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**Central Institute for Rural Electrification of
Rural Electrification Corporation Ltd
(A Govt. of India)**

Hyderabad, Andhra Pradesh, India



**CAPACITY BUILDING
PROGRAM ON
DISTRIBUTION SYSTEM LOSS
REDUCTION
FOR
AFGHANISTAN POWER
EXECUTIVES**



**TARIFF PHILOSOPHY –
SUBSIDY CONCEPTS – RETAIL
TARIFF – COST BENEFIT
ANALYSIS OF DISTRIBUTION
LOSSES**




1. What is TARIFF
2. National Electricity Policy
3. National Tariff Policy
4. Rate of Return
5. Loss Concept
6. HT / LT Tariff
7. Various HT Categories / LT Categories of Tariff / Bulk Tariff / Retail Tariff
8. Pattern of Consumption
9. How to arrive at rate for each Tariff?
10. Cost to Serve
11. Subsidy Concept
12. Cost Benefit Analysis – Distribution Losses

1. National Electricity Policy:

This is the backbone for development of any country, as Electricity plays significant part in every sphere of activity. Every country has to bring out an Electricity Policy, keeping in view of the resources, type of demand, conditions of the climate and economic viability of the systems to be developed.

2. National Tariff Policy:

The tariff policy envisages the cost price at which electricity to be supplied to the customers and the sustainable capacity of the power utilities, taking overall perspective into consideration.



3. Loss Concept:

The loss concept has to be arrived properly. The Transmission, Distribution losses and Commercial losses may cast bearing on the overall working of the utility.

4. Rate of Return:

The rate of return annunciated by National Electricity Policy, should pave way for sustenance of Electricity supply utility, while simultaneously extending electricity to the customers at reasonable cost price.

5. HT Consumers : Who avail bulk supply:

HT supply is extended to big industries for manufacturing, processing & preserving of various goods. The various categories also include, Railways, Ferro alloys, steel mills, lift irrigation schemes and Townships.

HT supply is normally associated with Two Part Tariff:

1. Rate/KVA (Contracted demand)
2. Rates for units consumption rate / KWH

The other aspects, like Reactive Power and Power Factor also separately dealt based on limitation.

6. LT Consumers:

The LT supply is extracted by Single phase or 3 phase depending on loads and customer requirements:

The following are the normal LT categories:

1. Domestic
2. Non domestic (commercial)
3. LT industrial
4. Cottage Industries
5. Agriculture
6. Public lighting
7. Special Purpose
8. Temporary Supply

(Masjeed, Religious places etc.,)



7. How to arrive at rate for each category of Tariff:

The following are main guide lines, while arriving at rates, for each category

- a. Power purchase cost
- b. Cost of Generation
- c. Loss Spectrum
- d. Rate of return
- e. Living conditions of consumers
- f. Cost to Serve for each category
- g. Commercial and industrial activity
- h. Bearable capacity of subsidy
- i. Whether to adopt telescopic procedure -

8. Subsidy Concept:

- a. Direct subsidy from Govt. : Received directly from Govt. based on the policy of Govt.
- b. Subsidy from same category is arrived based on the slab system to cater to the needs of the customers below poverty line, and charging higher income consumers with bigger slab.
- c. Cross Subsidy : Charging the Commercial and Industrial consumers with higher tariff to make the system viable.

What is Tariff

- Tariff is the charge payable by any consumer for utilizing electricity, in terms of energy and capacity requirements.
- The Tariff structure should ensure reasonable degree of price stability and should avoid large fluctuations in Tariff from year to year.
- The Tariff structure should be as simple as possible so that the consumer can understand the metering and billing mechanism and they may not have the impression of unduly being charged.

The Tariff should be fair and equitable.



- To meet the mandatory requirements of Electricity supply Acts, it is required to adjust the tariffs to ensure that the total revenues in any year of account shall, after meeting all the expenses properly chargeable to revenues including operation, maintenance and management expenses, taxes if any, on income and Profits, depreciation and interest payable on all debentures, bonds, loans, leave a minimum surplus of the value of fixed assets of the electricity utility in service.
- To comply with any policy directions issued by the Govt. to the utility in the Tariff.

