



**"13TH CAPACITY BUILDING
PROGRAMME FOR OFFICERS OF
ELECTRICITY REGULATORY
COMMISSIONS"**

SUBJECT:

***"Distribution Tariff Design :
Methodological Approach".***

BY

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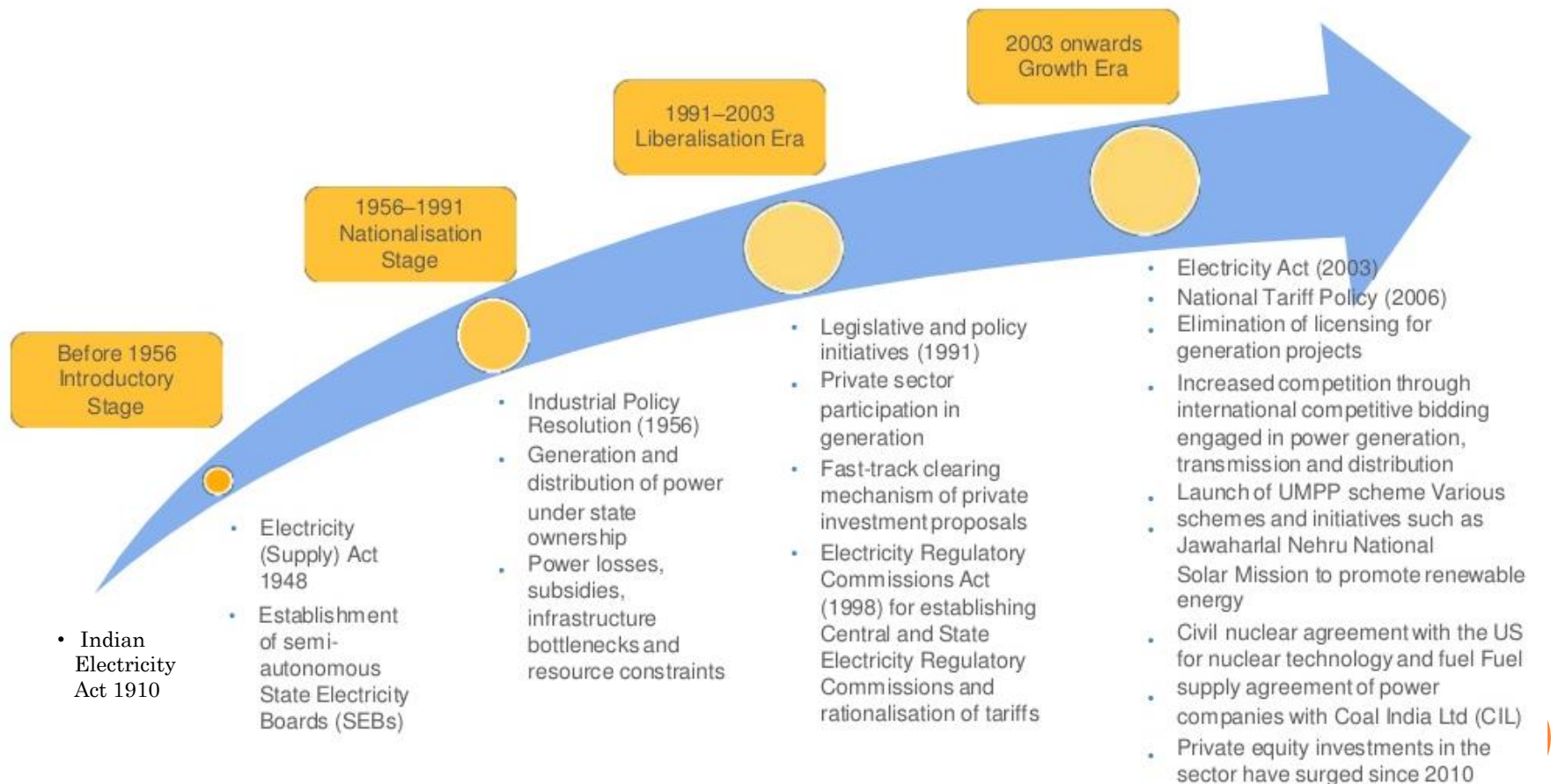
CONTENTS

