power stations and various sub-stations as on 31.03.20..	11	Y	Y	Y		Y				
Details of step-down transformers in service as on 31.03.20..	12	Y	Y	Y		Y				
Details of distribution transformers in service as on 31.03.20..	13	Y		Y		Y				
Details of transmission and distribution lines as on 31.03.20..	14	Y	Y	Y		Y				
Details of electricity consumers, connected load and consumption	15			Y		Y				
Details of manpower	16	Y	Y	Y		Y				
Training Facilities/ Training Capacity in the Power Sector (Man-days of year)	17	Y	Y	Y		Y				

Details of theft of electricity	18			Y		Y				
Statistics on electrical accidents	19	Y	Y	Y		Y	Y	Y		
Reasons for electrical accidents	20	Y	Y	Y		Y	Y	Y		
Annual data of HV/ EHV industry having electricity demand of 1 MW or above	21									Y
Daily Operational Data of Thermal Power Stations and Nuclear Power Stations	22	Y				Y	Y	Y		
Daily Operational Data of Hydro Power Stations	23	Y				Y	Y	Y		
Monthly Operational Data of Thermal Power Stations and Nuclear Power Stations	24	Y				Y	Y	Y		
Monthly Operational Data of Hydro Power Stations	25	Y				Y	Y	Y		
Data for fixation of annual targets of electricity generation for year 20---20…..	26	Y				Y			Y	
Regional Power Supply Position (Daily Operation Report)	27						Y			
Provisional Power Supply Position	28						Y		Y	
Revised Power Supply Position	29						Y		Y	
Daily data regarding loss of generation on account of shortage of Coal, Gas, Unrequestioned liquid fired capacity	30	Y				Y	Y	Y		

Monthly data regarding loss of generation on account of shortage of Coal, Gas, Unrequestioned liquid fired capacity & Backing Down due to System Constraints	31	Y				Y				
Data for load generation balance report (LGBR)	32	Y		Y		Y				
Unscheduled Interchange (UI) Status	33						Y		Y	
Details of Power Traded by the Trading Company	34				Y					
Progress of capacitor installation programme	35								Y	
Daily Coal Report	36	Y				Y				
Coal Report	37	Y				Y				
Generation Loss due to fuel shortage	38	Y				Y				
Report of Monthly Average Ash percentage	39	Y				Y				
Report of Quarterly/ Annual Average Ash Percentage (by weight) in coal received	40	Y				Y				
Proposed Coal Allocation for Short Term Linkages for Thermal Power stations	41	Y				Y				
Monthly Fuel Supply Data of Gas Based Thermal Power Stations	42	Y				Y				
Monthly Fuel Supply Data of Liquid Fuel Based Thermal Power Stations	43	Y				Y				

Monthly Fuel Supply Data of DG Power Stations	44	Y				Y				
Fuel-Oil Data	45	Y				Y				
Status of Progress of Villages Electrification and Irrigation Pump sets Energisation	46			Y		Y				
District wise status of progress of village electrification and energisation of Pump sets	47			Y		Y				
District wise Monthly Progress of Inhabited Village Electrification	48			Y		Y			Y	
District-Wise Monthly Progress of Energisation of Irrigation Pump sets	49			Y		Y				
Villages electrified in various population groups and the population covered as on……..	50			Y		Y				
Metering Status for the Month --------- year-------	51			Y		Y				
Details of Failure of Distribution & Power Transformers in the Month-Year 20 -------	52			Y		Y				
Reliability Index at Customer Level for the Month -----, year----	53			Y		Y				
Reliability Indices(11KV Feeders) for theMonth--- Year-----	54			Y		Y				
Financial Turn Around of Power Distribution for the Financial Year----	55			Y		Y				

Aggregate Technical & Commercial (AT & C) Losses for the Financial Year -------	56			Y		Y				
Fuel Data of Fossil Fuel Based Thermal Power Stations for the month 20….	57	Y				Y				
Heat Rate Data of Coal/Lignite Based Thermal Power Stations for Month ---- Year ----	58	Y				Y				
Heat Rate Data of Combined Cycle Gas TurbinePower Stations for Month ----- 20 ------	59	Y				Y				
Monthly Environmental Data of Thermal Power Plants	60	Y				Y				
Monthly Peak Hours Generation Data by Coal/ Lignite Based or Combined Cycle Gas Turbine (CCGT) Power Stations	61	Y				Y				

Appendix - II

NOTIFICATIONNo.: RA-14026(11)/4/2020-CERC:Dated: 23rd June 2020

Terms and Conditions for Tariff determination from Renewable Energy Sources)Regulations, 2020

CENTRAL ELECTRICITY REGULATORY COMMISSION NEW DELHI

Dated: 23rd June 2020

NOTIFICATION

No.: RA-14026(11)/4/2020-CERC: In exercise of powers conferred under Section 61 read with sub-clause (s) of Clause (2) of Section 178 of the Electricity Act, 2003 (36 of 2003), and all other powers enabling it in this behalf, and after previous publication, the Central Electricity Regulatory Commission hereby makes the following regulations:

1. **Short title and commencement**

   1) These regulations may be called the Central Electricity Regulatory Commission (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2020.

   2) These regulations shall come into force on 1.7.2020, and unless reviewed earlier or extended by the Commission, shall remain in force up to 31.3.2023.

2. **Definitions and Interpretation**

   1) In these regulations, unless the context otherwise requires,

      a) **'Act'** means the Electricity Act, 2003 (36 of 2003);

      b) **'Auxiliary energy consumption'** or '**AUX**' in relation to a period in case of a generating station means the quantum of energy consumed by auxiliary equipment of the generating station, and transformer losses within the generating station, expressed as a percentage of the sum of gross energy generated at the generator terminals of all the units of the generating station;

      c) **'Biomass'** means wastes produced during agricultural and forestry operations (for example straws and stalks) or produced as a by-product of processing operations of agricultural produce (e.g., husks, shells, de-oiled cakes,); wood produced in dedicated energy plantations or recovered from wild bushes or weeds; and the wood waste produced in some industrial operations;

      d) **'Biomass gasification'** means the process of incomplete combustion of biomass resulting in production of combustible gases consisting of a mixture of carbon monoxide (CO), hydrogen (H2) and traces of methane(CH4);

e) **'Biogas'** means a gas produced when organic matter like crop residues, sewage and manure breaks down (ferments) in an oxygen-freeenvironment;

f) **'Capital cost'** means the capital cost of a project as referred to in Regulations 12, 24, 27, 31, 39, 46, 50, 56, 62, 70 and73;

g) **'Commission**' means the Central Electricity Regulatory Commission referred to in sub-section (1) of section 76 of theAct;

h) **'Conduct of Business Regulations'** means the Central Electricity Regulatory Commission (Conduct of Business) Regulations, 1999 or any subsequent re-enactmentthereof;

i) **'Control Period'** means the period during which the norms for determination of tariff specified in these regulations shall remainvalid;

j) **'Floating solar project'** or '**FPV**' means a solar PV power project where the arrays of photovoltaic panels on a structure of the project float on top of a body of water, such as artificial basin or lake, with the help of floater, anchoring and mooring system;

k) **'Grid Code'** means the Central Electricity Regulatory Commission (Indian Electricity Grid Code) Regulations, 2010 as amended from time to time or any subsequent re-enactmentthereof;

l) **'Gross calorific value'** or '**GCV**' in relation to a fuel used in a generating station means the heat produced in kCal by complete combustion of one kilogram of solid fuel or one litre of liquid fuel or one standard cubic meter of gaseous fuel, as the case maybe;

m) **'Gross station heat rate'** or 'Gross **SHR**' means the heat energy input in kCal required to generate one kWh of electrical energy at generator terminals of a generatingstation;

n) **'Installed capacity'** or '**IC**' means the summation of the name plate capacities of all the units of the generating station or the capacity of the generating station (reckoned at the generator terminals). In case of Solar PV power projects and Floating solar projects, Installed capacity shall be sum of name plate capacities (Nominal AC power) of the inverters of theproject;

o) **'Inter-connection point'** shall mean interface point of renewable energy generating facility with the transmission system or distribution system, where the energy is injected, as the case may be, andinclude:

(i) in relation to wind power projects, solar PV power projects, renewable hybrid energy projects and renewable energy with storage Projects, line isolator on outgoing feeder on HV side of the pooling sub-station;and

(ii) in relation to small hydro projects, biomass gasifier based power projects, non-fossil fuel based co-generation projects and solar thermal power projects, line isolator on outgoing feeder on HV side of generator transformer.