- The tariff structure should have in built penalties to discourage theft or fraudulent use of energy or violation of load control measures.
- To meet any extra cost involved in achieving social objectives of state by making available the power to weaker sections of the society and priority sectors like Agriculture at below cost or subsidized rates, with suitable grant or subsidy from the state Govt.

INDIAN ELECTRICITY ACTS

1. India Electricity Act 1910 (Forms Basic Frame Work)
2. Indian Electricity (Supply) Act 1948 (Formation of Electricity Boards)
3. Indian Electricity Rules 1956.
4. Electricity Regulatory Commission Act 1998.
5. Electricity Act 2003.

1998 Electricity Regulatory Commission Act

Formed Central Electricity Regulatory Commission.

Formed State Electricity Regulatory Commissions.

AIM : To provide private sector participation in Generation, Transmission & Distribution and distancing the regulatory responsibilities from the Govt. and harmonizing and rationalizing the provisions of 1910 & 1948 Acts.

The following are the revised guidelines as per the reforms in India, and brought out in latest Electricity Act:

1. The principles & Methodologies specified by the central Commission for determination of Tariff applicable to generating Companies & transmission companies.
2. The Generation, Transmission & Distribution and supply of electricity are conducted on commercial principles.
3. Competition, efficiency and Economic use of resources and good performance & optimum investments.
4. Safeguarding consumer interests and recovering the cost of Electricity in a reasonable manner.

5. Multi year Tariff.
6. Reduces and eliminates cross subsidies within a period to be specified by appropriate commission.
7. Promotion of Renewable sources of energy.
8. National electricity policy and tariff policy.
9. The electricity regulatory commissions are empowered to finalize the tariffs.

These regulatory commissions are either CERC or SERC, who will decide the tariff structures as the case may be.



DETERMINATION OF TARIFF

- I. Appropriate commission determines the Tariff in accordance with the provision of Electricity Acts.
 - (a) Supply the Electricity by a generating company to a distribution company.
 - (b) Transmission of Electricity.
 - (c) Wheeling of Electricity.
 - (d) Retail sale of Electricity.

- II. Tariff or part of tariff shall not be amended more frequently than once in a financial year.

- III. Commission may require a licensee or generating company to comply the procedure as may be specified for calculating the expected revenues from the tariff and charges which it permits to recover.
- IV. If any licensee or generating company recovers a price or charge exceeding the tariff determined under this section, the excess amount shall be recoverable by the person, who has paid such price or charge along with interest equivalent to bank rate without prejudice to any other liability incurred by the licensee.

Procedure for Tariff Order

1. Application for determination of tariff shall be made by generating company or license accompanied by fees as determined by regulation.
2. Every applicant shall publish the application in such abridged form and manner, specified by commission.
3. Commission within 120 days from receipt of application under section (I) and after considering all suggestions and objections received from public.
 - a. Issues an order accepting the application with such modifications / conditions.
 - b. Reject the application for reasons to be recovered in writing, if such application is not in accordance with the provisions of Act.

- c. Provided that an applicant shall be given reasonable opportunity of being heard before rejection.
4. The commission shall in this 7 days of making the order, send a copy to the appropriate Govt., the authority and the concerned Licenses and to the person.
5. The tariff for any interstate supply, transmission or wheeling of electricity, as the case may be involving the territories of two states may, upon made to it by the parties intending to undertake such supply, transmission or wheeling, be determined under this section, by the state commission, having jurisdiction in respect of license who intends to distribute electricity and make payment there for.

A Tariff order shall, unless amended or revoked, continue to be in force for such period as may be specified in the tariff order.

Provision of by state – Government If the state Govt. requires the grant of subsidy to any consumer, or class of consumers in the tariff determined by the state commission the state Govt. may pay in advance as may be specified by commission the amount to compensate

The person affected by the grant of subsidy.

Functions of Central Commission

- a. To regulate the tariff of generating companies owned or controlled by Central Govt.
- b. To regulate the tariff of generating companies other than owned or controlled by Central Govt. if such generating companies enter into or otherwise have a composite scheme for sale of generation or sale of electricity in more than one state.
- c. To regulate interstate transmission of electricity.
- d. To determine tariff for interstate transmission of electricity.
- e. To issue licenses to persons to function as transmission licenses and electricity trader with reference to this interstate operation.

