

## 27. Norms of Operation ( Regulations 25)

27.1 The Commission had started the process of finalizing terms and conditions of tariff in Jan 2008 directing the central utilities under its control to furnish the actual operational data from the year 2002-03 to 2006-07 in the specified formats. The Commission intended to review the existing norms for the new and existing stations including specifying of norms for the coal based plants on super critical boiler technology and for the Lignite Based Plants based on Circulating fluidized bed combustion (CFBC) boiler technology. The Commission vide letter dated 3.4.2008 requested CEA to recommend suitable operational norms for the thermal generating stations by July 2008. CEA could make their recommendations only in Sept 2008. In the meanwhile, Commission had come out with draft regulation in Aug 2008 specifying terms and condition of tariff for a five year period 2009-14 including norms for operation on its own in the absence of CEA recommendations.

27.2 The Commission's approach has been so far to prescribe single value norms depending upon unit sizes and type of fuel and technology. In specific cases relaxed norms have also been prescribed when situation so demanded. In the meantime, CEA made its recommendations on operational norms for the thermal generating stations in September 2008. On the request of beneficiaries the operational data submitted by the CPSUs and the CEA recommendations on operational norms were made public on CERC web site.

27.3 The beneficiaries like MPPTCL, UPPCL, RRVUNL, GUVNL; etc have sought for fixing more stringent norms. One of the stakeholders has sought the average of actual should be the norm. On the other hand generators namely NTPC, NLC, NEEPCO and DVC had sought for continuation of the existing norms or relaxed norms in specific cases. Some State generators have sought for more relaxed norms. According to them, norms based on high performing stations when adopted by the SERCs would lead to innumerable losses for them.



27.4 Before dealing with the concerns of the stakeholders, we would like to discuss some of the provisions of the tariff policy notified by Govt of India on 6.1.2006. Some of the provisions are extracted as under:

(a) The Para 1.3 and 1.4 of the tariff policy reads as follows:

*"1.3. It is therefore essential to attract adequate investments in the power sector by providing appropriate return on investment as budgetary resources of the Central and State Governments are incapable of providing the requisite funds. It is equally necessary to ensure availability of electricity to different categories of consumers at reasonable rates for achieving the objectives of rapid economic development of the country and improvement in the living standards of the people.*

*1.4. Balancing the requirement of attracting adequate investments to the sector and that of ensuring reasonability of user charges for the consumers is the critical challenge for the regulatory process. Accelerated development of the power sector and its ability to attract necessary investments calls for, inter alia, consistent regulatory approach across the country. Consistency in approach becomes all the more necessary considering the large number of States and the diversities involved."*

Thus, the objectives of tariff policy are to:

- (i) Ensure availability of electricity to consumers at reasonable and competitive rates;*
- (ii) Ensure financial viability of the sector and attract investments;*
- (iii) Promote transparency, consistency and predictability in regulatory approaches across jurisdictions and minimise perceptions of regulatory risks;*
- (iv) Promote competition, efficiency in operations and improvement in quality of supply.*

(b) The tariff policy in para 5.1 also provides as follows:



*"All future requirement of power should be procured competitively by distribution licensees except in cases of expansion of existing projects or where there is a State controlled/owned company as an identified developer and where regulators will need to resort to tariff determination based on norms provided that expansion of generating capacity by private developers for this purpose would be restricted to one time addition of not more than 50% of the existing capacity.*

*Even for the Public Sector projects, tariff of all new generation and transmission projects should be decided on the basis of competitive bidding after a period of five years or when the Regulatory Commission is satisfied that the situation is ripe to introduce such competition."*

Thus tariff policy has laid down a framework for performance based cost of service regulation in respect of aspects common to generation, transmission as well as distribution.