p) **'MNRE'** means the Ministry of New and Renewable Energy of the Government of India;

q) **'Municipal solid waste'** or '**MSW**' means and includes commercial and residential wastes generated in a municipal or notified area in either solid or semi-solid form and excludes industrial hazardous wastes, but includes treated bio-medicalwastes;

r) **'Non-fossil fuel based co-generation project'** means a generating station that uses the process in which more than one form of energy (such as steam and electricity) are produced in a sequential manner by use ofbiomass;

s) **'Operation and Maintenance expenses'** or '**O&M expenses**' means the expenditure incurred on operation and maintenance of the project, or part thereof, and includes the expenditure on manpower, repairs, spares, consumables, insurance andoverheads;

t) **'Project'** means a generating station or an evacuation system upto inter-connection point, as the case may be, and in case of a small hydro project includes all components of generating facility such as dam, intake water conductor system, power generating station and generating units of the scheme, as apportioned to powergeneration;

u) **'Pumped storage hydro project'** means a hydro power project which generates power through water stored as potential energy, pumped from a lower elevation reservoir to a higher elevationreservoir;

v) **'Refuse derived fuel'** or '**RDF**' means segregated combustible fraction of solid waste other than chlorinated plastics in the form of pellets or fluff produced by drying, de-stoning, shredding, dehydrating, and compacting combustible components of solid waste that can be used asfuel;

w) **'Renewable energy'** or '**RE**' means the electricity generated from renewable energysources;

x) **'Renewable energy project'** means a generating station that produces electricity from renewable energysources;

y) **'Renewable energy source'** means renewable source of energy such as water, wind, sunlight, biomass, bagasse, municipal solid waste and other such sources as approved by the MNRE;

z) '**Renewable energy with storage project**' means a combination of renewable energy project with storage or a combination of renewable hybrid energy project with storage at the same inter-connectionpoint;

aa) **Renewable hybrid energy project'** means a renewable energy project that produces electricity from a combination of renewable energy sources, connected at the same inter-connection point;

ab) **'Small hydro project'** means a hydro power project with a installed capacity up to and including 25 MW or as defined by the Government of India, from time to time at a singlelocation;

ac) **'Solar PV power project'** means a project that uses sunlight for direct conversion into electricity through photovoltaic technology and is based on technologies such as crystalline silicon or thin film or any other technology as approved by MNRE;

ad) **'Solar thermal power project'** means a project that uses sunlight for direct conversion into electricity through concentrated solar power technology and is based on line focus or point focusprinciple;

ae) **'State Nodal Agency'** means the agency in a State as may be designated by Ministry of New and Renewable Energy to promote efficient use of renewable energy in thatState;

af) "**Storage"** means energy storage system utilizing methods and technologies like, solid state batteries, flow batteries, pumped storage, compressed air, fuel cells, hydrogen storage or any other technology, to store various forms of energy and to deliver the stored energy in the form of electricity;

ag) **'Tariff period'** for renewable energy projects will be same as their Useful Life and tariff period shall be considered from the date of commercial operation of such powerprojects.

ah) **'Useful Life'** in relation to project, including dedicated evacuation system, from the date of commercial operation of such project, shall mean the following:-

1)	Wind power project	25 years
2)	Biomass power project with Rankine cycle technology	25 years
3)	Non-fossil fuel based co-generation project	25 years
4)	Small hydro Project	40 years
5)	Municipal solid waste based power project/ Refuse derived fuel based power project	25 years
6)	Solar PV power project/ floating solar project/ Solar thermal power project	25 years
7)	Biomass gasifier based power project	25 years
8)	Biogas based power project	25 years
9)	Renewable hybrid energy project	Minimum of the Useful Life of different RE technologies combined for Renewable Hybrid Energy Project for Composite Tariff as specified under Regulation 72.
10)	Renewable energy with storage project	Same as Useful Life of project assuming that there is no storage

ii) 'Year' means a financial year.

2) Save as aforesaid and unless repugnant to the context or if the subject matter otherwise requires, words and expressions used in these regulations and not defined,

but defined in the Act, or the Grid Code or the Central Electricity Regulatory Commission (Terms and conditions of Tariff) Regulations, 2019 shall have the meanings assigned to them respectively in the Act or the Grid Code or the Central Electricity Regulatory Commission (Terms and conditions of Tariff) Regulations, 2019.

3. **Scope and extent of application**

These regulations shall apply to cases where tariff for a grid connected generating station or a unit thereof commissioned during the Control Period and based on renewable energy sources, is to be determined by the Commission under Section 62 read with Section 79 of the Act:

Provided that in cases of wind power projects, small hydro projects, biomass power project with Rankine cycle technology, non-fossil fuel based co-generation projects, solar PV power projects, floating solar projects, solar thermal power projects, renewable hybrid energy projects, renewable energy with storage projects, biomass gasifier based power projects, biogas based power projects, municipal solid waste based power projects and refusederived fuel based power projects, these regulations shall apply subject to the fulfilment of eligibility criteria specified in Regulation 4 of these Regulations.

4. **Eligibility Criteria**

a) Wind power project – The project that uses new wind turbine generators and is located at sites, on-shore or off-shore, approved by State Nodal Agency or Appropriate Government.

b) Small hydro project – The project that uses new plant and machinery and is located at sites approved by State Nodal Agency or Appropriate Government.

c) Biomass power project with Rankine cycle technology – The project that uses new plant and machinery, is based on Rankine cycle technology, and does not use any fossil fuel.

d) Non-fossil fuel based co-generation project – The project that uses new plant and machinery, and is based on topping cycle mode of co-generation.

Topping cycle mode of co-generation – Any facility that uses non-fossil fuel input for the power generation and also utilizes the thermal energy generated for useful heat applications in other industrial activities simultaneously:

Provided that for the co-generation facility to qualify under topping cycle mode, the sum of useful power output and one half the useful thermal output be greater than 45% of the facility's energy consumption, during crushing season.

Explanation- For the purposes of this clause,

(i) **'Useful power output'** is the gross electrical output from the generator. There will be an auxiliary consumption in the cogeneration plant itself (e.g. the boiler feed pump and the FD/ID fans). In order to compute the net power output, it would be necessary to subtract the auxiliary consumption from the gross output. For simplicity of calculation,

the useful power output is defined as the gross electricity (kWh) output from the generator.

(ii) **'Useful Thermal Output'** is the useful heat (steam) that is provided to the process by the cogenerationfacility.

(iii) **'Energy Consumption'**of the facility istheusefulenergy input that is supplied by the fuel (normally bagasse or other suchbiomass).

(iv) **'Topping Cycle'** means a co-generation process in which thermal energy produces electricity followed by useful heatapplication.

e) Solar PV power project, floating solar project and solar thermal power project–The project is based on technologies approved byMNRE.

Provided that floating solar project installed with existing renewable energy project other than ground mounted Solar PV project shall be treated as renewable hybrid energy project.

f) Renewable hybrid energy project – The rated capacity of generation from one renewable energy source is at least 25% of the rated capacity of generation from other renewable energy source(s), which operate at the same point of interconnection: Provided that energy is injected into grid at the same interconnection point and metering is done at such common interconnection pointaccordingly.

g) Biomass gasifier based power project – The project uses new plant and machinery, and has a grid connected system that uses 100% producer gas engine, coupled with gasifier technologies approved byMNRE.

h) Biogas based power project – The project uses new plant and machinery and has a grid connected system that uses 100% biogas fired engine, coupled with biogas technology for co-digesting agriculture residues, manure and other bio-waste as approved byMNRE.

i) Municipal solid waste based power projects – The project uses new plant and machinery based on Rankine cycle technology, and uses municipal solid waste as fuel.

j) Refuse derived fuel based power projects – The project uses new plant and machinery based on Rankine cycle technology, and uses refuse derived fuel asfuel.

k) Renewable energy with storage project – The renewable energy project including renewable hybrid energy project that uses, partly or fully, renewable energy generated from such project to store energy into storage facility which is connected at the same point of interconnection as the renewable energyproject.

Chapter 1: General Principles

5. **Control Period**

The Control Period under these Regulations shall be from 1.7.2020 to 31.3.2023:

Provided that the tariff determined as per these regulations for the RE projects commissioned during the Control Period, shall remain valid for the tariff period;

Provided further that the tariff norms specified in these regulations shall continue to remain applicable until notification of the revised norms through subsequent re-enactment of these regulations.