- f. To adjudicate upon disputes generating companies or transmission licenses.
- g. To levy fees for purpose of this act.
- h. To specify grid code having regards to Grid standards.
- i. To specify, and enforce, standards with report to quality, continuity and reliability of service by license.
- j. To fix trading Margin in the interstate trading of electricity, if considered necessary.

Functions of state Commission

- a. To determine tariff for generation, supply, transmission, and wheeling of electricity, whole sale, bulk or retail within the state.
- b. To regulate electricity purchase and procurement process of distribution licensees including the price at which electricity shall be procured from the generating companies, or licensees or from other sources through agreements for purchase of power & distribution with in the state.
- c. To facilitate intrastate transmission and wheeling of electricity.
- d. To issue licenses to Act transmission licensees, distribution licensees, electricity traders with in the state operation.

- e. To promote Cogeneration & generation of electricity from renewable sources of energy and purchase of electricity from such sources a percentage of total consumption of electricity in the area of distribution lines.
- f. To adjudicate upon disputes of licensees.
- g. To levy fees for purpose of Act.
- h. Specify or enforce standards w.r.t quality continuity, reliability of service of licensees.
- i. To fix trading margin for intrastate trading, if necessary.

Types of Tariffs

1. LT Tariff

2. HT Tariff

LT Tariff

Category I - Domestic

Category II - Commercial (Non Domestic)

Category III - Industrial

Category IV - Cottage Industries.

Category V - Agriculture.

Category VI - Public Lighting

Category VII - General purpose

Category VIII - LT Temporary supply.

HT Tariff

HT Category I -

- a. Industrial Consumers
- b. Manufacturing processing and preserving.
- c. Shall not include, shops, Business, Houses, Offices, Public building, Hospitals, Hotels, Hostels, Choulis, Restaurants, clubs, Theatre, Cinemas, Railway stations.
- d. Water works of Municipalities & corporation come under this category.
- e. The information Technology with identified and approved by consultative committee of IT industry. Govt of AP will come under this category.

HT Category II	Which shall not come under category I.
HT Category III	Power Intensive Industries (Deleted) merged with HT Category I.
HT Category IV	(A) Govt. lift irrigation schemes. (B) Irrigation and Agriculture purposes and not covered under HT category IV (A).
HT Category V	Railway traction.
HT Category VI	Town ships & Residential colonies.

HT Supply Shall be given keeping in-view of the technical parameters

Upto 1500 KVA	11 KV
1501 KVA to 5000 KVA	33KV
Above 5000 KVA	132KV/220KV

(as may be decided by Licensees).

Independent feeds : The consumer should have an exclusive dedicated feeder.

Up to 2500 KVA - 11 KV

2500 KVA to 10000 KVA - 33 KV

Above 10000 KVA - 132 KV/220KV

Sale of Volumes for a Company

(MU)

Category	Purpose	Sales
LT I	Domestic	3558.12
LT II	Non Domestic/Commercial	1113.70
LT III	Industrial	994.70
LT IV	Cottage Industry	13.86
LT V	Agriculture	5938.00
LT VI	Public Lighting	555.51
LT VII	General Purpose	48.03
LT VIII	Temporary Supply	2.63
HT 1A	Industry, General	5393.00
HT IB	Industry, Ferro Alloys	300.00
HT II	Non-Industrial	774.00
HT IV	Irrigation & Agricultural	238.81
HT V	Railway Traction	88.05
HT VI	Townships/Colonies	66.66
	HT Temporary Supply	0.00
	RESCOs	0.00
TOTAL		19084.83

Sales, Energy Losses and Energy Purchases

Sales, Purchase and Losses	Company	Commission
Energy Sales (MU)	19085	19085
Energy Purchases (MU)	24211	24085
Total Losses (MU)	5126	5000
Total Loss (%)	21.17%	20.76%

Revenue from Company

(Rs. Crores)

Category	Purpose	Company	Commission
LT I	Domestic	892.73	938.52
LT II	Non-Domestic/Commercial	646.79	646.79
LT III	Industrial	419.46	419.46
LT IV	Cottage Industry	2.74	2.74
LT V	Agriculture	11.32	11.32
LT VI	Public Lighting	101.57	101.57
LT VII	General Purpose	19.21	19.21
LT-VIII	Temporary Supply	1.63	1.63
HT IA	Industry, General	2004.00	1893.41
HT IB	Industry, Ferro Alloys	77.00	76.50
HT II	Non-Industrial	401.00	398.34
HT IV	Irrigation & Agricultural	49.27	49.27
HT V	Railway Traction	37.65	36.98
HT VI	Township/Colonies	23.33	23.33
	HT Temporary Supply	0.00	0.00
	RESCOs	0.00	0.00
	Total	4687.70	4619.07