(c) With regards to operational norms, tariff policy provide as follows:

*"Suitable performance norms of operations together with incentives and disincentives would need to be evolved along with appropriate arrangement for sharing the gains of efficient operations with the consumers. Except for the cases referred to in para 5.3 (h)(2), the operating parameters in tariffs should be at "normative levels" only and not at "lower of normative and actuals". This is essential to encourage better operating performance. The norms should be efficient, relatable to past performance, capable of achievement and progressively reflecting increased efficiencies and may also take into consideration the latest technological advancements, fuel, vintage of equipments, nature of operations, level of service to be provided to consumers etc. Continued and proven inefficiency must be controlled and penalized.*



*The Central Commission would, in consultation with the Central Electricity Authority, notify operating norms from time to time for generation and transmission. The SERC would adopt these norms. In cases where operations have been much below the norms for many previous years, the SERCs may fix relaxed norms suitably and draw a transition path over the time for achieving the norms notified by the Central Commission.*

(d) The para 5.3 (h)(2) of the tariff policy provide as follows:

*"In cases where operations have been much below the norms for many previous years the initial starting point in determining the revenue requirement and the improvement trajectories should be recognized at "relaxed" levels and not the "desired" levels. Suitable benchmarking studies may be conducted to establish the "desired" performance standards. Separate studies may be required for each utility to assess the capital expenditure necessary to meet the minimum service standards."*

27.5 In the light of above provisions of tariff policy, the Commission's endeavor is to specify just and fair norms balancing the interest of the beneficiaries as well as the generators to the extent practicable and possible. The Commission is neither in favour of specifying stringent operational norms nor in favour of giving relaxed norms unless conditions warrant such relaxation. Commission is also conscious of the fact that the future procurement of power by the licensee shall be through competitive bidding. Nevertheless, regulated prices are expected to give price signals for the investors to invest in the Indian power sector. The Commission's approach is to have distinct operational norms depending upon type of technology and fuel, relatable to past performance in case of existing stations duly taking into consideration actual performance level, age of stations, providing for sufficient operational flexibility with system of built in incentive and disincentive mechanism. In respect of new station



which would be achieving COD on or after 1.4.2009 operational norms intend to capture the new technological advancements

27.6 The Commission doesn't consider it right approach to specify actual performance to be made the norms. This would not incentivize the generator to sustain the performance and improved efficiency levels.

27.7 The actual average based on past performance of stations during 2004-05 to 2007-08 has acted as guide for the commission to specify reasonable norms after passing on gains in efficiency over these years to the beneficiaries in the form of improved efficiency and performance norms of aux energy consumption for the next tariff period wherever deemed fit. It is because the SHR and the aux energy consumption of a station are dependent on the PLF of the station. Higher the PLF lower the SHR and Aux. energy consumption signifying more electricity available to the beneficiary in the form of additional generation. This additional generation which requires lot of efforts on the part of generator is at nominal cost by way of incentive and energy charges and effectively reduces the unit cost of electricity to the beneficiaries. Thus passes on the benefit of efficient operation to the beneficiaries directly.

27.8 The Commission is of the view that unlike SHR and Aux energy consumption norm, the specific fuel oil consumption norm is on a different footing. The use of specific fuel oil is necessary for the stable operation of units and the grid. It has been observed in the past that generator is saving much due to improved performance of the station beyond 70%. Whereas, commission does not want to sacrifice the grid stability and unit stability but at the same time would like the savings in specific fuel oil consumption as against norm be shared with the beneficiaries on year to year basis.

27.9 *The actual operational parameters for the 2007-08 have also been submitted by the CPSUs. The station wise existing operational norms, actual operational parameters for 2004-05 to 2007-08, average performance parameters, Norms as per draft and norms as recommended by CEA are tabulated in Annexure-B. Various*



operational norms are discussed below in the light of CEA recommendations, submissions of the stakeholders and considering the operational data of 2007-08:

***Norms of Operation of Thermal Generating Stations:***

**28. Normative Annual Plant Availability Factor (Regulation 26)**

28.1 The Commission in the draft regulations had raised the Normative Annual plant availability factor (target availability) for the full recovery of fixed charges from 80% to 85% in general for existing as well as new thermal generating stations. In the draft regulations for tariff period 2009-14, Normative Annual Plant Availability Factor (NAPAF) for recovery of fixed charge and for incentive were specified as follow:

- (a) All thermal generating stations, except those covered under clauses (b), (c), (d), (e) & (f) - 85%

- (b) Thermal generating stations of NTPC Ltd

Talcher TPS	82%
Tanda TPS	82%
Badarpur TPS	82%

- (c) Thermal generating stations of Neyveli Lignite Corporation Ltd

TPS-I	72%
TPS-II Stage-I & II	75%
TPS-I (Expansion)	80%





(d) Thermal generating stations of Damodar Valley Corporation (DVC):

Bokaro TPS	75%
Chandrapura TPS	60%
Durgapur TPS	74%

(e) Assam Gas Based Station of NEEPCO :

Assam GPS	70%
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(f) Lignite-based generating stations using Circulatory  
Fluidized Bed Combustion (CFBC) Technology – 80%

28.2 The CEA has recommended the continuation of existing norms for the thermal generating stations. Beneficiaries have sought a norm of 90%. On the other hand NTPC has sought to continue with existing norm of 80% citing problems in coal supply for its generating stations and dwindling coal stock position.