6. **Generic Tariff**

The generic tariff shall be determined by the Commission on annual basis in accordance with these Regulations for the following types of renewable energy projects:

a) Small hydro project;

b) Biomass power project with Rankine cycle technology;

c) Non-fossil fuel based co-generation project;

d) Biomass gasifier based power project; and

e) Biogas based power project

Provided that the generic tariff determined for the year, in which an RE project is commissioned, shall be applicable for such RE Project of same type and shall remain valid for the tariff period.

7. **Project Specific tariff**

a) Project specific tariff, on case to case basis, shall be determined by the Commission for the following types of renewable energy projects:

   i. Solar PV power projects, floating solar projects and solar thermal power projects;

   ii. Wind power projects (both on-shore and off-shore);

   iii. Biomass gasifier based power projects and biogas based power projects – if a project developer opts for project specific tariff;

   iv. Municipal solid waste based power projects and refuse derived fuel based power projects;

   v. Renewable hybrid energy projects;

   vi. Renewable energy with storage projects; and

   vii. Any other project based on new renewable energy sources or technologies approved by MNRE.

b) Financial and operational norms specified in these regulations, except for capital cost shall be the ceiling norms while determining the project specific tariff.

8. **Petition and proceedings for determination of tariff**

(1) In case of renewable energy projects for which generic tariff has to be determined as per these regulations, the Commission shall determine such generic tariff at least one month before the commencement of year for each year of the Control Period:

Provided that for first year of Control Period i.e., from 1.7.2020 to 31.3.2021, the generic tariff shall be determined upon issuance of these regulations.

(2) A petition for determination of project specific tariff shall be accompanied by such fee as may be specified in the Central Electricity Regulatory Commission (Payment of Fees) Regulations, 2012 as amended from time to time or any subsequent re-enactment thereof, and shall be accompanied by:

a) Information in forms 1.1, 1.2, 2.1, 2.2 and 2.3, as the case may be, as appended to these regulations;

b) Detailed project report outlining technical and operational details, site specific aspects, basis for capital cost, detailed break-up of capital cost and financing plan;

c) A statement of all applicable terms and conditions and anticipated expenditure for the period for which tariff is to be determined;

d) A statement containing details of calculation of any grant or subsidy or incentive received, due or assumed to be due, from the Central Government or State Government or both. This statement shall also include the proposed tariff calculated without such subsidy or incentive;

e) Consent from beneficiary for procurement of power from renewable energy project at tariff approved by the Commission, in the form of initialled Power Purchase Agreement or Memorandum of Understanding;and

f) Following documents in case of petition for determination of project specific tariff by renewable energy projects, where tariff from such renewable energy sources is generally determined through competitive bidding process in accordance with provisions of Section 63 of theAct:

(i) Rationale for opting project specific tariff instead of competitive bidding;and

(ii) Competitiveness of the proposed tariff vis-à-vis tariff discovered through competitive bidding/ tariff prevalent in themarket

g) Any other information directed by theCommission

(3) The proceedings for determination of tariff shall be in accordance with the provisions of the Conduct of Business Regulations.

9. **Tariff Structure**

The tariff for renewable energy sources shall consist of the following components:

a) Return on equity;

b) Interest on loan;

c) Depreciation;

d) Interest on working capital; and

e) Operation and Maintenance expenses;

Provided that for renewable energy projects having fuel cost component, like biomass power projects with rankine cycle technology, biomass gasifier based power projects, biogas

based power projects, non-fossil fuel based co-generation projects and refuse derived fuel based power projects, single part tariff with two components, fixed cost component and fuel cost component, shall be determined.

10. **Tariff Design**

1. The generic tariff shall be determined, on levelized basis, considering the year of commissioning of the project, for the tariff period of the project:

   Provided that for renewable energy projects having single part tariff with two components, fixed cost component shall be determined on levelized basis consideringthe year of commissioning of the project while fuel cost component shall be determined on year of operation basis in the Tariff Order to be issued by the Commission.

2. For the purpose of levelized tariff computation, discount factor equivalent to post-tax weighted average cost of capital shall beconsidered.

3. The above principles shall also apply for project specifictariff.

11. **Treatment for Over-Generation**

In case a renewable energy project, in a given year, generates energy in excess of the capacity utilization factor or plant load factor, as the case may be, specified under these Regulations, the renewable energy project may sell such excess energy to any entity, provided that the first right of refusal for such excess energy shall vest with the concerned beneficiary. In case the concerned beneficiary purchases the excess energy, the tariff for such excess energy shall be 75 percent of the tariff applicable for that year.

Chapter 2: Financial Principles

12. **Capital Cost**

Norms for capital cost, as specified in relevant chapters of these regulations, shall be inclusive of land cost, pre-development expenses, all capital work including plant & machinery, civil work, erection, commissioning, financing cost, interest during construction, and evacuation infrastructure up to inter-connection point

13. **Debt Equity Ratio**

1. For determination of generic tariff and project specific tariff, the debt equity ratio shall be considered as 70:30:

   Provided that, for project specific tariff, where the equity actually deployed is more than 30% of the capital cost, equity in excess of 30% shall be treated as normative loan;

   Provided further that for project specific tariff where equity actually deployed is less than 30% of the capital cost, the actual equity shall be considered for determination of tariff;

   Provided also that the equity invested in foreign currency shall be designated in Indian rupees on the date of each investment;

   Provided also that debt equity ratio shall be considered after deducting the amount of grant or capital subsidy received for the project for arriving at the amount of debt and equity.

Explanation-The premium, if any, raised by the generating company, while issuing share capital and investment of internal resources created out of its free reserve, for the funding of the project, shall be reckoned as paid up capital for the purpose of computing return on equity, only if such premium amount and internal resources are actually utilized for meeting the capital expenditure of the renewable energy project.

2. The project developer shall submit the resolution of the Board of the company or approval of the competent authority in other cases regarding infusion of funds from internal resources in support of the utilization made or proposed to be made to meet the capital expenditure of the renewable energy project

14. **Loan Tenure and Interest on Loan**

(1) **Loan Tenure**

For determination of generic tariff and project specific tariff, loan tenure of 15 years shall be considered.

(2) **Interest on Loan**

(a) The loans arrived at in the manner indicated in Regulation 13 shall be considered as gross normative loan for calculation for interest on loan. For project specific tariff, the normative loan outstanding as on 1st of April of every year shall be worked out by deducting the cumulative repayment up to 31st March of previous year from the gross normative loan.

(b) For the purpose of computation of tariff, normative interest rate of two hundred(200) basis points above the average State Bank of India Marginal Cost of Funds based Lending Rate (MCLR) (one-year tenor) prevalent during the last available six months shall be considered.

(c) Notwithstanding any moratorium period availed by project developer, the repayment of loan shall be considered from the first year of commercial operation of the project and shall be equal to the annual depreciationallowed

15. **Depreciation**

1. The value base for the purpose of depreciation shall be the capital cost of the project admitted by the Commission. The salvage value of the project shall be considered as 10% and depreciation shall be allowed up to maximum of 90% of the capital cost of the project:

   Provided that, no depreciation shall be allowed to the extent of grant or capital subsidy received for the project.

2. Depreciation rate of 4.67% per annum shall be considered for the first 15 years and remaining depreciation shall be evenly spread during remaining Useful Life of the project.

3. Depreciation shall be computed from the first year of commercial operation:

   Provided that, for determination of project specific tariff, in case of commercial operation of the project for part of the year, depreciation shall be computed on pro rata basis.

16. **Return on Equity**

(1) The value base for equity shall be as determined under Regulation 13.

(2) The normative Return on Equity shall be 14%. The normative Return on Equity shall be grossed up by the latest available notified Minimum Alternate Tax (MAT) rate for the first 20 years of the Tariff Period and by the latest available notified Corporate Tax rate for the remaining Tariff Period.

17. **Interest on Working Capital**

(1) The Working Capital requirement in respect of wind power projects, small hydro projects, solar PV power projects, floating solar projects, solar thermal power projects, and renewable energy with storage projects shall be computed in accordance with the following:

a) Operation and Maintenance expenses for one month;

b) Receivables equivalent to 45 days of tariff for sale of electricity calculated on normative Capacity Utilisation Factor or Plant Load Factor, as the case may be; and

c) Maintenance spares equivalent to 15% of Operation and Maintenanceexpenses.