Revenue Requirement for Company (Rs. Crores)

SL. No	Revenue Requirement item	Company	Commission
1.	Power purchase cost	4069.95	4143.36
2.	Transmission cost	309.32	250.09
3.	PGCIL and ULDC cost	0.00	84.78
4.	SLDC cost	0.00	10.91
5.	HT Incentive cost		0.00
6.	Interest on consumer security deposits	132.22	37.77
7.	Supply Margin	0.00	6.47
8.	Distribution cost	620.18	637.91
9.	Gross ARR	5131.67	5171.29
10.	Less Non-tariff income	332.77	404.37
11.	Net Revenue Requirement	4798.90	4766.92
12.	Less Revenue from tariff	4687.70	4619.07
13.	Revenue Gap	111.20	147.85

ANNEXURE – H (i)

POWER PURCHASE FOR RETAIL SUPPLY BUSINESS COMPANY

Power Purchase Costs

Source	Power Purchase	Fixed costs	Variable cost	Tax, Incentives, Other Charges	Total Cost	Average Cost
	(MU)	Rs Crores	Rs Crores	Rs Crores	Rs Crores	Rs/KWh
Genco	11537.98					1.50
Thermal	8239.46					
Hydel	3298.52					
CGS	4603.77	223.57	454.64	43.18	721.39	1.57
NTPC	3217.52	196.53	327.35	10.47	534.35	1.66
GPCL-I & II	166.41	7.98	20.16	-	28.14	1.69
IPPS	3347.48	416.07	360.19	13.45	789.72	2.36
NCE & Others*	1337.96	-	262.79	-	262.79	1.96
Total Sale to other DISCOMs	24211.13	1586.00	2416.85	67.10	4069.95	1.68
Net Input	24211.13					

Power Purchase Costs

		Fixed Cost (Rs Crores)	Variable Cost (Rs Crores)	Incentive (Rs Crores)	Income Tax & Others (Rs Crores)	Total Cost (Rs Crores)	Avg. Cost (Rs/KVA)
Genco Thermal Hydel	11471.31 8172.79 3298.52						1.50
CGS	4603.77	223.13	454.64	3.85	39.34	720.96	1.57
NTPC	3217.52	196.53	327.35	9.97	0.49	534.34	1.66
GPCL	120.25	7.98	12.87	-	-	20.85	1.73
IPPs	347.48	416.07	360.26	13.45	-	789.79	2.36
OTHER	436.77	-	123.27	-	13.35	136.62	3.13
TOTAL	23197.11	1585.56	2251.16	27.27	53.18	3917.17	1.69
						4087.75	
						4143.36	1.72

Total cost after D to D transfer of 887.77 MU deficit energy @ Rs 1.92142/kWh
 Total cost after NCE cost adjustment for 489.39 MU deficit energy @ Rs 1.13462/kWh.

Expenditure Items in Distribution Business Company

Rs Crores

	Company			Commission		
	2006-07	2007-08	2008-09	2006-07	2007-08	2008-09
SLDC Charges	23.47	25.43	27.23	0.00	0.00	0.00
Operation and Maintenance charges	406.44	437.87	487.09	398.77	419.61	437.64
Depreciation	66.51	79.67	94.34	130.90	152.47	171.85
Advance Against Depreciation	84.73	63.48	39.78	0.00	0.00	0.00
Taxes on Income	0.00	0.00	0.00	0.00	0.00	0.00
Other Expenditure	6.64	2.17	2.17	4.47	0.00	0.00
Special Appropriations for safety measures	0.00	0.00	0.00	5.00	5.00	5.00
Less IDC Capitalized	29.35	29.62	27.86	0.00	0.00	0.00
Less O & M Expenses Capitalised	28.03	31.07	34.21	27.50	29.77	30.74
Net Expenditure	530.41	577.55	616.40	511.64	547.31	583.75