28.3 The Commission had proposed the above norms having due regard to the actual performance of the coal/lignite based stations for the period 2004-05 to 2006-07. The availability of these stations of NTPC and NLC has further improved in 2007-08 except in case of Farakka TPS of NTPC and TPS-I station of NLC. The average availability of stations for the period 2004-05 to 2007-08 having 200 MW sets and above is in the range of around 86 to 97% except Farrakka TPS. These stations are performing at commendable high performance levels consistently for all these years. Problem of coal supply in case of one station at Farakka TPS and specific problem at TPS-I station cannot be a ground for lower norm. At the same time, we are also conscious of the fact that these stations are amongst the best performing stations and setting norm close to such high performance level will not leave them scope for operational flexibility in case of poor supply of fuel, any operational contingency,

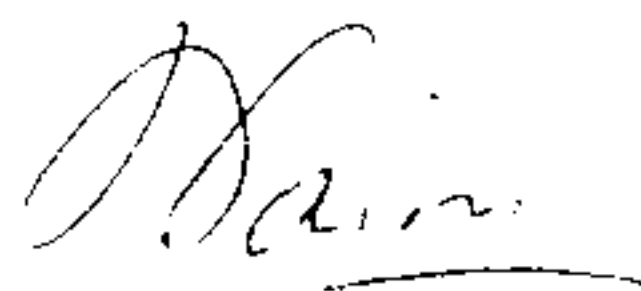


deterioration in the fuel quality etc. A very high performance norm may also discourage the new investment in the sector as in the regulated regime it may be difficult for them to mitigate any risk for not achieving the specified high performance level. Commission is therefore, convinced that norm of 85% for these stations is just, reasonable and equitable.

28.4 The beneficiaries have sought for higher availability norm for Badarpur, Tanda and Talcher TPS of NTPC. The commission had kept the lower availability norm for these stations having regard to their vintage. However, Tanda is performing at fairly high level consistently above 90% for the last two years and has still not completed its useful life. As such, we are inclined to set a norm for Tanda TPS at 85%. But in case, of Talcher TPS and Badarpur TPS, we intend to keep the norm same as provided in the draft regulations at 82% for the reasons specified in draft regulation.

28.5 In respect of DVC stations we do not find any reason to set a different availability norm except Mejia TPS 1 to 4. Mejia unit 1 to 4 has improved upon its performance and has achieved a PLF of 90% in 2007-08 but only one year performance is not sufficient to justify the same availability norms as set for other good performing stations which are consistently performing at level above the availability norm of 85%. As such, we are fixing a norm of 82% for the Mejia unit 1 to 4 based on their performance for the year 2006-07 and 2007-08. Other stations namely Bokaro, Chandrapura and Durgapur despite improved performance than the previous years are still short of norms specified by CERC for the year 2008-09 and as such availability norms as specified in draft regulations are being adopted in the final regulation for these DVC stations.

28.6 Similarly in case of lignite based stations of NLC we don't find that there is a case for review of norms for these stations. In case of lignite stations of NLC, TPS-I (Expansion) is consistently achieving availability and actual PLF level of more than 80%. TPS-II stage-I & II has also been able to achieve availability of more than 75% in 2007-08. But in case of TPS-I Station availability levels has gone further down to 70%





in 2007-08 (Actual PLF). The NLC during the hearing has informed that they have decided to phase out TPS-I units one by one in a phased manner. But the average availability is of the order of 76% and hence we are keeping the availability norm as 72%. With regard to lignite fired stations using CFBC technology are concerned, we found that the availability in initial years was of the order of 76% in case of surat lignite fired station and gradually picked up thereafter. In view of this we are providing for a norm of 75% during first three years of COD and thereafter, retaining a norm of 80%. In respect of the new lignite power stations with PF Boilers, availability norms have been combined with the coal power fire stations at 85%. NLC has expressed that difference in the availability norms of 5% between coal and lignite power stations should be maintained as in the previous Tariff Orders for the period 2004-2009 in view of the difficulties faced in lignite fired boilers. However, it has been decided to retain the draft and specific difficulties if any brought out by NLC could be looked into for suitable modifications.