- Evaluation of Indian Power Sector
- General approach for Regulated Tariff
- Legal Hierarchy and Provisions of Law
- Multi Year Tariff Framework
- Steps for Determination of ARR
- Retail Tariff Design
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EVALUATION OF INDIAN POWER SECTOR

- 1st demonstration of electric light in Calcutta on 24.07.1879.
- 1st Electric Licensee in Calcutta on 07.01.1897 by Kilburn & Co. (renamed as CESC)



1947: IC = 1,362 MW

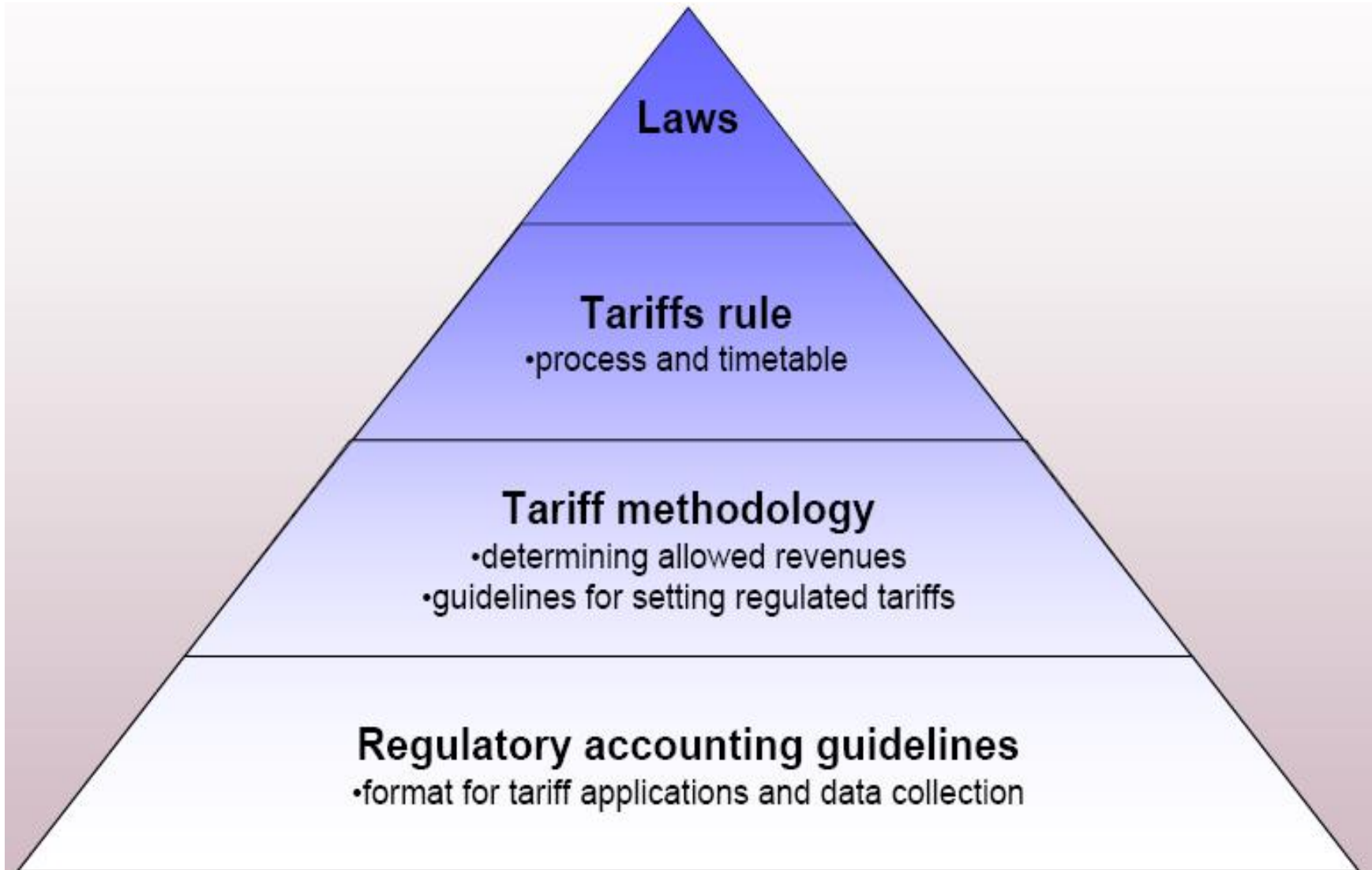


30.11.2019: IC = 3,65,980 MW

GENERAL APPROACH FOR REGULATED TARIFF


OPTIONS	CHARACTERISTICS
Target Based Regulations (TBR)	<ul style="list-style-type: none">- Specific targets set for important operating elements (e.g. losses, collections, quality of service) for control period- All other cost elements subject to normal cost -plus regulation- Improvements on targets to account of utility or shared with consumers and vice-versa
Reference Utility Regulations (RUR)	<ul style="list-style-type: none">- Based on forward looking (incremental) cost framework Hypothetical “ideal” utility modelled based on load and generation configuration for control period (upto 10 years)- Tariffs for “ideal” utility set in advance and subject to only a few pass through elements (primarily fuel)
Performance Based Regulations (PBR)	<ul style="list-style-type: none">- Characterised by $RPI-X+Y$ formula- Base cost set at beginning of control period (3-7 yrs ordinarily) based on historical cost data- Efficiency gains/losses to account of utility- Pass through of external costs (Y) allowed

LEGAL HIERARCHY



PROVISIONS OF ELECTRICITY ACT 2003

Section 61: Appropriate Commission to specify Tariff Regulations

- the generation, transmission, distribution and supply of electricity are **conducted on commercial principles**; [b]
