



Department of Industrial and Management Engineering
Indian Institute of Technology Kanpur



4th Capacity Building Programme for
Officers of Electricity Regulatory Commissions
18 – 23 July, 2011

Bulk Power Generation Tariff- Commercial Issues and Regulatory Perspective



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Tariff Regulation in India

- Till 1998-
 - By Govt.
- Since Aug. 1998
 - By Central & State Regulatory Commissions under ERC Act 1998
- Since 2003-
 - By Central & State Regulatory Commissions under EA 2003



Tariff Setting In India

- Prior to 1992-
 - Single part Tariff Cost plus on actual (Schedule 6 of E(S) Act 1948)
- Since 1992 to 2001-
 - For SEBs- Single part Cost plus on actual
 - For CPSUs & IPPs- Two part Cost Plus with performance based rate making (KP Rao Committee)
- Since 2001 to 2003-
 - For SEBs- Single part Cost plus on actual
 - For CPSUs & IPPs- Availability Based Tariff (ABT) Cost Plus with performance based rate making (CERC Regulation)
- Since 2003 onward-
 - Availability Based Tariff (ABT) Cost Plus with performance based rate making
 - Competitively Bid Tariff



The Electricity Act, 2003

- Sec 61 - Appropriate Commission shall specify the terms & conditions for the determination of tariff.
- The principles & methodologies specified by the Central Commission for determination of tariff applicable to generating companies & transmission licensees shall be the guiding factor for the State Commissions.
- Sec 61 of the 2003 Act carries forward and enlarges Sec 28 of ERC Act, 1998. (Schedule VI omitted)

Statutory Provisions in EA 2003

- Section 62: Provide for determination of Tariff for sale of power from a generating company to distribution licensees
- Section 63: "Notwithstanding anything contained in section 62, the Appropriate Commission shall adopt the tariff if such tariff has been determined through transparent process of bidding in accordance with the guidelines issued by the Central Government"



Key Features of 2009-14 Regulation

- Capital cost to include estimated additional capitalisation during the Tariff period with provision of true up
- Benchmark norms for prudence check of capital cost of thermal generating station and transmission system
- Separate Compensation allowance in case of coal/lignite based generating stations after 10 years
- IDC, financing charges and FERV during construction period on the equity considered as normative loan
- Special provision for capital cost of hydro projects
- Introduced pre-tax Return on Equity
- Income Tax not pass through in Tariff
- Inducement to hedging of foreign loans
- Sharing net benefits on re-financing of loan



Key Features of 2009-14 Regulation

- Provision of Advance against Depreciation dispensed with
- Land for reservoir in case of hydro projects to be depreciable asset
- Repayment linked to depreciation O&M Norms Rationalised for Thermal generating stations
- Cost of secondary fuel oil consumption made part of fixed charges with provision for sharing of savings with beneficiaries
- Provision for R&M with life extension and with option for 'Special Allowance' for thermal generating stations



Key Features of 2009-14 Regulation

- Capacity Index concept for hydro stations has been dispensed with.
- Sharing hydrological risks in hydro projects
- Operational Norms for thermal generating stations further rationalised.
- Norms of heat rate linked to designed heat rate with a margin
- De-scaling factor for O&M norms of thermal projects to take care of economy of scale
- Norms for new technologies (such as supercritical)
- Incentive linked to Plant Availability Factor and AFC
- Sharing CDM benefits
- Special provisions for DVC



Availability Based Tariff (ABT)

- Annual Fixed Charge- Payment Linked to Availability
- Energy Charge- Payment linked to Scheduled Generation
- Unscheduled Interchange (UI) Charge- Payment linked to grid frequency
- Incentive- Linked to Availability



Fixed Charge

Driving Parameters

- Capital cost
- Debt Equity Ratio

Components of Fixed Charges

- Return on Equity
- Interest on Loan
- Depreciation
- O&M Expenses
- Interest on Working Capital
- Cost of secondary fuel oil as applicable
- Special allowance in lieu of R&M or
- separate compensation allowance, wherever applicable.



Capital cost

- Capital Cost includes
 - Cost of land & R&R, Plant and Equipment, Civil Works, Initial Spares, Taxes & Duties, Pre operative/ commissioning expenses, IDC& FC
- Additional capitalization during the useful life time
- Renovation & Modernization

Commission is to ensure the reasonability of capital cost and relate to assets which have been put to use or in use.



