

ISSUES ON REGULATORY COMPENSATION FOR FLEXIBLE OPERATIONS

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RENEWABLE GENERATION

- ▶ Generating power from renewable sources of energy is of cardinal importance if India is to meet its INDC targets of include reduction in the emissions intensity of its GDP by 33 to 35 per cent by 2030 from 2005 level.
- ▶ The aim is to ensure security, reliability & stability of electricity grids for supplying affordable & reliable power to the consumer while maximizing generation of power from renewable energy sources (RES) & integration of the same into grid.

RENEWABLE GENERATION

- ▶ Russia-Ukraine war have increased the petroleum product costs more than double and resulted into energy crisis.
- ▶ Number of countries have forced into financial collapse/distress and recession.
- ▶ Number of countries have started their coal plants
- ▶ Intensifying of RE generation to replace the fossil fuel is the viable option.
- ▶ Coal base generation may continue for some more time.
- ▶ Flexible operation of coal plants to accommodate intermittent generation of RE units is one of the main way forward

TOTAL COST OF CYCLING

- ▶ Increase in maintenance, operation (excluding fixed costs), and overhaul capital expenditures.
- ▶ Increased time-averaged replacement energy and capacity cost due to increased Equivalent Forced Outage Rate
- ▶ Increase in the cost of heat rate changes due to low load and variable load operation.
- ▶ Increase in the cost of start up fuel, auxiliary power, chemicals, water, and extra manpower for start-up's.
- ▶ Costs of long-term heat rate increases (i.e., efficiency loss)

CAPITAL EXPENDITURE (CAPEX) REGULATORY COMPENSATION FOR FLEXIBLE OPERATIONS

- ▶ Capital expenditure required to meet the requirement of flexible operation mainly comes from the capital interventions required at plant level.
- ▶ The number and type of interventions required would vary from plant to plant depending on the age of unit and scope of works.

OPERATIONAL EXPENDITURE (OPEX)

- ▶ Cost due to increase in Heat Rate.
- ▶ Cost due to increase in O&M due to reduction in life of components.
- ▶ Cost due Increased Oil consumption due to frequent start/ stops

OPERATIONAL EXPENDITURE (OPEX)

- ▶ Hon'ble CERC and State Electricity Regulatory Commission's (SERC) on compensation for generation units for flexible operations and for identifying and proposing regulations for flexible operations of coal based units in the country; and to enable market enabled flexible services in the long run providing due incentives for increased flexibility
- ▶ MOP and Central Electricity Authority (CEA) on proposed recommendations for scaling up and capacity building initiatives for flexible operations in the country

COMPENSATION FOR FLEXIBLE OPERATIONS

- ▶ Allow cost (CAPEX) recovery for retrofit investments in regulated power plants
- ▶ All units are not required to be made flexible and the unit-wise interventions are specific to the value that is required
- ▶ To be delivered to the grid from such unit viz. minimum load, increased ramp rates and required start-up frequency.
- ▶ If a proposed retrofit project for a regulated power plant is considered cost-effective and appropriate for the system,
- ▶ The regulators can consider allowing retrofit costs to be passed through to rate payers.

COMPENSATION FOR FLEXIBLE OPERATIONS

- ▶ For units preparing to undergo flexible interventions resulting in capex investments, due diligence and approval by CEA with support from respective OEMs is recommended.
- ▶ Provide financial incentives (CAPEX) that encourage new coal based power plants to utilize high-flexibility technical components
- ▶ All new units must be reimbursed for additional flexibility retrofits and better part load efficiencies in terms of advanced design, material or additional components

START-UP LIFE CONSUMPTION COSTS

- ▶ In every start-up there will be costs associated with equipment life consumption, inputs including fuel oil, DM water and chemicals consumption and auxiliary power.
- ▶ Cost of additional oil consumption has already been provisioned as per the 4th IEGC amendment as per the start-up type (hot, warm and cold), which is adequate.
- ▶ Additionally, costs due to life consumption may be reimbursed based on the analysis and every additional start-up or significant load following may be reimbursed as percentage increase in the normative O&M cost.

