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आरोग्य, ऊर्जा, शिक्षण आणि पालकत्व
या विषयांतील विशेष प्रयत्न

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8 January 2014

To,
The Secretary,
Central Electricity Regulatory Commission
3rd & 4th Floor, Chanderlok Building,
36 Janpath, New Delhi- 110001

Subject: Prayas submission regarding draft Central Electricity Regulatory Commission (Terms and Conditions of Tariff) Regulations, 2014 for the tariff period from 1.4.2014 to 31.3.2019.

Ref: Public notice dated 6th December, 2013

Dear Sir,

CERC has prepared draft regulations on the Terms and Conditions of Tariff for the period April 1, 2014 to March 31, 2019. On 6th December 2013, it issued a public notice inviting comments, suggestions and objections to the draft regulations. Prayas, Energy Group is pleased to submit comments and suggestions on these regulations and the same are enclosed as Annexure I.

Our comments are focused on three aspects of the regulations: (1) norms for heat rates and the need to improve the performance of coal power plants; (2) the equity base (gross or net) on which return should be calculated; and (3) asymmetric distribution of hydrological risk for hydro-electric power plants.

We request the Commission to take this submission on record and allow us to make further submissions in this matter, if any. We also request the Commission to allow us to present our views during the public hearing in this matter scheduled on 15th and 16th January 2014.

Thanking you

Sincerely

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Annexure I

Prayas submission regarding draft CERC (Terms and Conditions of Tariff) Regulations, 2014 for the tariff period from 1.4.2014 to 31.3.2019

Contents

1. Norms for Heat Rates for Coal Plants

Coal provides about 70 percent of the country's electricity. While it is our most abundant resource, recent problems with inadequate supply indicate that our reserves are limited. Some experts have even indicated that the amount of extractable coal may be much smaller than estimated. Furthermore, there are local, regional and global environmental concerns about the use of coal for power generation. Therefore, coal for power generation must be used as efficiently as possible; generating as much electricity with as little coal as possible. Improving efficiency has an economic benefit too. The heat rate (a measure of efficiency) is the most sensitive parameter in determining the tariff. A one percent improvement in the heat rate of a power plant will reduce the cost of generation by 0.4 percent and reduce coal use by three percent (Chikkatur et.al., 2007).

The Commission recognizes the importance of improving efficiency, and in its draft regulations has tightened the norms for heat rate. However, more needs to be done. The norms are changed once every five years, but given the importance of improving heat rates, there is a need for a mechanism that ensures on-going improvement and is self-reinforcing. We discuss one possible solution in the next sub-section.

We also think that rather than focus on the gross heat rate, it may be better to focus on the net heat rate, where the net heat rate is the amount of electric energy provided to the electric grid for every kcal of coal burnt. It differs from the gross heat rate in that it subtracts the auxiliary power used within the plant. Net heat rate (NHR) is preferable to gross heat rate (GHR) because it obviates the need for a separate norm and incentive mechanism for auxiliary power. It also helps to focus on the characteristic that is ultimately of interest – how much electricity is made available for use by consumers per unit of coal. Furthermore, the PAT scheme of BEE will be using NHR, and as we discuss later, it would be desirable to have coordination and consistency between PAT and the CERC norms.

1.1 Preferred Mechanism for Improving Heat Rates

The preferred scheme has been adapted from the scheme developed by Ananth Chikkatur et. al. and described in their paper in *Energy Policy* (Chikkatur et. al., 2007). We propose that the norm be the median net heat rate (MNHR) for all plants covered under the scheme, segregated by size as done currently by CERC. Further, the data set for estimating the MNHR should include all coal plants of that size in the country including plants owned by state generating companies and private companies, and should not be restricted to plants regulated by CERC. This will enrich the data base and provide a better estimate of performance.

This scheme based on MNHR is expected to improve performance. Those who are below the norm will strive to improve their heat rates to avoid losing money. As they do so, the MNHR will decrease (improve) and even the plants that had heat rates that were better than MNHR will strive to improve their performance to avoid being in the lower half of the population that will lose money. Consequently, we expect that the performance of all coal plants of that size will converge to a higher level – lower MNHR and lower standard deviation.

1.2 Challenges of Implementing the Preferred Approach

We recognize that implementing the preferred approach based on MNHR immediately will be difficult. First, the scheme requires unit-wise heat rates, which are not available. For most stations only gross heat rates are available, and even measurement systems for determining unit-wise heat rates are not available. Installing such systems will take time. The second hurdle is that many of the state generating

plants have very poor performance, and if these state plants are included in the scheme now, the MNHR would increase and thus the performance benchmark would thus be degraded considerably.