28.7 As regards target plant load factor for the payment of incentive is concerned, it is not relevant now when the Commission has decided to go for the availability based incentive scheme for the thermal generating stations as provided in draft regulations. This has been discussed separately. In coal/lignite based stations we intend to keep the target availability for payment of incentive as the same as that of target availability for the recovery of full fixed charges.

28.8 The availability of the various Gas/Liquid fuel based generating stations NTPC in the last 4 years i.e. 2004-05 to 2007-08 is as follows:

NTPC's gas based station	2004-05	2005-06	2006-07	2007-08	Average
Auraiya	82%	91%	90%	81%	86%
Anta	86%	91%	88%	85%	88%
Dadri	89%	90%	85%	84%	87%

Kawas	91%	93%	95%	87%	91%
Jhanor Gandhar	71%	81%	82%	78%	78%
Faridabad	98%	95%	89%	83%	91%
Kayamkulam (RGCCP)	85%	96%	93%	93%	92%

28.9 It can be seen that despite lower performance level in 2007-08, all the above plants of NTPC are maintaining average availability in the range of 86% to 91% except in case of Jhanor Gandhar GPS. The actual PLFs which were much lower than the respective availability during the last 4 years due to the fact that liquid fuel based capacity was not being dispatched by the beneficiaries due to very high cost of liquid fuel namely Naphtha and HSD and high spot prices of RLNG. But due to steep fall in crude prices we expect that this trend will no longer continue in the next tariff period. With the improvement in the despatches on liquid fuel from Kawas station of NTPC, we feel that more gas could be diverted to Gandhar GPS. Further, reduction in prices of spot gas will also enable despatches of capacity on RLNG so that generator like NTPC could arrange for Gas with some certainty. Nevertheless, in case of gas shortage, we have already provided that the generating co. may propose to deliver a higher MW during peak-load hours by saving fuel during off-peak hours. The nodal load dispatch centre may then specify a pragmatic day-ahead schedule for the generating station to optimally utilize its MW and energy capability, in consultation with the beneficiaries. In such a case the DCi shall be taken to be equal to the maximum peak-hour ex-power plant MW schedule specified by the nodal load dispatch centre for that day.

28.10 As such, we are fixing availability norm of 85% for all existing as well as new gas/liquid fuel based stations.

28.11 The actual availability for the period 2004-05 to 2007-08 as achieved by Small Gas turbine stations of NEEPCO is as below:

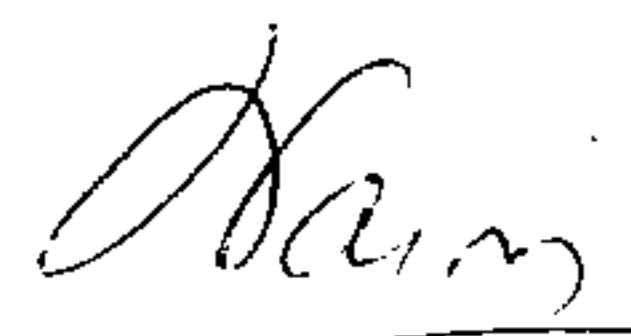


Station	2004-05	2005-06	2006-07	2007-08	Average
Assam GPS	78%	72%	72%	69%	73%
Agartala GPS	83%	97%	94%	93%	92%

28.12 It is observed that the Target Availability of 80% could not be achieved by the Assam GPS from 2004-05 to 2007-08. It is because the station is not getting required quantity of gas for availability declaration of 80%. Further, as brought out in our explanatory memorandum with draft regulation that the allocation of 1.0 MCMD of gas on firm basis and 0.4 MCMD on fall back basis is sufficient for sustaining a generation level of the order of 70% only. Arranging of spot gas or any other alternate fuel in the remote north-eastern region is also not a feasible option. In this back drop, Commission is of the view that there is a case for relaxation of target availability norm for the Assam GPS station. However, the average availability of the station is about 73% for the years 2004-05 to 2007-08 despite availability of 70% (Actual PLF) in the year 2007-08. As regards, provision regarding conserving gas during off peak hours and using it during off-peak hours in consultation with beneficiaries due to gas shortage may be a difficult option for Assam GPS due to supply of gas from scattered wells, through short pipelines which do not have any capacity for gas storage (line pack), Considering all these aspect, a target availability norm of 72% is allowed for the tariff period 2009-14 as against 70% provided in the draft regulation.