 - The factors which could **encourage competition, efficiency, economical use of the resources, good performance and optimum investments**; [c]
 - **safeguarding of consumers' interest** and at the same time, recovery of the cost of electricity in a reasonable manner; [d]
 - the principles **rewarding efficiency in performance**; [e]
 - **multi-year tariff principles**; [f]
 - that the tariff **progressively reflects the cost of supply** of electricity and also reduces cross-subsidies in the manner specified by the Appropriate Commission. [g]
 - the **National Electricity Policy and tariff policy**: [i]
- 

PROVISIONS OF ELECTRICITY ACT 2003

○ Section 62

- The Appropriate Commission shall determine the tariff for **retail sale of electricity** in accordance with the provisions of this Act;[1]
- In case of multiple distribution licensees, the Appropriate Commission may, for the promoting competition **fix only maximum ceiling of tariff for retail sale** of electricity;[proviso 1]
- No tariff or part of any tariff may ordinarily be amended, **more frequently than once in a year**, except expressly permitted under fuel surcharge formula;[4]

○ Section 65

- The **State Government may grant subsidy** to any consumer or class of consumers by making payment in advance to the distribution licensee.

TARIFF POLICY 2016

4.0 Objective of Tariff Policy 2016

- Ensure availability of electricity at reasonable and competitive rates;
- Ensure financial viability of the sector and attract investments;
- Promote transparency, consistency and predictability;
- Supply of adequate and uninterrupted power to all consumers;
- Ensure creation of adequate capacity including reserves in generation, transmission and distribution in advance for reliability of supply.