1.3 Interim Period

Given these difficulties in implementing the preferred approach, we propose that there be an interim period which can be used to prepare for the preferred approach. The most significant preparatory step is the installation of equipment and systems to obtain unit-wise data particularly for net heat rates. CPRI carried out a study for Maharashtra State Power Generation Company Ltd (MSPGCL) on the achievable performance at MSPGCL's plants and suggestions for improvement. Please see the text box on the next page for highlights of the report.

The CPRI study highlights two important issues which are very relevant to the discussion here on the tariff framework for 2014-19:

1. Presently, there are no systems to accurately measure unit level coal consumption, which is essential for calculating specific coal consumption and which effectively determines the variable cost of generation.
2. It is possible to install systems to effectively monitor and track coal supply from its source right up to unit level.

Thus, as the study points out, such systems can be put in place even for existing units. This may entail some capital expenditure and needs proper planning and coordination in terms of scheduling such R&M measures, but it is eminently possible.

We suggest that CERC review the study for applicability to generating plants under its jurisdiction. The information on best practices for improving performance in Volume III of the report should be disseminated to all plants, and plants should be encouraged to follow these best practices.

Box. Highlights of CPRI Study on Improving Coal Plant Performance

In 2008-09 MERC commissioned CPRI to undertake study to assess the level of achievable technical performance parameters for all stations of MSPGCL except the newly installed 250 MW units. One of the main objectives of the study was to identify specific measures for improving heat rates. After inspection, CPRI observed that none of the generating stations had accurate and/or reliable systems for monitoring unit level coal consumption. The report observes that in the absence of such measurement at unit level, it is not possible to accurately estimate specific fuel consumption, which is the basis for heat consumption at unit level. More importantly, there were issues pertaining to transit loss, coal quality and quantity. However, there was no data to precisely identify problem areas. In light of these findings, CPRI made various recommendations to both measure and quantify coal related issues and to improve plant performance. The recommendations were grouped into three categories as follows:

- Immediate term - 12 months
- Medium term - 2-3 years
- Long term - over 3 years

Some of the immediate and medium term measures do not entail any additional capital expenditure whereas, others do. The most important observations of the report are with respect to measuring coal quantity at both station and unit level:

> "*The Wheel impact load detector (WILD) developed under RDSO research initiative can integrate rail signature as well as wagon weighment at speeds in the range of 0-150 km/h in one system.* ***Besides weighing of primary resources, viz., coal, accurately, the transit losses can be reduced by effective tracking of wagons from their source mine to their destination (power house coal yard).*** *It is recommended to go in for fully automatic pitless in-motion weigh bridges (where the entire rake is measured at a speed of 10-150 km/h) (see Annex 4: A4-3). The in-motion weigh bridge should have an electronic digital interface to digital data transfer to a central server/data highway through communication media both at the sending and receiving end. The in-motion bridges would be required for gross weight and for tare weight at both sending and receiving ends. At a central server the data from the motion bridges and be downloaded into a data base from which it can be used to calculate a variety of information automatically without any human requirements of feeding in data.*"

Similarly, under section 2.3 Unit coal measurement (Coal consumption measurement), the report states:

> *"Coal flow into the units needs to be monitored by gravimetric feeders which provide accurate and authentic coal flow measurements, in addition to belt weighers. The differences in the two are to be within 0.5 %. It is recommended to go in for gravimetric feeders in all feeders areas for accurately measuring the coal consumption into each mill. The data from the belt weighers and the gravimetric feeder can be cross verified, calibrated and reconciled.* ***At present there are several types of reliable gravimetric feeders available and any reliable feeder can be installed*** *(see Annex 4: A4-6)."* ***(Emphasis added)***

1.4 Norms for Interim Period

For the interim period, CERC should develop norms based on the design net heat rate (DNHR). Just as the draft regulations propose a norm 4.5 percent above DNHR for new plants, we suggest the same process be applied to existing plants also. For existing plants, CERC should assess whether the 4.5 percent increment above DNHR is appropriate, or if it needs to be modified.

NHR norms are also being set up under PAT. It is important that there be coordination between CERC and BEE on this issue. In any case, the norm for tariffs applicable to a plant should be the more stringent of the DNHR norm and the PAT norm. This is because the capital expenditure for meeting PAT targets will be included in the tariff being charged to consumers, and therefore, consumers should also benefit from the lower heat rate that results.

2. Use of Net Equity Instead of Gross Equity to Calculate Return

Current and the new draft CERC regulations allow repayment of loan in the first twelve years and deem the annual repayments equivalent to the annual depreciation charges. Thus at the end of twelve years, the net assets consist of equity only, and they equal 30 percent of the original investment assuming a debt/equity ratio of 70/30. From the 13th year onwards, the draft regulations say that the return on equity will be calculated on the original value of equity which is 30 percent of the original investment. It is not clear what happens if the plant continues to run after the end of the book life. Book life is only 25 years for coal plants and many coal plants will run for a much longer period. If the generator continues to collect a return on the entire equity he invested at the beginning, he will make huge profits at the expense of consumers.