(2) The Working Capital requirement in respect of biomass power projects with Rankine cycle technology, biogas power projects, biomass gasifier based power projects, non-fossil fuel based co-generation projects, municipal solid waste based power projects and refuse derived fuel based power projects shall be computed in accordance with the following:

a) Fuel costs for four months equivalent to normative Plant Load Factor;

b) Operation and Maintenance expense for one month;

c) Receivables equivalent to 45 days of tariff for sale of electricity calculated on the plant load factor; and

d) Maintenance spares equivalent to 15% of Operation and Maintenance expenses.

(3) In case of renewable hybrid energy projects, the Working Capital requirement shall be sum of the Working Capital requirement determined as per norms applicable for renewable energy sources, in proportion to their rated capacity in the project.

(4) Interest on Working Capital shall be at interest rate equivalent to the normative interest rate of three hundred and fifty (350) basis points above the average State Bank of India Marginal Cost of Funds based Lending Rate (MCLR) (one-year tenor) prevalent during the last available six months.

18. **Calculation of capacity utilization factor and plant load factor:**

The number of hours in a year for calculation of capacity utilization factor and plant load factor, as the case may be, shall be considered as 8766.

19. **Operation and Maintenance Expenses**

1. Operation and Maintenance expenses shall be determined for the Tariff Period of the project based on normative O&M expenses specified in these regulations for the first year of the Control Period.

2. Normative O&M expenses allowed during first year of the Control Period i.e. financial year 2020-21 under these regulations shall be escalated at the rate of 3.84% per annum for the Tariff Period.

20. **Rebate**

(1) For payment of bills of the generating company through revolving and valid letter of credit on presentation or through National Electronic Fund Transfer (NEFT) or Real Time Gross Settlement (RTGS) payment mode within a period of 5 days of presentation of bills, a rebate of 1.5% on bill amount shall be allowed.

Explanation: In case of computation of '5 days', the number of days shall be counted consecutively without considering any holiday. However, in case the last day or 5th day is official holiday, the 5th day for the purpose of rebate shall be construed as the immediate succeeding working day.

(2) Where payments are made on any day after 5 days within a period of one month from date of presentation of bills by the generating company, a rebate of 1% shall be allowed.

21. **Late payment surcharge**

In case the payment of any bill for charges payable under these regulations is delayed beyond a period of 45 days from the date of presentation of bills, a late payment surcharge at the rate of 1.50% per month shall be levied by the generating company.

22. **Subsidy or incentive by the Central or the State Government**

(1) The Commission shall take into consideration any incentive, grant or subsidy from the Central or State Government, including accelerated depreciation benefit, availed by the project, while determining the tariff under these regulations:

Provided that the following principles shall be considered for ascertaining income tax benefit on account of accelerated depreciation, if availed, for the purpose of tariff determination:

i) Assessment of benefit shall be based on normative capital cost, accelerated depreciation rate and corporate income tax rate as per relevant provisions of Income Tax Act, 1961 as amended from time to time; and

ii) Capitalization of renewable energy projects during second half of the fiscal year

iii) Per unit benefit shall be derived on levelized basis at discount factor equivalent to weighted average cost ofcapital.

(2) Any grant, subsidy or incentives availed by renewable energy project, which is not considered at time of determination of tariff, shall be deducted by the beneficiary in subsequent bills after receipt of such grant, subsidy or incentive in suitable instalments or within such period as may be stipulated by theCommission

(3) In case the Central or State Government or their agencies provide any generation-based incentive, which is specifically over and above the tariff, such incentive shall neither be taken into account while determining the tariff nor be deducted by the beneficiary in subsequent bills raised by the particular Renewable energyproject

23. **Statutory Charges**

The renewable energy project developer shall recover from the beneficiaries, the statutory charges imposed by the State and Central Government such as water cess, electricity duty on auxiliary consumption subject to maximum of normative auxiliary consumption.

Chapter 3: Parameters for wind power projects

24. **Capital Cost**

The Commission shall determine only project specific capital cost considering the prevailing market trends.

25. **Capacity Utilisation Factor**

(1) Capacity utilization factor norms for this Control Period shall as follows:

Annual Mean Wind Power Density (W/m2)	Capacity Utilization Factor
Upto 220	22%
221-275	24%
276-330	28%
331-440	33%
> 440	35%

(2) The annual mean wind power density specified in sub-regulation (1) above shall be measured at 100-meterhub-height

(3) Wind power projects shall be classified into particular wind zone site as per MNRE guidelines for wind measurement. Based on validation of wind mast by National Institute of Wind Energy, State Nodal Agency should certify zoning of the proposed wind farm complex

26. **Operation and Maintenance expenses**

The Commission shall determine only project specific O&M expenses considering the prevailing market trends

Chapter 4: Parameters for small hydro projects

27. **Capital Cost**

(1) The normative capital cost for small hydro projects during first year of Control Periodi.e. financial year 2020-21 shall be as follows:

Region	Project Size	Capital Cost (₹ lakh/ MW)
Himachal Pradesh, Uttarakhand, West Bengal, Union Territory of Jammu and Kashmir, Union Territory of Ladakh andNorth Eastern States	Below 5 MW	1100
	5 MW to 25 MW	1100
Other States	Below 5 MW	780
	5 MW to 25 MW	900

(2) The capital cost for small hydro projects as specified for first year of the Control Period shall remain valid for the entire duration of the Control Period unless reviewed earlier by theCommission

28. **Capacity Utilisation Factor**

Normative capacity utilization factor for the small hydro projects located in Himachal Pradesh, Uttarakhand, West Bengal, Jammu and Kashmir, Ladakh and North-Eastern States shall be 45% and for other States, it shall be 30%:

Explanation: For the purpose of this Regulation, normative capacity utilization factor is net of free power to the home State, if any.

29. **Auxiliary Consumption**

Normative auxiliary consumption for the small hydro projects shall be considered as 1.0%.

30. **Operation and Maintenance expenses**

(1) Normative O&M Expenses for the first year of the Control Period i.e. financial year 2020-21 shall be as under:

Region	Project Size	O&M Expenses (in ₹ lakh/ MW)
Himachal Pradesh, Uttarakhand, West Bengal, Union Territory of Jammu and Kashmir, Union Territory of Ladakh and NorthEastern States	Below 5 MW	41.78
	5 MW to 25 MW	31.34
Other States	Below 5 MW	33.66
	5 MW to 25 MW	24.37

(2) Normative O&M Expenses allowed at the commencement of the Control Period i.e. financial year 2020-21 under these regulations shall be escalated at the rate specified in Regulation 19 of these Regulations for Tariff Period.

Chapter 5: Parameters for biomass power projects based on Rankine Cycle Technology

31. **Capital Cost**

(1) The normative capital cost for first year of the Control Period i.e. financial year 2020- 21 shall be as under:

Biomass power projects based on Rankine cycle technology	Capital Cost (₹ lakhs/ MW)
Project [other than rice straw and juliflora (plantation) based project] with water-cooled condenser	559
Project [other than rice straw and juliflora (plantation) based project] with air-cooled condenser	600
For rice straw and juliflora (plantation) based project with water-cooled condenser	611
For rice straw and juliflora (plantation) based project with air-cooled condenser	652

(2) The capital cost for biomass power projects based on Rankine cycle technology as specified for first year of the Control Period shall remain valid for the entire duration of the Control Period unless reviewed earlier by the Commission.

32. **Plant Load Factor**

For the purpose of determination of tariff, the Plant Load Factor shall be considered as 80%.

33. **Auxiliary Consumption**

The normative auxiliary consumption shall be as follows:-

a) For projects using water-cooled condenser: 10%

b) For projects using air-cooled condenser: 12%

34. **Station Heat Rate**

The Station Heat Rate shall be:

a) For projects using travelling grate boilers: 4200 kCal/kWh

b) For projects using AFBC boilers: 4125 kCal/kWh

35. **Operation and Maintenance expenses**

Normative O&M Expenses for the first year of the Control Period i.e. financial year 2020-21 shall be Rs.46.42 lakhs per MW and shall be escalated at the rate at the rate specified in Regulation 19 of these Regulations for the Tariff Period.

36. **Use of Fossil Fuel**

The use of fossil fuels shall not be allowed:

Provided that for biomass power projects based on Rankine cycle technology commissioned

on or before 31.03.2017, use of fossil fuels to the extent of 15% in terms of gross calorific value on annual basis, shall be allowed for the Useful Life of the project from the date of commercial operation

37. **Gross Calorific Value**

The gross calorific value of biomass fuel, for the purpose of determination of tariff, shall be at 3100 kCal/kg

38. **Fuel Cost**

Biomass fuel price during first year of the Control Period i.e. financial year 2020-21 shall be as specified in the table below and shall be escalated at the rate of 5% per annum to arrive at the base price for subsequent years of the Control Period, unless reviewed earlier by Commission. For the purpose of determining levelized tariff, a normative escalation factor of 5% per annum shall be applicable on biomass fuel price.