8.0 Distribution retail Tariff

- Licensee may have the flexibility to charge lower tariff than approved by the SERC if competitive condition requires so without claiming any excess cost. [8.1(4)]
- To progressively reflect cost of supply tariff a roadmap to bring tariff within $\pm 20\%$ of average cost of supply (ACoS). [8.3]
- BPL consumer tariff should be at least 50% of ACoS. [8.3]
- As a substitute of cross-subsidy State Govt can raise resources through electricity duty and then provide direct subsidies [8.3]

RULES AND ACCOUNTING GUIDELINES

- Every Electricity Regulatory Commission **notifies the Tariff Regulations** in terms of sub-section 181 of the Electricity Act 2003, which comprises of :

A) Detail **terms and conditions for Tariff determination**

B) **Form / Formats** of Regulatory Accounts statements

- Analysis of operating and maintenance costs;
- Regulatory asset base (RAB);
- Capital expenditure;
- Depreciation;
- Balance sheet;
- Cash flow statement;
- Major projects summary;
- Loan details;
- Provisions;
-



MULTI YEAR TARIFF FRAMEWORK

1. Control Period varies **from 3 to 5 years**;
2. Performance standards **trajectory for entire control period**;
3. DISCOM has to file MYT petition **at least 120 days prior** to control period along with the followings:
 - **Capital investment plan** along with capitalization schedule;
 - **Power purchase plan** matching with sales forecast;
 - **Trajectory of performance parameters**;
 - **Aggregate Revenue Requirement (ARR)** and **expected revenue from charges** for each year;
 - Truing-up of previous concluded year;
 - **Proposals to meetup the revenue gap**;
 - All information in specified formats;
 - Copy of audited accounts of previous years;



MULTI YEAR TARIFF FRAMEWORK

4. Cost elements are categorized as **uncontrollable** (change in law, fuel and power purchase cost, sales variation, taxes, etc) and **controllable** (O&M expenses, variation of T&D loss, variation in capitalization on time & cost overrun, etc).
5. **Uncontrollable costs** should be recovered speedily to ensure that future consumers are not burdened with past costs
 - Truing up is allowed at the end of the year (uncontrollable pass through, controllable gain /loss sharing);
 - Provision for incentive;
6. **Tariff is generally determined annually** considering the already determined ARR and the impacts of truing up, if any.
 - Fuel & Power purchase cost variation allowed on monthly / quarterly basis.



MULTI YEAR TARIFF FRAMEWORK

7. Procedure for tariff determination:

- ERC **admits the petition** based on availability of all information
- **Comments and suggestions** invited through paper notifications followed by public hearing (optional)
- ERC **prior to beginning of control period** approves the followings:
 - **Capital expenditure plan** and capitalization schedule;
 - **Power purchase plan**;
 - **ARR for each year** of the control period;
 - **Revenue gap** for each year;
 - **Tariff Order for 1st ensuing year** considering truing-up of previous year(s);

8. Once the revenue requirements are established, the ERC focus on regulation of outputs and not the input cost elements;

- Some ERC provides for **Mid-term review**.



STEPS FOR DETERMINATION OF ARR

1) Landed Power Purchase Cost: (60% to 75%)

Step1: Sales projection:

Methods:

- CAGR of sales for the last 3, 5 years or more;
- Trend analysis;
- Forecast based on methods such as use of Average annual load factor;
- Econometric model

Prudent adjustments:

- Govt policies on industry, tax, SEZs, etc;
- Inflection point in economic cycle (boom, slowdown, recession or expansion);
- Impact of open access or other consumer specific issues;

Challenges:

- Accuracy of data (metered or unmetered)



Step 2: Distribution AT&C loss

- **AT&C loss trajectory** for each year of the control period is specified in the regulation.
- AT&C loss target for each year is determined during MYT;
- There may be **voltage-wise loss** or overall loss;

Step 3: Availability of Power – PPAs

- DISCOMs has to prepare **long-term and med-term power purchase plan**;
- Power Purchase Plan is **approved by the ERC** during MYT approval or Business Plan approval;
- Each long-term and mid-term **PPAs are required to be approved**;
- Availability of power from the agreed sources are projected considering **previous years PAF or PPA or station specific conditions**;

Step 4: Energy Balance

- Energy requirement is computed by applying **normative loss over the sales projection**.
- For better result **seasonal average hourly LGB** may be considered to compute the amount of shortfall and surplus.
- Suitable **provision for reserve** is to be considered to provide uninterrupted supply.

