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

SUBJECT:
"Distribution Tariff Design : Methodological Approach".

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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
- Issues of Tariff rationalisation
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)

Before 1956 Introductory Stage
- Indian Electricity Act 1910

1956–1991 Nationalisation Stage
- Electricity (Supply) Act 1948
- Establishment of semi-autonomous State Electricity Boards (SEBs)
- Industrial Policy Resolution (1956)
- Generation and distribution of power under state ownership
- Power losses, subsidies, infrastructure bottlenecks and resource constraints

1991–2003 Liberalisation Era
- Legislative and policy initiatives (1991)
- Private sector participation in generation
- Fast-track clearing mechanism of private investment proposals
- Electricity Regulatory Commissions Act (1998) for establishing Central and State Electricity Regulatory Commissions and rationalisation of tariffs

2003 onwards Growth Era
- Electricity Act (2003)
- National Tariff Policy (2006)
- Elimination of licensing for generation projects
- Increased competition through international competitive bidding engaged in power generation, transmission and distribution
- Launch of UMPP scheme Various schemes and initiatives such as Jawaharlal Nehru National Solar Mission to promote renewable energy
- Civil nuclear agreement with the US for nuclear technology and fuel Fuel supply agreement of power companies with Coal India Ltd (CIL)
- Private equity investments in the sector have surged since 2010

1947: IC = 1,362 MW
30.11.2019: IC = 3,65,980 MW
## General Approach for Regulated Tariff Options

<table>
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<tr>
<th>OPTIONS</th>
<th>CHARACTERISTICS</th>
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</table>
| Target Based Regulations (TBR) | - 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 minus regulation  
- Improvements on targets to account of utility or shared with consumers and vice-versa |
| Reference Utility Regulations (RUR) | - 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) | - 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

Laws

Tariffs rule
  • process and timetable

Tariff methodology
  • determining allowed revenues
  • guidelines for setting regulated tariffs

Regulatory accounting guidelines
  • format for tariff applications and data collection
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]
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.
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 ± 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]
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 meet up the revenue gap;
   - All information in specified formats;
   - Copy of audited accounts of previous years;
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 hurly 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.
2) **Capital Investment Plan and Capitalization:**

**Step 1:** Projection in MYT petition
- Latest audited / approved Gross Fixed Asset;
- Each year's 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.
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.
3) O&M Expense- Employee Cost

EMP n = (EMP b * CPI inflation) + 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.
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:

\[ R&M_n = K_b \times GFA_{n-1} \]

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.
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:

\[ A\&G_n = (A\&G_b \times \text{WPI inflation}) + \text{Provision} \]

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:

<table>
<thead>
<tr>
<th>O&amp;M Element</th>
<th>BVP</th>
<th>Inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>R&amp;M expense</td>
<td>Distribution, Line length</td>
<td>CPI + WPI</td>
</tr>
<tr>
<td>O&amp;M expense</td>
<td>Consumer number</td>
<td>CPI + WPI</td>
</tr>
<tr>
<td>Meter reading &amp; bill distribution</td>
<td>Consumer number</td>
<td>CPI</td>
</tr>
</tbody>
</table>
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 prorate 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]
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.
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]
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
**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]
1. Recoverable Cost is derived as below:

   Recoverable ARR = ARR + impact of truing up + impact of regulatory asset

2. Average Cost of Supply (ACoS) = Recoverable ARR ÷ 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.
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

<table>
<thead>
<tr>
<th>DISCOM</th>
<th>ARR Fixed cost : variable cost</th>
<th>Retail Tariff design Fixed charges : Energy charges</th>
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</thead>
<tbody>
<tr>
<td>Maharashtra</td>
<td>42 : 58</td>
<td>16 : 84</td>
</tr>
<tr>
<td>Delhi</td>
<td>45 : 55</td>
<td>10 : 90</td>
</tr>
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-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
   (i) segregation of wire and supply and
   (ii) recovering sunk grid cost when consumers push back
Thank You