State	Biomass prices for FY 2020-21 (₹/MT)
Andhra Pradesh	3326
Haryana	3786
Maharashtra	3872
Punjab	3960
Rajasthan	3305
Tamil Nadu	3272
Telangana	3326
Uttar Pradesh	3384
Other States	3557

Chapter 6: Parameters for non-fossil fuel based co-generation projects

39. **Capital Cost**

Normative capital cost for the non-fossil fuel based co-generation projects shall be Rs. 492 lakhs/MW for the first year of Control Period i.e. financial year 2020-21 and will remain valid for the entire duration of the Control Period unless reviewed earlier by the Commission.

40. **Plant Load Factor**

The plant load factor for different States shall be as follows:

State	Plant Load Factor (%)
Uttar Pradesh and Andhra Pradesh	45%
Tamil Nadu and Maharashtra	60%
Other States	53%

41. **Auxiliary Consumption**

The auxiliary consumption shall be considered as 8.5% for the computation of tariff.

42. **Station Heat Rate**

The Station Heat Rate of 3600 kCal/ kWh for power generation component alone shall be considered for computation of tariff for non-fossil fuel based co-generation projects.

43. **Gross Calorific Value**

The gross calorific value for bagasse shall be considered as 2250 kCal/kg. For the use of biomass fuels other than bagasse, gross calorific value as specified under Regulation 37 shall be applicable.

44. **Fuel Cost**

a. The price of bagasse for first year of the Control Period i.e. financial year 2020-21 shall be as specified in the table below and shall be escalated at the rate of 5% per annum to arrive at the base price for subsequent years of the Control Period, unless specifically reviewed by Commission. For the purpose of determining levelized tariff, a normative escalation factor of 5% per annum shall be applicable on bagasse prices.

State	Bagasse Price for FY 2020-21 (Rs. /MT)
Andhra Pradesh	1878
Haryana	2671
Maharashtra	2632
Punjab	2351
Tamil Nadu	2023
Telangana	1877
Uttar Pradesh	2095
Other States	2274

For use of biomass other than bagasse in non-fossil fuel based co-generation projects, the biomass prices as specified under Regulation 38 shall be applicable.

45. **Operation and Maintenance expenses**

Normative O&M expenses during the first year of the Control Period, i.e. financial year 2020-21, shall be Rs. 24.52 lakhs per MW and shall be escalated at the rate specified in Regulation 19 of these Regulations for Tariff Period.

Chapter 7: Parameters for solar PV power projects, solar thermal power projects and floating solar projects

46. **Capital Cost**

The Commission shall determine only project specific capital cost considering the prevailing market trends.

47. **Capacity Utilisation Factor**

The Commission shall only approve capacity utilisation factor for project specific tariff:

Provided that the minimum capacity utilization factor for solar PV power projects shall be 21%:

Provided further that the minimum capacity utilization factor for solar thermal power projects shall be 23%:

Provided also that the minimum capacity utilisation factor for floating solar projects shall be 19%.

48. **Operation and Maintenance expenses**

The Commission shall determine only project specific O&M expenses considering the prevailing market trends.

49. **Auxiliary Consumption**

The Commission shall only approve auxiliary consumption for project specific tariff:

Provided that the maximum auxiliary consumption for solar PV power projects shall be 0.75%;

Provided further that the maximum auxiliary consumption for solar thermal power projects shall be 10%;

Provided also that the maximum auxiliary consumption for floating solar projects shall be 0.75%.

Chapter 8: Parameters for biomass gasifier based power projects

50. **Capital Cost**

Normative capital cost for biomass gasifier based power projects shall be Rs.593 lakhs/MW during first year of Control Period i.e. financial year 2020-21 and will remain valid for the entire duration of the Control Period unless reviewed earlier by the Commission.

51. **Plant Load Factor**

Plant load factor for determination of tariff shall be considered as 85%.

52. **Auxiliary consumption**

The auxiliary consumption shall be considered as 10% for the determination of tariff.

53. **Specific fuel consumption**

Normative specific fuel consumption shall be 1.25 kg per kWh.

54. **Operation and Maintenance expenses**

Normative O&M expenses for the first year of the Control period i.e. financial year 2020- 21 shall be Rs. 61.31 lakhs per MW and shall be escalated at the rate specified in Regulation 19 of these Regulations for Tariff Period.

55. **Fuel Cost**

Biomass fuel price for biomass gasifier-based power projects shall be the same as for biomass power project based on Rankine cycle technology as mentioned in Regulation 38.

Chapter 9: Parameters for biogas based power projects

56. **Capital Cost**

Normative capital cost for biogas based power projects shall be Rs.1186 lakhs/MW for first year of the Control Period i.e. financial year 2020-21 and shall remain valid for the entire duration of the Control Period unless reviewed earlier by the Commission.

57. **Plant Load Factor**

Plant load factor shall be considered as 90% for determination of tariff.

58. **Auxiliary Consumption**

The auxiliary consumption shall be considered as 12% for determination of tariff.

59. **Operation and Maintenance Expenses**

Normative O&M expenses for the first year of the Control Period i.e. financial year 2020- 21 shall be Rs. 61.31 lakhs per MW and shall be escalated at the rate specified in Regulation 19 of these Regulations for the Tariff Period.

60. **Specific Fuel Consumption**

Normative specific fuel consumption shall be 3 kg of substrate mix per kWh

61. **Fuel Cost (Feed stock Price)**

Feed stock price during first year of the Control Period i.e. financial year 2020-21 shall be Rs. 1422/MT and shall be escalated at the rate of 5% per annum to arrive at the base price for subsequent years of the Control Period, unless specifically reviewed by Commission. For the purpose of determining levelized tariff, a normative escalation factor of 5% per annum shall be applicable.

Chapter 10: Parameters for municipal solid waste based power projectsand refuse derived fuel based power projects

62. **Capital Cost**

The Commission shall determine only project specific capital cost considering the prevailing market trends.

63. **Plant Load Factor**

(1) Plant load factor for determining tariff for municipal solid waste based power projects and refuse derived fuel based power projects shall be:

Sl. No.	Plant load factor	MSW	RDF
a)	During stabilisation period	65%	65%
b)	During the remaining period of the first year (after stabilization period)	65%	65%
c)	2nd year onwards	75%	80%

(2) The stabilisation period shall not be more than 6 months from the date of commercial operation of the project.

64. **Auxiliary Consumption**

The auxiliary consumption for determination of tariff shall be considered as 15%.

65. **Station Heat Rate**

The Station Heat Rate for determination of tariff shall be considered as 4200 kcal/kWh

66. **Operation and Maintenance Expenses**

The Commission shall determine only project specific O&M expenses considering the prevailing market trends.

67. **Gross Calorific Value**

(1) The gross calorific value of RDF for the purpose of determination of tariff shall be at 2500 kcal/kg.

(2) The gross calorific value of MSW shall be determined by the Commission on a case to case basis while determining the project specific tariff.

68. **Fuel Cost**

(1) Price of refuse derived fuel during financial year 2020-21 shall be considered as ₹2,084 per MT and shall be escalated at the rate of 5% per annum to arrive at the base price for subsequent years of the Control Period, unless specifically reviewed by Commission. For the purpose of determining levelized tariff, a normative escalation factor of 5% per annum shall be applicable.

(2) Fuel cost shall be considered as nil for municipal solid waste:

Provided that the Commission may consider allowing transportation cost of such fuel while determining the project specific tariff.

Chapter 11: Parameters for Renewable Hybrid Energy Projects

69. **Capital Cost**

The capital cost shall be determined on project specific basis considering the prevailing market trends.

70. **Capacity Utilisation Factor**

1. The Commissionshall determine only project specific capacity utilisation factor in respect of renewable hybrid energy projects taking into consideration the proportion of rated capacity of each renewable energy source, as the case may be,and applicable capacity utilisation factor for such renewable energy source, as the case may be:

   Provided that the minimum capacity utilization factor for renewable hybrid energy project shall be 30% when measured at the inter-connection point, where the energy is injected into the grid.

71. **Operation and Maintenance expenses**

The Commission shall determine only project specific O&M expenses considering the prevailing market trends.