Step 4: Shortfall and surplus management:

- **Shortfall management** through Short-term Power Purchase, power swapping / banking , demand side management, efficiency improvement;
- **Surplus management** through sale of incidental power, power swapping arrangement



Step 5: Power Purchase cost determination:

- Power purchase is allowed in the following sequence:
 - must run sources,
 - Sources to meet RPO; and
 - conventional following merit order (energy charge).
- Tariff as determined **u/s 62 or discovered u/s 63** is considered for all long-term and mid-term PPAs;
- For short-term purchase rate of **power exchanges** during last year may be used as benchmark;
- Any real time variation in power purchase cost to be recovered through **fuel surcharge formula** (MVCA, Zfac, etc)

Step 6: Landed Power Purchase cost

- Landed power purchase cost is finally determined by applying suitable **transmission (CTU & STU) losses** and the **payable transmission charges**.

STEPS FOR DETERMINATION OF ARR

2) Capital Investment Plan and Capitalization:

Step 1: Projection in MYT petition

- Latest audited / approved Gross Fixed Asset;
- Each years projected work-in-progress vs capitalisation;

Step 2: Allowable yearly capitalization based on following:

- Projects allowed in perspective plan and their status;
- Performance of previous years and specific govt policies;

Step 3 : **Gross Fixed Asset = Average of opening and closing GFA**

1. CAPEX includes IDC, other finance charges and initial spares.
2. CAPEX above a certain limit needs prior approval from ERC.
3. **Cost or time overrun** is generally **not allowed**.



STEPS FOR DETERMINATION OF ARR

Common Gap in CAPEX approval process:

1. Identify the benefits
2. Translate the benefits in subsequent reduction in O&M cost, Losses, etc.

Way forward:

1. Capital expenditure to be clearly categorised into
 - CAPEX for USO;
 - CAPEX for loss reduction;
 - CAPEX for reliability improvement;
 - CAPEX for better consumer support;
2. Pass on the benefit to consumer by improving target norms
3. Methodology for proper tracing the benefits.



STEPS FOR DETERMINATION OF ARR

3) O&M Expense- Employee Cost

$EMP_n = (EMP_b * CPI \text{ inflation}) + \text{Provisions}$ [FOR formula]

Where:

- EMP n: EMP expense for the year n
- EMP b: Baseline EMP expense as per the annual study
- CPI inflation: is the average increase in the Consumer Price Index (CPI) for immediately preceding three years
- Provision: Provision for expenses beyond control of the Distribution Licensee and expected one-time expenses as specified above , such as hike in Dearness allowance, implications of pay commission, arrears & Interim Relief

In **West Bengal** employee cost is computed as below:

- Determining average number of employee for the year;
- per employee basic as per last audited account;
- Applying increments on per employee basic and then per employee DA, HRA, other allowances as a percentage of basic & DA for each year;
- For private licensee apply CPI on per employee cost.

STEPS FOR DETERMINATION OF ARR

4) O&M Expense- Repair & Maintenance

Repairs and Maintenance expense can be expressed as a baseline percentage of Gross Fixed Assets of last financial year as governed by following formula:

$$R\&M_n = K_b * GFA_{n-1}$$

Where:

- R&M_n: Repairs & Maintenance expense for nth year
- GFA_{n-1}: Gross Fixed Assets for n-1th year
- K_b: is a baseline percentage to be determined based on approved R&M expense versus GFA by the SERC in the past.