Prudence Check of Capital cost for New Projects

- Capital Expenditure-Gross block less deferred liabilities anticipated add cap during the tariff period
- Cost & Time over run and agency responsible
- Whether execution of project is through competitively bid contract packages
- Cost comparison with similar projects on over all cost basis duly taking into account size & number of units and site specific features etc.
- Prudence check of capital cost may be carried out based on the benchmark norms to be specified by the Commission from time to time:



Prudence Check of Capital cost for Existing Projects

- Already Admitted Cost
- Anticipated Add. Cap. during tariff period
- R&M expenditure as admitted by Commission



Capital cost- Special Provision for Hydro Projects

- Capital cost shall include:
 - Cost of approved R&R Plan, in conformity with National R&R Policy and R&R package.
 - Developer's 10% contribution to RGGVY in affected area.
- Expenditure incurred by private developers in getting project sites allotted shall not form a part of capital cost.
- Any ceiling expenditure/cost provided in the PPAs shall be considered.
- CERC may issue guidelines for:
 - vetting of capital cost by independent agency or expert.
 - scrutiny and approval of commissioning schedule in case the developer is not state controlled or owned.



Capital cost- Special Provision for Hydro Projects

- Additional capital expenditure to be allowed:
 - On account of damage caused of natural calamities (but not due to flooding of powerhouse attributable to negligence of Genco) after adjusting for insurance proceeds.
 - Due to any work which has become necessary for successful and efficient plant operation.

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Prudence Check of Additional Capital Expenditure

- Expenditure relates to balance payment or balance work in the original scope of work- Admissible up to the cut-off date
- Expenditure is necessary on account of change of law/ statutory requirement or court order
- Expenditure on Ash handling system and ash pond related works
- Expenditure on minor assets-
In case of replacement, expenditure admitted after de-capitalisation of gross value of old asset

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Renovation & Modernisation

- Expenditure resulting in the extended life of the unit/station beyond useful life.
- Expenditure necessary for sustaining the operation of the plant on account of obsolescence or changed working conditions etc.



Renovation & Modernisation for Extended Life

- A Detailed Project Report giving complete scope & justification,
- Cost-benefit analysis,
- Estimated life extension from a reference date,
- schedule of completion,
- Reference price level,
- Estimated cost



Renovation & Modernisation "A Special Allowance"

For a coal-based/lignite fired thermal generating station

- Option to generator
- For availing a special allowance
- @ Rs. 5 lakh/MW/year in 2009-10 and
- Thereafter, escalated @ 5.72% every year
- Unit -wise
- From the next financial year from the respective date of the completion of useful life



Debt Equity Ratio

- For New Projects: 70:30
- For Existing Projects: as admitted by the Commission in earlier tariff setting
- Additional capitalisation & R&M- 70:30
- Actual debt : Equity ratio in case equity less than 30%



Return on Equity

- 14% (Post Tax) during 2004-09
- During 2009-14
- Pre-tax return with base of 15.5% (Post-Tax) grossed up by applicable tax rate for the company
 - Incentive for timely completion of Project
 - Additional RoE of 0.5% (Post Tax)
 - Beneficiaries not to bear burden of income tax on UI earnings, incentive earnings and efficiency gains



Interest on Loan

- Computed loan wise on normative loan
- After accounting for the cumulative repayments
- Depreciation recovered shall be deemed as repayment
- Repayment to be considered from the 1st year irrespective of moratorium
- Generator to make every effort to swap the loan to reduce interest liability
- Benefits to be shared in the ratio of 2:1



Depreciation

- Depreciation rate linked to useful life of assets
- 90% of asset value recoverable
- Land is not depreciable
- After 12 years balance depreciable value to be spread over balance useful life



O&M Expenses

- Administrative Expenses
- Repair & Maintenance
- Employee Salary & welfare measures
- Corporate Expenses
- Miscellaneous Expenses

Prudence of O&M Expenses

- Abnormal increase in O&M expenses
- Expenses not of recurring nature
- Prior period adjustment/recoveries
- Revenue earned
- Apportionment of corporate expense
- Incentive/ex-gratia paid over and above statutory bonus
- Donations made
- Expenses not relating to the generating station
- Profit/ Loss of assets in inventory or on disposal of decapitalised assets



Coal/Lignite based Generating Stations

(Rs. in lakh/MW)

Year	200/210 /250	300/330 /350	500 MW sets	600 MW and
2009-10	18.2	16.00	13.00	11.70
2010-11	19.2	16.92	13.74	12.37
2011-12	20.3	17.88	14.53	13.08
2012-13	21.5	18.91	15.36	13.82
2013-14	22.7	19.99	16.24	14.62