72. **Tariff**

The tariff for a renewable hybrid energy project shall be a composite levelised tariff for the project as a whole by factoring in the tariff components upto the minimum of the useful life of the RE technologies combined for such RE hybrid Project:

Provided that, in case any of the RE technologies combined for RE hybrid project is left with further useful life, the levelised tariff for remaining useful life of such RE technology shall be determined separately, by factoring in the tariff components for the remaining useful life.

Chapter 12: Parameters for renewable energy with storage project

73. **Capital Cost**

The Commission shall determine only project specific capital cost for renewable energy with storage project considering the prevailing market trends

74. **Storage Efficiency**

(1) The Commission shall approve the storage efficiency only for project specific tariff:

   Provided that the minimum efficiency for storage based on technology of solid state batteries shall be 80%:

   Provided further that the minimum efficiency for storage based on technology of pumped storage shall be 75%:

(2) Efficiency of storage component of renewable energy with storage project shall be measured as ratio of output energy received from storage and input energy supplied to the storage component of such project, on annualbasis

75. **Operation and Maintenanceexpenses**

The Commission shall determine only project specific O&M expenses considering the prevailing market trends.

76. **Tariff determination for Energy Storage**

The tariff for renewable energy with storage project shall be a composite tariff or differential tariff based on time of day, determined for energy supplied from the Project including the energy supplied from the storage facility:

Provided that such tariff may be determined for supply of power on round the clock basis or for time periods as agreed by Project Developer andBeneficiary.

77. **Deviation from norms**

Tariff for electricity generated from a generating station based on renewable energy sources, may also be agreed between the generating company and beneficiary, in deviation from the norms specified in these regulations:

Provided that the levelized tariff of the project calculated on the basis of the norms specified in these regulations shall be the ceiling levelized tariff.

78. **Power to Relax**

The Commission may by general or special order, for reasons to be recorded in writing, and after giving an opportunity of hearing to the parties likely to be affected, may relax any of the provisions of these regulations on its own motion or on an application made before it by an interested person

79. **Power to Relax**

The Commission may by general or special order, for reasons to be recorded in writing, and after giving an opportunity of hearing to the parties likely to be affected, may relax any of the provisions of these regulations on its own motion or on an application made before it by an interested person

80. **Power to remove difficulty**

If any difficulty arises in giving effect to the provisions of these Regulations, the Commission may, by general or specific order, make such provisions not inconsistent with the provisions of the Act, as may appear to be necessary for removing the difficulty

Sd-

(Sanoj Kumar Jha)

Secretary

APPENDIX

Form-1.1: Template for (Wind power projects/ Small hydro projects/ Solar PV power projects/ Solar thermal power projects/ Renewable energy hybrid power projects/Renewable energy with storage projects)

Sl. No.	Assumption Head	Sub-head	Sub-head (2)	Unit	Parameter
1	Power Generation	Capacity	Installed Power Generation Capacity	MW	
			Capacity Utilization Factor (CUF)	%	
			Auxiliary Consumption	%	
			Commercial Operation Date (COD)	dd/mm/yyyy	
			Useful Life	Years	
2	Project Cost	Capital Cost	Normative Capital Cost	₹ Crore/ MW	
			Capital Cost	₹ Crore	
			Capital Subsidy, if any	₹ Crore	
			Net Capital Cost	₹ Crore	
3	Financial Assumption	Debt Equity	Tariff Period	Years	
			Debt	%	
			Equity	%	
		Debt Component	Total debt amount	₹ Crore	
			Total equity amount	₹ Crore	
			Loan Amount	₹ Crore	
			Moratorium Period	Years	
			Repayment Period (incl moratorium)	Years	
			Interest Rate	%	
		Equity Component	Equity Amount	₹ Crore	
			Return on Equity for First 20 Years	% p.a.	
			Return on Equity after 20 years	% p.a.	
			Discount Rate	%	
		Depreciation	Dep Rate for 1st 15 years	%	
			Dep rate 16th year onwards	%	
		Incentives	GBI, if any	₹ Crore	
			Period for GBI	Years	
4	O& M Expenses	Normative O&M Expense		₹ Lakh/MW	
		O&M Expenses p.a.		₹ Crore	
		Escalation Factor		%	

5	Working Capital	O&M Expenses		Month	
		Maintenance Spares	% of O&M Expenses	%	
		Receivables		Days	
		Interest on Woking Capital		% per annum	

Form-1.2: Template for (Biomass/MSW/RDF)

Sl. No.	Assumption Head	Sub-head	Sub-head (2)	Unit	Parameter
1	Power Generation	Capacity	Installed Power Generation Capacity	MW	
			Aux Consumption	%	
			PLF (1st year)	%	
			PLF (2nd year onwards)	%	
			Commercial Operation Date	dd/mm/yyyy	
			Useful Life	Years	
2	Project Cost	Capital Cost/ MW	Normative Capital Cost	₹ Crore /MW	
			Capital Cost	₹ Crore	
			Capital Subsidy, if any	₹ Crore	
			Net Capital Cost	₹ Crore	
3	Financial Assumption	Debt Equity	Tariff Period	Years	
			Debt	%	
			Equity	%	
		Debt Component	Total debt amount	₹ Crore	
			Total equity amount	₹ Crore	
			Loan Amount	₹ Crore	
			Moratorium Period	Years	
			Repayment Period (including moratorium)	Years	
			Interest Rate	%	
		Equity Component	Equity Amount	₹ Crore	
			Return on Equity for First 20 years	% p.a.	
			Return on Equity after 20 years	% p. a.	
			Discount Rate	%	
		Depreciation	Dep Rate for 1st 15 years	%	
			Dep rate 16th year onwards	%	

		Incentives	GBI, if any	₹ Crore	
			Period for GBI	Years	
4	O&M Expenses	Normative O&M Expenses		₹ Lakh/MW	
		O&M Expenses p.a.		₹ Crore	
		Escalation Factor		%	
5	Working Capital	O&M Expenses		Month	
		Maintenance Spares	% of O&M Expenses	%	
		Receivables		Days	
		Interest on WC		%	
6	Fuel Related assumption	Station Heat Rate	During 1st year	kcal/kWh	
			2nd year onwards	kcal/kWh	
		Fuel Type and mix	Biomass Fuel Type-1	%	
			Biomass Fuel Type-2	%	
			Municipal Solid Waste	%	
			Refuse Derived Fuel	%	
			Fossil Fuel (Coal)	%	
			GCV of Biomass Fuel Type-1	kcal/kWh	
			GCV of Biomass Fuel Type-2	kcal/kWh	
			GCV of MSW	kcal/kWh	
			GCV of RDF	kcal/kWh	
			GCV of Fossil Fuel (Coal)	kcal/kWh	
			Biomass Price (Fuel Type-1)/ Yr 1	₹/MT	
			Biomass Price (Fuel Type-2)/ Yr 1	₹/MT	
			MSW Price/ Yr 1	₹/MT	
			RDF Price/ Yr 1	₹/MT	
			Fossil Fuel (Coal) Price)/ Yr 1	₹/MT	
			Fuel Price Escalation Factor	% p.a.	

Form-2.1: Template for (Wind power projects or Solar PV power projects /Solar thermal power projects): Determination of Tariff Components

Units Generation	Unit	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Yr-6	Yr-7	Yr-8	Yr-9	Yr-10	Yr-11	Yr-12
Installed Capacity	MW												
Net Generation	MU												

Units Generation	Unit	Yr-13	Yr-14	Yr-15	Yr-16	Yr-17	Yr-18	Yr-19	Yr-20	Yr-21	Yr-22	Yr-23	Yr-24	Yr-25
Installed Capacity	MW													
Net Generation	MU													

Tariff Components (Fixed charge)	Unit	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Yr-6	Yr-7	Yr-8	Yr-9	Yr-10	Yr-11	Yr-12
O&M Expenses	₹ Lakh												
Depreciation	₹ Lakh												
Interest on term loan	₹ Lakh												
Interest on workingCapital	₹ Lakh												
Return on Equity	₹ Lakh												
Total Fixed Cost	₹ Lakh												

Tariff Components (Fixed charge)	Unit	Yr-13	Yr-14	Yr-15	Yr-16	Yr-17	Yr-18	Yr-19	Yr-20	Yr-21	Yr-22	Yr-23	Yr-24	Yr-25
O&M Expenses	₹ Lakh													
Depreciation	₹ Lakh													
Interest on term loan	₹ Lakh													
Interest on workingCapital	₹ Lakh													
Return on Equity	₹ Lakh													
Total Fixed Cost	₹ Lakh													