STEPS FOR DETERMINATION OF ARR

4) O&M Expense- A&G Expense

A&G expense can be computed as approved baseline A&G expense escalated by wholesale price index (WPI) adjusted by provisions for confirmed initiatives governed by following formula:

$$\text{A\&G}_n = (\text{A\&G}_b * \text{WPI inflation}) + \text{Provision}$$

Where:

- A&G_n: A&G expense for the year n
- A&G_b: Baseline A&G expense as per the annual study
- WPI inflation: is the average increase in the Wholesale Price Index (CPI) for immediately preceding three years
- Provision: Cost for initiatives or other one-time expenses as proposed by the Distribution Licensee and validated by the SERC

STEPS FOR DETERMINATION OF ARR

Alternative O&M determination approach (in West Bengal):

- For each of the O&M elements a **sensitivity parameter** (termed as BVP) is considered;
- **Per unit expense** of the O&M element i.r.o BVP for previous years are computed based on admitted / audited data;
- **Annual escalation** is allowed based on suitable inflation index (CPI or WPI or HI) or CAGR value of per unit whichever is low.
- Computed the **per unit cost of O&M element** for ensuing years by applying annual escalation;
- Multiply it with BVP to get the **O&M element for that year**.

Some examples:

O&M Element	BVP	Inflation
R&M expense	Distribution Line length	CPI + WPI
O&M expense	Consumer number	CPI + WPI
Meter reading & bill distribution	Consumer number	CPI

STEPS FOR DETERMINATION OF ARR

5) Treatment of Depreciation


- Depreciation shall be calculated for each year of the control period on the **original cost** of the fixed assets of the corresponding year **upto 90% of asset value**.
- **No depreciation** on assets funded by capital subsidies, consumer contributions or grants.
- Depreciation **rate schedule specified by Commission**.
- Depreciation charged **from the first year of operation** of the asset. (in case operation for part year on prorated basis);
- In Electricity tariff depreciation is used to **repay the principal** amount of loan. Thus if mismatch arises then:
 - Advance against depreciation - **in case depreciation falls short**;
 - Interest credit – **in case moratorium period**; [not in FOR]

STEPS FOR DETERMINATION OF ARR

6) Treatment of Interest on Capital Loan:

- Gross normative loan:
 - **Actual loan capital** is considered;
 - If the equity deployed is more than 30 % of the CAPEX, equity in excess of 30 % shall be treated as **normative loan**;
 - Actual loan or normative loan, if any, shall be referred as **gross normative loan**.

 - **Outstanding loan as on 1st April** by deducting cumulative repayment from gross normative loan:
 - Depreciation amount is considered repayment (FOR Reg)
 - Actual repayment schedule is consider (WBERC)

 - Weighted average interest is applied on the outstanding loan quantum:
 - Licensees should look for swapping costlier loans. Finance charges are allowed as expenditure.
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STEPS FOR DETERMINATION OF ARR

7) Return on Equity

Return on equity shall be computed on 30% of the capital base or actual equity, whichever is lower.

Capital base= Original cost of asset excluding assets funded by capital subsidies/grant

Provided that 16% of post-tax Return on Equity per annum shall be considered for tariff determination pertaining to the Distribution Licensee. [FOR Reg]

Tax on income, if any, liable to be paid shall be limited to tax on return on the equity component of capital employed

WBERC allows ROE at 16.5%. [1% above generation
Transmission business]

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STEPS FOR DETERMINATION OF ARR

8) Treatment of Working Capital interest

Distribution Licensee are allowed normative working capital:

- a) O&M expenses for one month
- b) Two months equivalent of expected revenue
- c) Maintenance spares @ 40% of R&M exp for one month:

Less: Security deposits from consumers, if any.

- interest rate shall be equal to the State Bank Advance Rate (SBAR) as of the date on petition accepted by the Commission.
 - **interest shall be allowed on consumer security deposits** and security deposits from Distribution System users at the Bank Rate.
 - Adjust the benefit of excess of cash security deposit available after meeting Working Capital requirement
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STEPS FOR DETERMINATION OF ARR

9) Aggregated Revenue Requirement

- a) Landed Power Purchase cost (PPC + Tr ch)
 - b) O&M expense – employee cost
 - c) O&M expense – R&M expense
 - d) O&M expense – A&G expense
 - e) Depreciation
 - f) Interest on loan capital
 - g) Return on equity
 - h) Interest on working capital
 - i) Interest on consumer security deposit
 - j) Income Tax
- Less:
- k) non-tariff income
 - l) income from other business