Return on Capital Employed for the Control Period

Rs Crores

	Company			Commission		
	2006-07	2007-08	2008-09	2006-07	2007-08	2008-09
Depreciation Regulated Rate Base	1337.98	1561.03	1804.03	1293.16	1426.47	1559.85
Capital Structure						
Debt, percent	NA	0.70	0.70	0.75	0.75	0.75
Equity, percent	NA	0.30	0.30	0.25	0.25	0.25
Cost of Funds	NA	0.00	0.00	0.00	0.00	0.00
Cost of Debt, percent	NA	0.10	0.10	0.09	0.09	0.09
Return on Equity, percent*	NA	0.16	0.16	0.14	0.14	0.14
Cost of Capital	NA	0.12	0.12	0.10	0.10	0.10
Return on Capital Employed, Rs. Cr*	126.00	184.20	212.88	132.55	146.21	159.88

Revenue Requirement for the Control Period

Rs Crores

	Company			Commission		
	2006-07	2007-08	2008-09	2006-07	2007-08	2008-09
Net Expenditure	530.41	577.55	616.40	511.64	547.31	583.75
Return on Capital Employed	126.00	184.20	212.88	132.55	146.21	159.88
Non Tariff Income	0.00	0.00	0.00	0.00	0.00	0.00
Revenue Requirement, Net	656.41	761.75	829.28	644.18	693.52	743.63

MYT (Multi Year Tariff)

1. Section 61 of the Act states that the appropriate commission for determine the terms and conditions for the determination of tariff, shall be guided, inter alia by multi year tariff principles.
2. The frame work should feature a 5 year control period.
3. The initial period may however, be of 3 year duration for Transmission and Distribution, if deemed necessary by regulatory commission on account of data uncertainties and other practical consideration.
4. The appropriate commission may state assumption in MYT for first control period.
5. MYT is only to ensure to the consumers, that there tariff increase levels are not beyond the bearable levels..

Differential Tariff

1. The aim is to get advantages for the optimum utilization of the most efficient generating units.
2. Introduced in developed countries.
3. This is done by staggering.
4. The differential tariff can not be introduced to Domestic & Commercial because of exorbitant cost of Meters, as they are 3 times normal meter cost.
5. It can be introduced for HT consumers by staggering of working hours from peak load hours to non peak load hours.

1. Tariff Concession
2. Subsidies of State Government
3. Cost to Serve

Cost to Serve

	<u>LT</u>	<u>Cost to Serve</u>	<u>Company Tariff</u>
1.	Domestic	3.78	1.45
			2.80
			3.05
			4.75
			5.50
2.	Commercial	3.65	3.95
			6.25



Cost to Serve (Cont'd)

	<u>LT</u>	<u>Cost to Serve</u>	<u>Tariff</u>
3.	Industrial	3.04	3.75
4.	Cottage Industrial	2.97	1.80
5.	Agricultural	2.15	Zero
6.	Public Lighting	4.48	-
7.	General Purpose	4.41	4.00
8.	Temporary	4.14	6.20
<u>HT</u>			
1.	Category I	2.52 (11 KV)	195/KVA 3.30
		2.11 (33 KV)	230/KVA 3.10
		1.90 (132KV)	250/KVA 2.80

Cost to Serve (Cont'd)

<u>HT</u>		<u>Cost to Serve</u>	<u>Tariff</u>
2.	Category II	3.52 (11 KV)	195 4.40
		2.81 (33 KV)	230 3.90
		2.36 (132KV)	250 3.65
3.	Category IV (Agricultural)	2.84	NIL.
4.	Category V (Railway)	2.87	4.20
5.	Category VI	2.61	3.50

Cost Benefit Analysis Distribution Losses: The cost benefit analysis is worked out based on keeping distribution system intact.

- i. Evaluation on distribution loss (Technical)
- ii. Commercial loss connected with meters & theft

The following are the main remedial measures to be taken to contain the distribution losses to arrive at cost benefit analysis:

- i. Replacement of electro mechanical meters by electronic meters.

- ii. Ensuring meter seals and meter terminal covers while releasing services.
- iii. Extending supply to slums etc. by LT AB cables and single phase transformers.
- iv. Spot billing by hand held computers.
- v. Two LT circuits should emanate from each DTRs
- vi. DTR should be at load centre.
- vii. Immediate attention for attending to meter exceptions.
- viii. Line rectification & Re-conductoring.
- ix. Pole mounted meters.



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