Per Unit Tariffcomponents	Unit	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Yr-6	Yr-7	Yr-8	Yr-9	Yr-10	Yr-11	Yr-12
PU O&M expenses	₹/kWh												
PU Depreciation	₹/kWh												
PU Interest on termLoan	₹/kWh												
PU Interest on workingcapital	₹/kWh												
PU Return on Equity	₹/kWh												
PU Tariff Components	₹/kWh												

Per Unit Tariff components	Unit	Yr-13	Yr-14	Yr-15	Yr-16	Yr-17	Yr-18	Yr-19	Yr-20	Yr-21	Yr-22	Yr-23	Yr-24	Yr-25
PU O&M expenses	₹/kWh													
PU Depreciation	₹/kWh													
PU Interest on term Loan	₹/kWh													
PU Interest on working Capital	₹/kWh													
PU Return on Equity	₹/kWh													
PU Tariff Components	₹/kWh													

Levelized Tariff	Unit	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Yr-6	Yr-7	Yr-8	Yr-9	Yr-10	Yr-11	Yr-12
Discount Factors													
Discounted Tariff components	₹/kWh												
Levelized Tariff	₹/kWh												

Levelized Tariff	Unit	Yr-13	Yr-14	Yr-15	Yr-16	Yr-17	Yr-18	Yr-19	Yr-20	Yr-21	Yr-22	Yr-23	Yr-24	Yr-25
Discount Factors														
Discounted Tariff Components	₹/kWh													
Levelized Tariff	₹/kWh													

Form-2.2: Template for (Biomass power projects, municipal solid waste based power projects, refuse derived fuel based power projects or non-fossil fuel based co-generation plants): Determination of Tariff Components

Units Generation	Unit	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Yr-6	Yr-7	Yr-8	Yr-9	Yr-10	Yr-11	Yr-12
Installed Capacity	MW												
Net Generation	MU												

Units Generation	Unit	Yr-13	Yr-14	Yr-15	Yr-16	Yr-17	Yr-18	Yr-19	Yr-20	Yr-21	Yr-22	Yr-23	Yr-24	Yr-25
Installed Capacity	MW													
Net Generation	MU													

Tariff Components (Fixed charge)	Unit	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Yr-6	Yr-7	Yr-8	Yr-9	Yr-10	Yr-11	Yr-12
O&M Expenses	₹ Lakh												
Depreciation	₹ Lakh												
Interest on term loan	₹ Lakh												
Interest on working Capital	₹ Lakh												
Return on Equity	₹ Lakh												
Total Fixed Cost	₹ Lakh												

Tariff Components (Fixed charge)	Unit	Yr-13	Yr-14	Yr-15	Yr-16	Yr-17	Yr-18	Yr-19	Yr-20	Yr-21	Yr-22	Yr-23	Yr-24	Yr-25
O&M Expenses	₹ Lakh													
Depreciation	₹ Lakh													
Interest on term loan	₹ Lakh													
Interest on working Capital	₹ Lakh													
Return on Equity	₹ Lakh													
Total Fixed Cost	₹ Lakh													

Tariff Components (Variable Charge)	Unit	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Yr-6	Yr-7	Yr-8	Yr-9	Yr-10	Yr-11	Yr-12
Biomass Fuel Type-1	₹ Lakh												
Biomass Fuel Type-2	₹ Lakh												
Fossil Fuel (coal)	₹ Lakh												
Municipal Solid Waste	₹ Lakh												
Refuse Derived Fuel	₹ Lakh												
Sub-total (Fuel Costs)	₹ Lakh												
Fuel cost allocable to power	%												
Total Fuel Costs	₹ Lakh												

Tariff Components (Variable Charge)	Unit	Yr-13	Yr-14	Yr-15	Yr-16	Yr-17	Yr-18	Yr-19	Yr-20	Yr-21	Yr-22	Yr-23	Yr-24	Yr-25
Biomass Fuel Type-1	₹ Lakh													
Biomass Fuel Type-2	₹ Lakh													
Fossil Fuel (coal)	₹ Lakh													
Municipal Solid Waste	₹ Lakh													
Refuse Derived Fuel	₹ Lakh													
Sub-total (Fuel Costs)	₹ Lakh													
Fuel cost allocable to power	%													
Total Fuel Costs	₹ Lakh													

Per Unit Tariff components (Fixed)	Unit	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Yr-6	Yr-7	Yr-8	Yr-9	Yr-10	Yr-11	Yr-12
PU O&M expenses	₹/kWh												
PU Depreciation	₹/kWh												
PU Interest on term loan	₹/kWh												
PU Interest on working capital	₹/kWh												
PU Return on Equity	₹/kWh												
PU Tariff Components (Fixed)	₹/kWh												
PU Tariff Components (Variable)	₹/kWh												
PU Tariff Components (Total)	₹/kWh												

Per Unit Tariff components (Fixed)	Unit	Yr-13	Yr-14	Yr-15	Yr-16	Yr-17	Yr-18	Yr-19	Yr-20	Yr-21	Yr-22	Yr-23	Yr-24	Yr-25
PU O&M expenses	₹/kWh													
PU Depreciation	₹/kWh													
PU Interest on term loan	₹/kWh													
PU Interest on working capital	₹/kWh													
PU Return on Equity	₹/kWh													
PU Tariff Components (Fixed)	₹/kWh													
PU Tariff Components (Variable)	₹/kWh													
PU Tariff Components (Total)	₹/kWh													

Levelized Tariff	Unit	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Yr-6	Yr-7	Yr-8	Yr-9	Yr-10	Yr-11	Yr-12
Discount Factors													
Discounted Tariff components (Fixed)	₹/kWh												
Discounted Tariff components (Variable)	₹/kWh												
Discounted Tariff components (Total)	₹/kWh												
Levelized Tariff (Fixed)	₹/kWh												
Levelized Tariff (Variable)	₹/kWh												
Levelized Tariff (Total)	₹/kWh												

Levelized Tariff	Unit	Yr-13	Yr-14	Yr-15	Yr-16	Yr-17	Yr-18	Yr-19	Yr-20	Yr-21	Yr-22	Yr-23	Yr-24	Yr-25
Discount Factors														
Discounted Tariff components (Fixed)	₹/kWh													
Discounted Tariff components (Variable)	₹/kWh													
Discounted Tariff components (Total)	₹/kWh													
Levelized Tariff (Fixed)	₹/kWh													
Levelized Tariff (Variable)	₹/kWh													
Levelized Tariff (Total)	₹/kWh													

Form-2.3: Template for (Small Hydro projects): Determination of Tariff Components

Units Generation	Unit	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Yr-6	Yr-7	Yr-8	Yr-9	Yr-10	Yr-11	Yr-12	Yr-13
Installed Capacity	MW													
Net Generation	MU													

Units Generation	Unit	Yr-14	Yr-15	Yr-16	Yr-17	Yr-18	Yr-19	Yr-20	Yr-21	Yr-22	Yr-23	Yr-24	Yr-25	Yr-26
Installed Capacity	MW													
Net Generation	MU													

Units Generation	Unit	Yr-27	Yr-28	Yr-29	Yr-30	Yr-31	Yr-32	Yr-33	Yr-34	Yr-35	Yr-36	Yr-37	Yr-38	Yr-39	Yr-40
Installed Capacity	MW														
Net Generation	MU														

Tariff Components (Fixed charge)	Unit	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Yr-6	Yr-7	Yr-8	Yr-9	Yr-10	Yr-11	Yr-12	Yr-13
O&M Expenses	₹ Lakh													
Depreciation	₹ Lakh													
Interest on term loan	₹ Lakh													
Interest on working Capital	₹ Lakh													
Return on Equity	₹ Lakh													
Total Fixed Cost	₹ Lakh													

Tariff Components (Fixed charge)	Unit	Yr-14	Yr-15	Yr-16	Yr-17	Yr-18	Yr-19	Yr-20	Yr-21	Yr-22	Yr-23	Yr-24	Yr-25	Yr-26
O&M Expenses	₹ Lakh													
Depreciation	₹ Lakh													
Interest on term loan	₹ Lakh													
Interest on workingCapital	₹ Lakh													
Return on Equity	₹ Lakh													
Total Fixed Cost	₹ Lakh													

Tariff Components (Fixed charge)	Unit	Yr-27	Yr-28	Yr-29	Yr-30	Yr-31	Yr-32	Yr-33	Yr-34	Yr-35	Yr-36	Yr-37	Yr-38	Yr-39	Yr-40
O&M Expenses	₹ Lakh														
Depreciation	₹ Lakh														
Interest on term loan	₹ Lakh														
Interest on working Capital	₹ Lakh														
Return on Equity	₹ Lakh														
Total Fixed Cost	₹ Lakh														