Coal/Lignite based Generating Stations

200/210/250 MW	Additional 5 th & 6 th units	0.90
	Additional 7 th & more units	0.85
300/330/350 MW	Additional 4 th & 5 th units	0.90
	Additional 6 th & more units	0.85
500 MW and above	Additional 3 rd & 4 th units	0.90
	Additional 5 th & above units	0.85

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Gas/Liquid fuel based Generating Stations

(Rs. in lakh/MW)

Year	Gas Turbine/ Combined Cycle generating stations other	Small gas turbine power generating	Agarta la GPS
(1)	(2)	(3)	(4)
2009-10	14.80	22.90	31.75
2010-11	15.65	24.21	33.57
2011-12	16.54	25.59	35.49
2012-13	17.49	27.06	37.52
2013-14	18.49	28.61	39.66

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Compensation Allowance

Years of operation	Compensation Allowance (Rs lakh/MW/year)
0-10	Nil
11-15	0.15
16-20	0.35
21-25	0.65

Interest on working capital

- Cost of Coal/Lignite/Gas-
 - 1.50 month for pit head
 - 2 month for non-pit head
 - 1.0 Month for gas based stations
- Sec. Fuel Oil Cost- 2 months
- Liquid Fuel stock- ½ Month
- O&M Expenses- 1 month
- Maintenance spares-
 - 20% of O&M for Coal/Lignite
 - 30% of O&M for Gas/Liquid Fuel
- Receivables – 2 Months
- Interest rate- ST PLR of SBI as on 1.4.2004

Availability Based Tariff- Thermal

Annual Fixed Charge including incentive Payment Linked to availability as per following formulas:

-For generating stations in commercial operation for more than ten (10) complete financial years :

$$(AFC \times NDM / NDY) \times (PAFM / NAPAF)$$

-For generating stations in commercial operation for not more than ten (10) complete financial years :

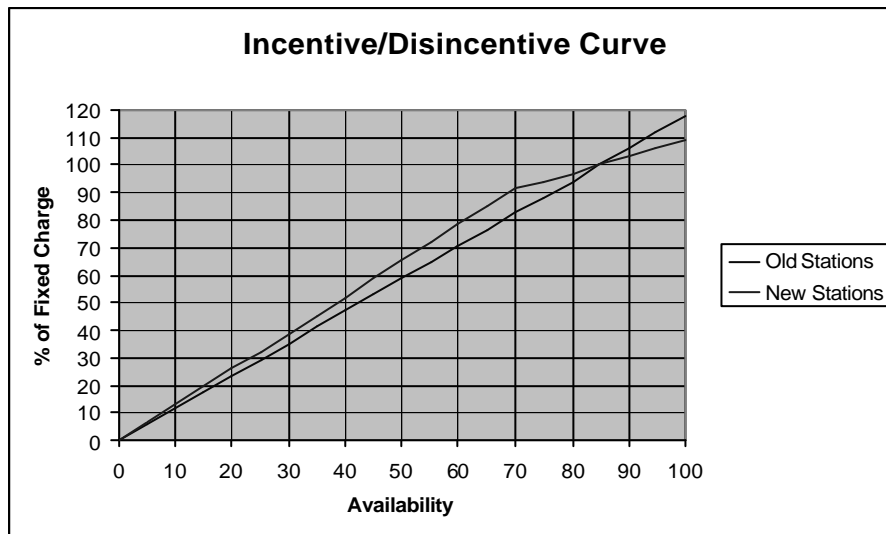
$$(AFC \times NDM / NDY) \times 0.5 (1.0 + PAFM / NAPAF)$$

-Provided that in case the plant availability factor achieved during a financial year (PAFY) is less than 70%, then the total fixed charges for the year shall be restricted to

$$AFC \times (0.5 + 0.35 / NAPAF) \times (PAFY / 70).$$

Availability Based Tariff- Thermal

Incentive/Disincentive Curve



Performance/Operational Norms

- Target Availability
- Gross Station Heat rate
- Specific Fuel Oil Consumption
- Aux. Energy Consumption
- Transit losses

Target Availability

- Thermal power generating stations in general - 85%

Incentive shall now be paid on the basis of declared availability to increase the availability of the plant.