28.13 In case of Agartala GPS, the station is able to achieve an average availability of 92% in last three years i.e. 2005-06 to 2007-08 and there is no gas supply problem. As such, a target availability norm of 85% is allowed for the Agartala GPS.

28.14 For the new small gas turbine stations, the target availability norm for the full recovery of fixed charges and payment of incentive shall also be 85%. Accordingly, following availability norms are specified:



**“(i) Normative Annual Plant Availability Factor (NAPAF) for recovery of fixed charge and for Incentive**

- (a) All thermal generating stations, except those covered under clauses (b), (c), (d), (e) & (f) - 85%

- (b) Thermal generating stations of NTPC Ltd

Talcher TPS	82%
Badarpur TPS	82%

- (c) Thermal generating stations of Neyveli Lignite Corporation Ltd

TPS-I	72%
TPS-II Stage-I & II	75%
TPS-I (Expansion)	80%

- (d) Thermal generating stations of Damodar Valley Corporation (DVC):

Mejia TPS Unit-I to IV	82%
Bokaro TPS	75%
Chandrapura TPS	60%
Durgapur TPS	74%

- (e) Gas Based Station of NEEPCO :

Assam GPS	72%
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(f) Lignite-fired Generating Stations using Circulatory Fluidized Bed Combustion (CFBC) Technology –

1. First three years from COD – 75%
2. From next year after completion of 3 years of COD – 80%.”

**29. Gross Station Heat Rate {Regulation 26(ii)}**

29.1 Coal/Lignite based thermal generating stations :CERC had tightened the Gross station heat rate norm in the draft regulation for existing as well as new 500 MW units from 2450 kCal/kWh to 2400 kCal/kWh. The SHR norm for lignite based stations continued to be linked to SHR norm of coal based station with correction factor for moisture content. Separate norms were specified for 600 MW and above sets based on super critical boiler technology and lignite based stations based on CFBC technology.

29.2 So far as existing stations commissioned before 1.4.2004 are concerned, CEA has recommended continuation of existing norms. In respect of new generating stations commissioned after 1.4.2004, CEA has departed from earlier practice of specifying single value norms according to the unit sizes and class of turbines in case of gas based stations. CEA has recommended for specifying Station heat rate norms with a multiplying factor of 6% over the design heat rate in respect of coal/lignite fired stations and 5% over the design heat rate in respect of gas based stations and 2% over the SHR norm of gas based stations for liquid fuel firing.

29.3 It may be appreciated that CERC had specified Operational norms having regard to the actual of 2004-05 to 2006-07 in the absence of CEA recommendations. CEA before making its recommendations has gone in to operational performance of not only CPSUs but has also considered operational performance of generating stations of State Utilities as well. CEA has also deliberated upon various operational aspects and operation margins. The CEA recommendation that design heat rates quoted by the





manufacturer or based on the quotations of manufactures are more representative numbers taking in to account all site specific conditions; quality of coal, etc definitely has a merit. The operating margin of 6% for the coal based stations and 5% for the gas based stations over the design heat rate are after due consideration of actual of a class of best performing stations including stations of State Utilities . However, to safeguard against the misquoting of design heat rate, CEA has also recommended following ceiling design turbine cycle heat rate and boiler efficiency depending upon domestic or imported coal as fuel:

Steam parameters at Turbine inlet		Maximum Turbine cycle heat rate
Pressure Kg/cm <sup>2</sup>	MST/RST (Deg C)	(kcal/kWh)
150	535/535	1955
170	537/537	1910 (with MD-BFP ), 1950 (with TD-BFP)
170	537/565	1895 (with MD-BFP ), 1935 (with TD-BFP)
247	537/565	1860 (with MD-BFP ), 1900 (with TD-BFP)
247	565/593	1810 (with MD-BFP ), 1850 (with TD-BFP)
Fuel		Minimum Boiler Efficiency (%)
Sub-bituminous Indian coals		85%
Bituminous Imported coal		89%