STEPS FOR DETERMINATION OF ARR

10) Treatment of Regulatory Assets

- Regulatory asset should be done only as **a very rare exception** in case of natural calamity or force majeure conditions. [T.P.]
- Recovery of outstanding Regulatory Assets along with carrying cost of Regulatory Assets should be time bound and **within a period not exceeding seven years**. The State Commission may specify the trajectory for the same.[T.P]
- **Carrying cost** of the regulatory asset shall be line with the State Bank Advance Rate (SBAR) for the tenure for which regulatory asset has been created. [FOR]



AVERAGE COST OF SUPPLY (ACoS)

1. Recoverable Cost is derived as below:

$$\text{Recoverable ARR} = \text{ARR} + \text{impact of truing up} + \text{impact of regulatory asset}$$

2. **Average Cost of Supply (ACoS)** = $\frac{\text{Recoverable ARR}}{\text{Projected Sales}}$

3. **Expected revenue at the existing tariff** is computed.

4. **Revenue gap**: the shortfall / surplus is balanced by way of

- revising the tariff schedule of the consumers
- Adjusting with govt subsidy.
- In case of govt subsidy, ERC has to publish two sets of tariff schedule

RETAIL TARIFF DESIGN

1) Objective of Tariff Design:

○ *Revenue-Related Objectives:*

- Rates should yield the total revenue requirement;
- Rates should provide predictable and stable revenues; and,
- Rates themselves should be stable and predictable.

○ *Cost-Related Objectives:*

- Rates should be set so as to promote economically-efficient consumption;
- Rates should reflect the present and future private and social costs and benefits of providing service (*i.e.*, all internalities and externalities);
- Rates should be apportioned fairly among customers and customer classes;
- Undue discrimination should be avoided; and,

○ *Practical Considerations:*

- Rates should be simple, certain, payable conveniently, understandable, acceptable to the public, and easily administered.
- Rates should be, to the extent possible, free from controversies as to proper interpretation.

RETAIL TARIFF DESIGN

2) Cost of Supply vs Cost of serve

- ❑ Cost of Supply **based on average billing rate**:
- ❑ Cost to Serve: Costs of ARR has to be **allocated to different consumer categories depending in the cost drivers**
 - It requires **functionalization of cost** eg. Power purchase cost, Transmission cost, distribution network usage cost, general administration cost, etc
 - **Classification of functionalized costs** into demand cost (vary with kW demand), energy cost (vary with kWh) and consumer cost (number of consumer served)
 - **Allocation among consumer categories** based on following drivers:
 - Connected load of consumer category
 - **Voltage profile of consumption / sales data**
 - **Loss data of consumer category**;
 - No of consumers in the category



RETAIL TARIFF DESIGN

1. Telescopic Rates

- Increasing block

2. Flat Rates

- Issues of conservation

3. Time of Day

- Peak
- Off-Peak
- Normal hours

4. Time of Year

- Seasonal (summer, monsoon, winter)

5. Geographical variation

- Rural / urban tariff

Boundary conditions:

1. Within $\pm 20\%$ of ACoS
2. Legacy tariff rates
3. Avoid tariff shock
4. Govt. Policies
5. Socio political impact

Tariff design is more an art than a science



ISSUES OF TARIFF RATIONALIZATION

1. Fixed costs are not truly recovered through fixed charges

DISCOM	ARR Fixed cost : variable cost	Retail Tariff design Fixed charges : Energy charges
Maharashtra	42 : 58	16 : 84
Delhi	45 : 55	10 : 90

-source DERC approach paper.

2. Too many consumer categories

- Too many sub-categories makes the tariff issue more complicated and difficult to compare across the states.

3. Two part tariff may be insufficient to meet future challenges of

- segregation of wire and supply and
- recovering sunk grid cost when consumers push back



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Thank You