Gross Station Heat rate

- Existing Coal based Stations
 - 210 MW - 2500
 - 500 MW - 2425
 - In respect of 500 MW and above units where the boiler feed pumps are electrically operated, the gross station heat rate shall be 40 Cal/kWh lower than the station heat rate indicated above.
- New Coal based Stations
 - 1.065 x Design heat rate
 - Prescribed maximum permissible design heat rate to discourage procurement of inefficient machines

Gross Station Heat rate

Existing Gas based stations

Gandhar, Faridabad, Kayamkulam	-	2000
Kawas, Anta & Dadri	-	2075
Auraiya	-	2100
Assam GBPP	-	2400
Agartala GBPS	-	3500

New Gas based stations

1.05 x Design heat rate

Specific Fuel oil Consumption

- Part of Fixed Charges
- 1.0 ml/kWh (Coal)
- 2.0 ml/kWh (Lignite)
- Savings in Secondary Oil Consumption below 1 ml/kWh are to be shared with beneficiaries in 50:50 ratio

Aux. Energy Consumption

		With Natural Draft cooling tower or without cooling tower
(i)	200 MW series	8.5%
(ii)	500 MW & above	
	Steam driven boiler feed pumps	6.0%
	Electrically driven boiler feed pumps	8.5%

For thermal generating stations with induced draft cooling towers, the norms shall be further increased by 0.5%.



Scheduling & Despatch

- Generators are required to declare their available capacity for the day on a day ahead basis
- Beneficiaries are required to give their power requirement for the day on a day ahead basis
- RLDCs are required to balance the generation and demand and finalise the generation and drawal schedules for the generators and beneficiaries also on a day ahead basis
- Both generator & beneficiaries may revise their declaration or requirement



Recovery of Tariff

- Generators gets paid the annual fixed or capacity charges corresponding to annual availability based on the daily capacity declarations and energy charges corresponding to scheduled generation.
- In real time it is difficult to maintain exact balance between generation and load specially in deficit conditions prevailing in India and actual generation or the drawal varies invariably from the schedules

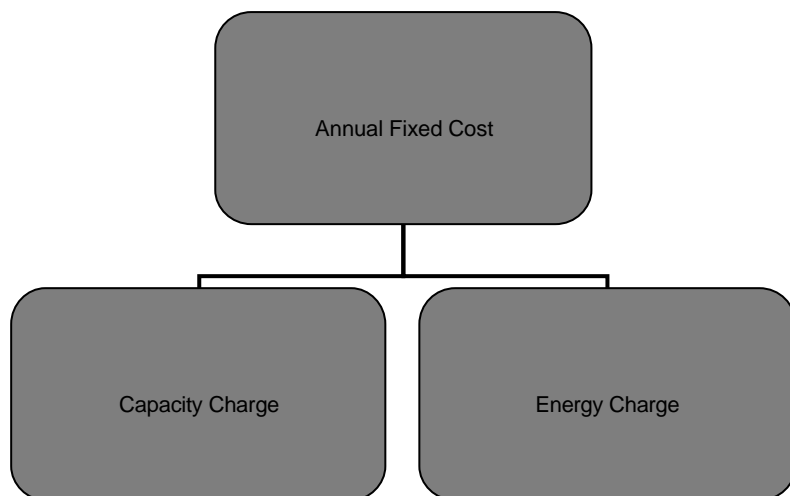
Hydro Tariff Structure

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Recovery of Tariff



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Recovery of Tariff

- 50% of the Annual Fixed Cost is collected in the form of Capacity charge on monthly basis
- 50% of the AFC is divided by the Design energy net off of AUX and FEHS to find out energy rate per unit
- Energy rate so derived is multiplied with monthly scheduled energy to find out Energy charge per month.
- Incentive is inbuilt in the formulae and not provided separately.

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Capacity Charges 2009-14

- Capacity Charge (Inclusive of incentive) payable to a hydro generating station for a month shall be :

$$\text{AFC} \times 0.5 \times \text{NDM} / \text{NDY} \times (\text{PAFM} / \text{NAPAF})$$

where,

- ❖ AFC is the annual fixed cost specified
- ❖ NAPAF is Normative plant availability factor (%)
- ❖ PAFM is Plant availability factor achieved (%)
- ❖ NDM & NDY are the number of days in the month/ year

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Capacity Charges – 2004-09

- Capacity Charge payable to a hydro generating :

AFC – Primary Energy Charge

where,

- ❖ AFC is the annual fixed cost specified
- Primary Energy Charge not be more than the Annual Fixed Charges
- Primary Energy Charge =
Saleable Primary Energy x Primary Energy Rate

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Energy Charges : 2009-14 Regulation

- Energy charge is payable month wise for the total energy scheduled to be supplied for the month ex power plant to the beneficiaries, excluding free energy.