29.4 In view of this we are accepting CEA recommendations with following modifications as discussed below:

(a) In respect of existing units, CEA has recommended that existing norms may be allowed to continue. NTPC has also submitted SHR data of its 500 MW units in the stations having mix of 200/210 MW and 500 MW units which averages to 2405 kCal/kWh. However, having regard to actual heat rate data and actual PLF data of NTPC stations for 2004-05 to 2007-08, Commission is of the view that improvement in SHR norm is on account of improved in PLF in year to year basis except few stations. CEA has also recognized that the NTPC units are operating near 100% of their MW rating. Such a performance consistently is really very credit worthy and beneficiaries has gained tremendously with extra generation at nominal incentive plus energy charges effectively reducing their per unit cost. However, sustaining of such high performance level may not be sustained always thus calling for providing some margin for operational flexibility. The present margin for operational flexibility is of the order of 2-3% in respect of coal based stations. As for as 500 MW sets (including those commissioned between 1.4.2004 to 31.3.2009) are concerned, these units are relatively new and are expected to maintain current performance levels, and as such, for these stations there is scope for tightening of SHR norm for 500 MW unit by about 25 kCal/kWh still giving them operational flexibility to deal with variation in fuel quality and fuel supply constraints etc. As such, we are fixing a SHR norm of 2425 kCal/kWh (instead of 2400 kCal/kWh as proposed in draft) for the existing 500 MW units and passing on the benefit of efficiency gain to the beneficiaries. In respect of 200/210/250 MW sets, which are relatively old and near completion of their useful life, the performance level is expected to be lower due to R&M activities, a point made by the NTPC. As such, in respect of 200/210/250 MW sets we are retaining the norms as 2500 kCal/kWh.



(b) In respect of NTPC stations namely Tanda TPS and Talcher TPS, it is felt that there is further scope of reduction of heat rate norm by about 25 kCal/kWh having regard to their actual heat rate data for the period 2004-05 to 2007-08. In respect of Gandhar GPS, NTPC has sought for relaxation of norm to 2080 kCal/kWh due to water injection to control NO<sub>x</sub>. However, considering actual performance we feel that a norm of 2040 kCal/kWh would be sufficient. Similarly, in case of Assam GPS due to non availability of gas, we are relaxing the SHR norm to 2400 kCal/kWh as provide in the draft regulations based on actual performance data as it is not possible for the NEEPCO in NE region to arrange gas from any other alternate source. In respect of Agartala GPS, we are providing for tightening of SHR norm to 3500 kCal/kWh from the present 3580 kCal/kWh considering its actual performance. With regard to DVC existing stations as provide in the draft regulation, we are specifying same norms as applicable in 2008-09 as these stations are yet to achieve norms specified for 2008-09. However, Commission would be taking stock of the actual performance of these stations and would review the DVC norms as and when considered necessary.

(c) In respect of new coal/lignite based thermal generating units, Commission is of the view that the SHR norms could not be set based on the actual performance of high performing units leaving them no scope for operational flexibility. As such, Commission is providing for a 0.5% additional margin over the design heat rate and accordingly, providing for a margin of 6.5% above the design heat rate as the SHR norm for the new coal/lignite based stations. Further, to safeguard against the misquoting of design heat rate, as suggested by CEA we are providing that the design heat rate should not exceed the following values in respect of units depending upon their temperature and pressure ratings:



Pressure Rating (Kg/cm <sup>2</sup> )	150	170	170	247	247
SHT/RHT (0C)	535/535	537/537	537/565	537/565	565/593
Type of BFP	Electrical Driven	Turbine driven	Turbine driven	Turbine driven	Turbine driven
Max Turbine Cycle Heat rate (kCal/kWh)	1955	1950	1935	1900	1850
Min.Boiler Efficiency					
Sub-Bituminous Indian Coal	0.85	0.85	0.85	0.85	0.85
Bituminous Imported Coal	0.89	0.89	0.89	0.89	0.89
Max Design Unit Heat rate (kCal/kWh)					
Sub-Bituminous Indian Coal	2300	2294	2276	2235	2176
Bituminous Imported Coal	2197	2191	2174	2135	2079

(d) It can be seen that the CEA had provided for ceiling of minimum boiler efficiency for imported coal as well. All the existing stations were designed for domestic sub-bituminous Indian coals. But due to deteriorating quality and shortage of coal, NTPC has started blending imported coal with domestic coal in some of its power stations. This is with a view to move towards design coal. As such, there should not be any confusion regarding use of imported coal for the blending with domestic coal in the existing stations. Since such, blending is unlikely to improve the guaranteed boiler efficiency which is given for a designed coal. We shall therefore, be guided by the design coal for which guarantees have been given by the supplier while adopting the efficiency parameters for the domestic coal or the imported coal as the case may be.