O&M EXPENSES

- ▶ Frequent start/stops and load following leads to damage in components (due to fatigue and creep interaction), which may be latent and manifest as component failure after a long period of operation.
- ▶ However, each such operation will result in reduction in useful life of the equipment.
- ▶ To cover-up the loss of useful life, generators will be required to carry out increased and more frequent maintenance and component replacement. The extra cost incurred will be reflected as increased repair and maintenance cost.
- ▶ **IEGC (Fourth Amendment) Regulation, 2016, notified on 06.04.2016 have addressed, Technical Minimum Schedule for operation**

TECHNICAL MINIMUM SCHEDULE FOR OPERATION

Regulation 6.3B.1:

The technical minimum for operation shall be **55%** of MCR loading or installed capacity of the unit."

Regulation 6.3B.2:

The generating stations may be directed by RLDC to operate at or above the technical minimum but below the normative plant availability factor

TECHNICAL MINIMUM SCHEDULE FOR OPERATION

Regulation 6.3B.3:

“ For part load operation unit may be **compensated** depending on average unit loading duly taking into account the:

- forced outages, planned outages, PLF, energy sent out ex-bus, number of start-stop, secondary fuel oil consumption, aux. energy consumption in due consideration of actual and normative operating parameters **on monthly basis.**”

TECHNICAL MINIMUM SCHEDULE FOR OPERATION

Station Heat Rate

“In case of coal/ lignite based station, following **SHR degradation** or actual heat rate, whichever is lower, shall be considered for the purpose of compensation.”

S. No.	Unit loading as a % of Installed capacity of the unit	Increase in SHR (for supercritical units) %	Increase in SHR (for sub-critical units) %
1	85-100	Nil	Nil
2	75-84.99	1.25	2.25
3	65-74.99	2	4
4	55-64.99	3	6

TECHNICAL MINIMUM SCHEDULE FOR OPERATION

Auxiliary Energy Consumption

“In case of coal/ lignite-based station, following **APC degradation** or actual, whichever is lower, shall be considered for the purpose of compensation.”

SI No.	Unit loading (% of MCR)	% Degradation in APC admissible
1	85 - 100	Nil
2	75 - 84.99	0.35
3	65 - 74.99	0.65
4	55 - 64.99	1.00

ADDITIONAL COMPENSATION

“ISGS shall have the option to go for **reserve shut down** and in such cases, start-up fuel cost over and above **7 start/stop** in a year shall be considered as **additional compensation** based on following norms or actual, whichever is lower.”

Oil Consumption per start up (KI)

Unit Size (MW)	Hot	Warm	Cold
200/210/250	20	30	50
500	30	50	90
660	40	60	110

NTPC PROPOSED SHR COMPENSATION

Sl No.	% Load range	Increase in SHR (for supercritical units) %	Submitted by NTPC	Increase in SHR (for sub-critical units) %	Submitted by NTPC
1	85 - 100	Nil	0.80	Nil	0.80
2	75 - 84.99	1.25	1.80	2.25	2.30
3	65 - 74.99	2	3.10	4	4.00
4	55 - 64.99	3		6	

NTPC PROPOSED APC COMPENSATION

SI No.	% load range	APC as per norm for 500MW unit	% Degradation in APC admissible	Expected APC (%) submitted by NTPC
1	85 - 100	5.75	Nil	0.45
2	75 - 84.99	5.75	0.35	1.25
3	65 - 74.99	5.75	0.65	1.65
3	55 - 64.99	5.75	1.00	

CEA RECOMMENDATION – SUMMARY OF OPERATIONAL COST

		Typical 200/210 MW Unit					Typical 500 MW Unit			
			Due to HR	Add. O&M	Start-up Oil	Total	Due to HR	Add. O&M	Start up Oil	Total
Sr. No.		Unit loading %	Addl. Paisa/kWh				Addl. Paisa/kWh			
1	Minimum load with significant load following	90%	0.0	0.0	0.0	0.0	1.1	0.0	0.0	1.3
2		80%	0.0	0.0	0.0	0.0	3.4	0.0	0.0	3.4
3		70%	2.1	3.3	0.0	5.4	6.7	7.1	0.0	13.8
4		60%	7.5	3.3	0.0	10.8	12.6	7.1	0.0	19.7
5		50%	15.0	3.3	0.0	18.3	20.0	7.1	0.0	27.2
6		40%	23.2	3.3	0.0	26.5	27.6	7.1	0.0	34.8
7		30%	34.6	3.3	0.0	38.0	38.0	7.1	0.0	45.2
	Weekly Start		23.2	60.2	14.8	98.2	27.6	69.2	10.7	107.5
	Daily Start		7.5	444.1	112.6	564.2	12.6	531.0	75.0	618.6

THANK YOU