- ECR (Rs/kwh)

$$= AFC \times 0.5 \times 10 / (DEX(100 - AUX_n) \times (100 - FEHS))$$

- Monthly Energy Charge (Rs):

$$= ECR \times \text{Scheduled energy (ex-bus) for the month corresponding to scheduled generation} \times (100 - FEHS) / 100$$

- 12% / (13% + 100 units) of ex-bus energy is given free to the home state.

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Energy Charge Recovery and Hydrological Risk- 2009-14

- Shortfall scenario (A_i (actual generation in yr. i) < DE):
 - DE in ECR formulae shall be:
 - Up to 10 yrs (till EC recovery shortfall of previous yrs. is made up) : $DE_r = A_i$
 - After 10 yrs: $DE_r = A_1 + A_2 - DE$
- Higher generation scenario ($A_i > DE$):
 - ECR for excess generation shall be restricted to 80 paise per unit
(in case of shortfall, ECR shall be restricted to 80p only after EC shortfall of previous year has been made up)

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Incentives

As per the 2004-09 Regulations:

- Incentive = $0.65 \times \text{annual fixed charges} \times (\text{capacity index achieved} - \text{normative capacity index}) \times 100$
- Deemed Generation: In case of reduced generation due to reasons beyond the control of generator or non-availability of Tr. Lines or backing down by RLDC, resulting in spillage of water, energy charges for such spillages shall be payable to generating company. Not admissible if energy generated during the year is more than Design Energy.
- Incentive on secondary energy generation

As per the 2009-14 Regulations:

- Shall form a part of recovered fixed charge and energy charge
- Linked to Plant Availability Factor
- ECR for incentive restricted to @80p/kWh. This rate is same for plants in all the regions

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Unscheduled Interchange

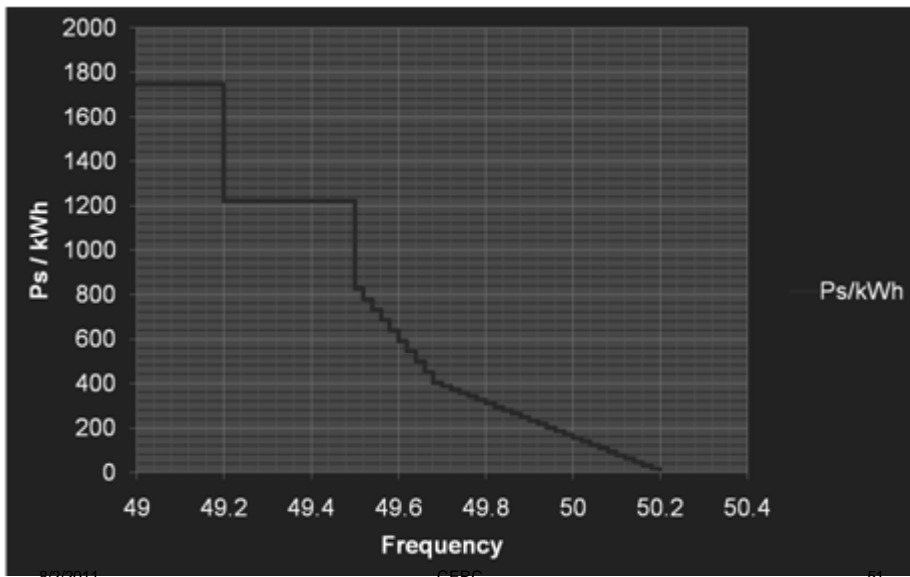
- The deviation from schedule is termed as unscheduled Interchange (UI)
- The deviation from schedules i.e. UI is paid as per the frequency linked rates



Unscheduled Interchange Charges

- Frequency linked Charges for unintended deviation from schedule for maintaining grid discipline
 - Each 0.02 Hz step is equivalent to 15.5 paise/kWh in the 50.2-49.7 Hz frequency range and 47.0 Paise/kWh in the 49.7-49.50 Hz frequency range.
- Payable for burdening the grid for over draws and under injections
- Additional UI charges below grid frequency of 49.5 Hz
 - Below 49.5 Hz to 49.2 Hz @40% of the UI Charges at 49.5 Hz of Rs. 8.73/kWh
 - Below 49.2 Hz @100% of the UI Charges at 49.5 Hz of Rs. 8.73/kWh
- Receivable for helping the Grid for under draws and over injections
- Imposes limits on over draws /under injections and under draws and over injections

UI Price Vector



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Thank You

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