(e) It may also be possible that the manufacturers may offer a machine whose pressure and temperature ratings may not exactly match with the pressure and temperature ratings specified above. In such a situation, the ceiling design heat rate of the nearest class shall be taken for determining the norm.

(f) It may also be possible that unit heat rate has not been guaranteed but turbine cycle heat rate and boiler efficiency are guaranteed separately by the same supplier or different suppliers. In such a situation, the unit design heat rate shall be arrived at by using guaranteed turbine cycle heat rate and boiler efficiency.

(g) It may also be possible that one or more units of a station achieve COD prior to 1.4.2009 and other units may achieve COD on or after 1.4.2009. The units achieving COD prior to 1.4.2009 then shall be called existing units. Then a question may arise whether the units of same type could have different norms. In order to deal with such a situation, it is provided that in such a situation, the heat rate norm for units achieving COD prior to 1.4.2009 as well as units achieving COD on or after 1.4.2009 for the tariff period shall be lower of the heat rate norms arrived at by above methodology and the norms for the existing units.

(h) In case of lignite fired stations, ceiling design heat rates shall be up graded using factor for moisture content.

(i) In respect of units where the boiler feed pumps are electrically operated, the design heat rate shall be 40 kCal/kWh lower than the design heat rate specified above with turbine driven BFP.

(j) As regards gas/liquid fuel based stations are concerned, margin specified by CEA of 5% of design heat rate for gas based stations and 2% above it for liquid fuel firing (7.1% of design heat rate) already provide for sufficient operational





flexibility.

29.5 Accordingly following operational norms are specified in clause (ii) of Regulation 26 of these regulations for the thermal generating stations:

**“(ii) Gross Station Heat Rate**

**A. Existing Thermal Generating Station**

(a) Existing Coal-based thermal generating unit(s), other than those covered under clauses (b) and (c) below

<b>200/210/250 MW Sets</b>	<b>500 MW Sets (Sub-critical)</b>
<b>2500 KCal/kWh</b>	<b>2425 kCal/kWh</b>

**Note 1**

In respect of 500 MW and above units where the boiler feed pumps are electrically operated, the gross station heat rate shall be 40 kCal/kWh lower than the gross station heat rate specified above.

**Note 2**

For the generating stations having combination of 200/210/250 MW sets and 500 MW and above sets, the normative gross station heat rate shall be the weighted average gross station heat rate.

(b) Thermal generating stations of NTPC Ltd.:

<b>Badarpur TPS</b>	<b>2825 kCal/kWh</b>
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Talcher TPS	2950 kCal/kWh
Tanda TPS	2825 kCal/kWh

- (c) Thermal generating stations of Damodar Valley Corporation (DVC):

Bokaro TPS	2700kCal/kWh
Chandrapura TPS	3100 kCal/kWh
Durgapur TPS	2820 kCal/kWh

- (d) Lignite-based thermal generating stations

(1) For lignite-based thermal generating stations, except for TPS-I and TPS-II (Stage I & II) of Neyveli Lignite Corporation Ltd, the gross station heat rates specified under sub-clause (a) above for coal-based thermal generating stations shall be applied with correction, using multiplying factors as given below:

- (i) For lignite having 50% moisture: 1.10
- (ii) For lignite having 40% moisture: 1.07
- (iii) For lignite having 30% moisture: 1.04
- (iv) For other values of moisture content, multiplying factor shall be pro-rated for moisture content between 30-40 and 40-50 depending upon the rated values of multiplying factor for the respective range given under sub-clauses (i) to (iii) above.