Per Unit Tariff Components	Unit	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Yr-6	Yr-7	Yr-8	Yr-9	Yr-10	Yr-11	Yr-12	Yr-13
PU O&M expenses	₹/kWh													
PU Depreciation	₹/kWh													
PU Interest on term loan	₹/kWh													
PU Interest on workingcapital	₹/kWh													
PU Return on Equity	₹/kWh													
PU Tariff Components	₹/kWh													

Per Unit Tariff Components	Unit	Yr-14	Yr-15	Yr-16	Yr-17	Yr-18	Yr-19	Yr-20	Yr-21	Yr-22	Yr-23	Yr-24	Yr-25	Yr-26
PU O&M expenses	₹/kWh													
PU Depreciation	₹/kWh													
PU Interest on term Loan	₹/kWh													

PU Interest on working Capital	₹/kWh													
PU Return on Equity	₹/kWh													
PU Tariff Components	₹/kWh													

Per Unit Tariff components	Unit	Yr-27	Yr-28	Yr-29	Yr-30	Yr-31	Yr-32	Yr-33	Yr-34	Yr-35	Yr-36	Yr-37	Yr-38	Yr-39	Yr-40
PU O&M expenses	₹/kWh														
PU Depreciation	₹/kWh														
PU Interest on term loan	₹/kWh														
PU Interest on working capital	₹/kWh														
PU Return on Equity	₹/kWh														
PU Tariff Components	₹/kWh														

Levelized Tariff	Unit	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Yr-6	Yr-7	Yr-8	Yr-9	Yr-10	Yr-11	Yr-12	Yr-13
Discount Factors														
Discounted Tariff Components	₹/kWh													
Levelized Tariff	₹/kWh													

Levelized Tariff	Unit	Yr-14	Yr-15	Yr-16	Yr-17	Yr-18	Yr-19	Yr-20	Yr-21	Yr-22	Yr-23	Yr-24	Yr-25	Yr-26
Discount Factors														
Discounted Tariff components	₹/kWh													
Levelized Tariff	₹/kWh													

Levelized Tariff	Unit	Yr-27	Yr-28	Yr-29	Yr-30	Yr-31	Yr-32	Yr-33	Yr-34	Yr-35	Yr-36	Yr-37	Yr-38	Yr-39	Yr-40
Discount Factors															
Discounted Tariff components	₹/kWh														
Levelized Tariff	₹/kWh														
Discounted Tariff components (Variable)	₹/kWh														

Discounted Tariff components (Total)	₹/kWh														
Levelized Tariff (Fixed)	₹/kWh														
Levelized Tariff (Variable)	₹/kWh														
Levelized Tariff (Total)	₹/kWh														
Discounted Tariff components (Variable)	₹/kWh														

APPENDIX-III

Summary of the key proposed amendments proposed in 2020

Establishment of the Electricity Contract Enforcement Authority ("ECEA")

While various provisions of the Electricity Act relate to the sale and purchase of electricity, there are no specific provisions existing in the Electricity Act dealing with the issues under power purchase agreements ("**PPAs** ") executed for such sale and purchase of electricity or contracts relating to transmission. In order to improve enforceability of PPAs and contracts relating to transmission, and to ensure time bound adjudication of disputes under PPAs/ transmission related contracts, the Amendment Bill proposes to establish the ECEA to adjudicate upon the matters regarding specific performance.

Payment Security Mechanism for Scheduling of Electricity

A robust system to enforce compliance with payment security mechanism has been a major pain point for the power industry and has led to a huge pool of unpaid dues to generators – this has caused a lot of stress in the sector. The Amendment Bill provides that "*no electricity shall be scheduled or despatched under such contract unless adequate security of payment as agreed upon by the parties to the contract, has been provided* ". The dispatch of electricity is being undertaken by the load dispatch centre through the process of scheduling – the Amendment Bill proposes to empower the load dispatch centres to administer the establishment of adequate payment security mechanism before scheduling dispatch of electricity as per the relevant contracts. Creation of such a payment security mechanism is proposed to be made mandatory keeping in view the sanctity of contracts, unless it is waived by the parties to the contract themselves.

Promotion of Renewable Energy and Hydro Power Sector

The Amendment Bill proposes that the Central Government (in consultation with the State Government) will prepare and notify, from time to time, a National Renewable Energy Policy ("NRE Policy "). The formulation and notification of the NRE Policy is intended to promote the generation of electricity from renewable sources of energy. The Amendment Bill proposed a minimum fixed percentage (as prescribed by the Central Government) of electricity from renewable and hydro sources of energy should be purchased – specifically, the proposed amendment to Section 86(1) (e) of the Electricity Act makes it mandatory for State Commissions to follow directions given in NRE Policy for prescribing a minimum percentage of purchase of electricity from renewable and hydro sources of energy. Further, as hydro power has been recognised as the renewable source of energy, the Amendment Bill further proposes to expand the scope of renewable power purchase obligations to include hydro sources.

Tariff and Cross Subsidy

In respect of the retail tariff, the Amendment Bill seeks to ensure that such retail tariff is determined by the Appropriate Commission to reflect the actual cost or fair cost of the power which is to be supplied in order to ensure financial health of the distribution companies. In order to achieve this, the Amendment Bill provides that the Appropriate Commission should set the tariff for the retail sale of electricity without accounting for any subsidy, which, if any, under Section 65 of the Electricity Act, should be provided by the relevant government

directly to the consumer. As per the Amendment Bill, it is proposed that the tariff should reflect the cost of the supply of electricity and reduces the cross-subsidies levied in the manner provided under the tariff policy.

Open Access

Under the Electricity Act, open access can be granted to a consumer on the payment of surcharge and wheeling charges as determined by the relevant State Commission. However, such charges do not include charges for intra-state transmission and inter-state transmission of power. In view of this, the Amendment Bill proposes to add such transmission charges, wherever applicable, to the existing charges (i.e. surcharge and wheeling charges). Further, it is proposed under the Amendment Bill that open access surcharge and cross-subsidies will be "progressively reduced" by the State Commission in the manner provided in the tariff policy – Section 42 of the Electricity Act envisaged reduction in cross subsidy as per discretion of the relevant State Commission, however, the Amendment Bill seek to take away discretion of the State Commission for determination of cross subsidy and post amendment the State Commission will be bound to follow the mandate of the Central Government.

The Distribution sub- licensee and Franchisee

The Amendment Bill proposes that distribution licensees, with the permission of the relevant State Commission, can recognise and authorise a person as "distribution sub-licensee" (distinct from the "franchisee" model already available under the Electricity Act) to distribute electricity on its behalf in a particular area within its area of supply – however, the original distribution licensee will remain the licensee and will ultimately be responsible for ensuring the quality of the distribution of electricity in its area of supply. It is also proposed that such distribution sub-licensee is not required to obtain a separate license under Section 14 of the Electricity Act from the relevant State Commission.

Enhancement of the Regulatory Framework/Ensuring Better Compliance

(a) Easing the process for appointment of members of regulatory and adjudicatory bodies: Under the existing provisions of the Electricity Act, there are multiple selection committees which are required to be constituted for the appointment of- (i) members of the APTEL, (ii) the chairperson and members of Central Commission4 and (iii) the members of State Commission.

The Amendment Bill proposes to streamline the appointment process by having a single selection committee for the appointment of (i) members of the APTEL, and (ii) chairperson and members of ECEA, Central Commission, State Commission and Joint Commissions. Further, the Amendment Bill also proposes uniform qualifications for the appointment of chairperson and members of Central Commission and State Commissions.

(b) Increasing the strength of APTEL: The Amendment Bill proposes to increase the number of APTEL members to seven from three, in addition to the chairperson to enable speedy adjudication and disposal of matters which are filed before the APTEL.

(c) Increase in penalties for non-compliance: Penalties under Section 142 and Section 146 of the Electricity Act are proposed to be increased through the Amendment Bill to ensure better compliance with the provisions of the Electricity Act.

Power & Electricity is a vital & essential utility for Economic Development of any Country. Reliable availability of electricity is strongly correlated with economic development and growth of any nation. Industrial production processes and activities require energy to carry out work to convert materials into desired products and to transport raw materials, goods, and people. The construction, operation, and maintenance of tools, machines, and factories require a flow of materials and electrical energy. Reliable supply of electricity at reasonable price is imperative for industrial activity aiding fast economic growth.

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