- (2) TPS-I and TPS-II (Stage I & II) of Neyveli Lignite Corporation Ltd



TPS-I	4000 kCal/kWh
TPS-II	2900 kCal/kWh

(e) Open Cycle Gas Turbine/Combined Cycle generating stations

(i) Existing generating stations of NTPC Ltd and NEEPCO

Name of generating station	Combined cycle (kCal/kWh)	Open cycle (kCal/kWh)
Gandhar GPS	2040	2960
Kawas GPS	2075	3010
Anta GPS	2075	3010
Dadri GPS	2075	3010
Auraiya GPS	2100	3045
Faridabad GPS	2000	2900
Kayamkulam GPS	2000	2900
Assam GPS	2400	3440
Agartala GPS		3500

B. New Thermal Generating Station

- (a) Coal based and lignite based thermal generating unit(s)  
 $= 1.065 \times \text{Design Heat Rate of the unit(s)} \text{ (kCal/kWh)}$

Where the Design Heat Rate of a unit means the unit heat rate guaranteed by the supplier at conditions of 100% MCR, zero percent make up, design coal and design cooling water temperature/back pressure.

Provided that the design heat rate shall not exceed the following design heat rates depending upon the pressure and temperature ratings of the units:



<b>Pressure Rating</b> (Kg/cm <sup>2</sup> )	<b>150</b>	<b>170</b>	<b>170</b>	<b>247</b>	<b>247</b>
<b>SHT/RHT (0C)</b>	<b>535/535</b>	<b>537/537</b>	<b>537/565</b>	<b>537/565</b>	<b>565/593</b>
<b>Type of BFP</b>	<b>Electrical Driven</b>	<b>Turbine driven</b>	<b>Turbine driven</b>	<b>Turbine driven</b>	<b>Turbine driven</b>
<b>Max Turbine Cycle Heat rate (kCal/kWh)</b>	<b>1955</b>	<b>1950</b>	<b>1935</b>	<b>1900</b>	<b>1850</b>
<b>Min.Boiler Efficiency</b>					
<b>Sub-Bituminous Indian Coal</b>	<b>0.85</b>	<b>0.85</b>	<b>0.85</b>	<b>0.85</b>	<b>0.85</b>
<b>Bituminous Imported Coal</b>	<b>0.89</b>	<b>0.89</b>	<b>0.89</b>	<b>0.89</b>	<b>0.89</b>
<b>Max Design Unit Heat rate (kCal/kWh)</b>					
<b>Sub-Bituminous Indian Coal</b>	<b>2300</b>	<b>2294</b>	<b>2276</b>	<b>2235</b>	<b>2176</b>
<b>Bituminous Imported Coal</b>	<b>2197</b>	<b>2191</b>	<b>2174</b>	<b>2135</b>	<b>2079</b>

Provided further that in case pressure and temperature parameters are different from above ratings, the ceiling design heat rate of the nearest class shall be taken:

Provided also that where unit heat rate has not been guaranteed but turbine cycle heat rate and boiler efficiency are guaranteed separately by the same supplier or different suppliers, the unit design heat rate shall be arrived at by using guaranteed turbine cycle heat rate and boiler efficiency.

Provided also that if one or more units achieve COD prior to 1.4.2009 then the heat rate norm for those units as well as units achieving COD on or after 1.4.2009 for



the tariff period shall be lower of the heat rate norms arrived at by above methodology and the norms as per the regulation 29 (ii) A (a).

Provided also that in case of lignite fired stations, ceiling design heat rates shall be up graded using factor for moisture content given in sub clause (1) of clause (ii) A(d) of this regulation.

Note: In respect of units where the boiler feed pumps are electrically operated, the design heat rate shall be 40 kCal/kWh lower than the design heat rate specified above with turbine driven BFP.

(b) Gas / Liquid based thermal generating unit(s)/ block(s)

= 1.05 X Design Heat Rate of the unit/block for Natural Gas and RLNG (kCal/kWh)

= 1.071 X Design Heat Rate of the unit/block for Liquid Fuel (kCal/kWh)

Where the Design Heat Rate of a unit shall mean the guaranteed heat rate for a unit at 100% MCR and at site ambient conditions; and the Design Heat Rate of a block shall mean the guaranteed heat rate for a block at 100% MCR, site ambient conditions, zero percent make up, design cooling water temperature/back pressure."

### 30. Secondary fuel oil consumption {Regulation 26(iii)}

30.1 Specific fuel oil consumption norm was reduced by the Commission from 2.0 ml/kWh to 1.00 ml/kWh for the coal based stations and 1.5 ml/kWh for lignite based stations whether new or existing, having 200MW sets and above in clause (iii) of Regulation 26 of draft Regulations. Relaxed norms were specified for some of the generating stations of NTPC, DVC, NLC and NEEPCO.

30.2 While MPPTCL and UPPCL have urged for reducing the secondary fuel oil