2.1 Prayas Recommendation

Return should be given only on net equity. For the first twelve years, depreciation should match loan repayments. At the end of the 12th year, when the loan is completely paid off, only equity will remain. For the remaining life of the plant (another 13 years for a coal plant), straight line depreciation of the equity can be used and annual return should be calculated on the remaining (net) equity in that year. Use of net equity to calculate the return is the conceptually correct approach.

- Returns are of two types: return "of," and return "on" the investment. Return "of" the investment is covered by depreciation. (Depreciation is a charge that consumers pay. Total depreciation at the end of the life of the plant is equal to the initial investment.) Return "on" the investment at any time should be calculated on the remaining investment in the plant.
- Depreciation accounting and calculation of return should be consistent. If the asset base on which return is calculated is higher than the net assets (initial investment less accrued depreciation), then the generator gains at the expense of consumers. GFA, as proposed in the draft regulations, forces consumers to pay a return on an investment already charged to operating costs as depreciation charges, effectively charging consumers twice.
- Using GFA is equivalent to the case where someone takes a loan from a bank, makes regular payments to return the principal, yet is required to pay interest on the total initial amount of the loan until the end of the period of the loan. Such an arrangement would be patently unfair and similarly the use of GFA is unfair to consumers.

- GFA will result in giving the generator an equivalent return of about 17.25% instead of 15.5% as in the draft regulations. Because consumers will also have to pay for the additional taxes on the higher return, their burden will be even higher.

2.2 Reasons Given in Support of GFA

One of the reasons given by the Commission for following the gross equity approach is that returns will be lower under the net equity approach and investors would be less interested in investing in this sector. It also said that reducing returns at this stage would be particularly harmful because the sector is facing various challenges: fuel availability, availability of land and water, etc. However, giving the investors additional returns by using gross equity for calculation is conceptually flawed and is a non-transparent way of augmenting the returns to generators.

2.3 APTEL Decision

In its comments, Powergrid referred to an APTEL decision (APTEL 121 of 2005) rejecting the NFA approach. For the tariff period 1992-1997, MoP had used the net equity for determining the tariff for Power Grid. But according to the APTEL decision, this was different from what was done for other Central Power Sector Undertakings (CPSUs). In 1998, while setting tariffs for the period 1997-2002, MoP stated that gross equity should be used. APTEL's support for the use of gross equity is based on two points: (1) Uniformity of rules to all. The decision says that this method of tariff determination was applied uniquely to PGCIL; and (2) A MoP note in 1998 that supports GFA for calculating the return.

The APTEL decision does not go into the merits of using either the gross or net equity for determining the return on equity. In fact, it finds nothing wrong with the transfer of assets to PGCIL on the basis of net book value.[1] In this proceeding, the Commission can examine in detail the issue of whether gross or net equity should be used for tariff determination, and take a decision on the merits of the arguments.

3. Asymmetric Distribution of Hydrological Risk for Hydro-Electric Plants

According to the draft regulations, the annual fixed cost of a hydro plant will be recovered in two parts. Fifty percent will be recovered through at capacity charge and the other fifty percent through an energy charge. The energy charge will be applicable to all the energy sold to beneficiaries excluding free energy. The energy charge rate (ECR) in Rs/kWh is to be calculated according to the following formula, subject to conditions which we discuss next:

ECR = AFC x 0.5 x 10 /(DE x (100 - AUX) x (100 – FEHS))

Where :
DE = Design Energy for the power plant in MWh, and is equal to the amount of energy that can be generated in a 90 percent dependable year with 95 percent of the installed capacity of the hydro generating station.

FEHS = Free energy for the home state in percent.

[1] APTEL uses the term "book value" in its decision. Generally book value refers to the original cost of the asset less accumulated depreciation, same as net book value. In addition, from its ruling it is clear it was referring to net book value.

The energy charge rate is calculated so that the generator fully recovers his annual costs if the energy produced is at least equal to the design energy in that year. In any year, if the actual energy produced is less than the design energy for reasons beyond the control of the company, then per the draft regulations, the generating company is made whole in the subsequent year or years by reducing the denominator in equation above. Effectively, the ECR in subsequent year(s) is increased to ensure that the revenue from the energy charge is at least as much as the design energy would give you. For the first ten years of operation, this "correction" is done in the next year. For years after the tenth year of operation, it is done with a gap of one year to allow for the possibility of energy generation in the year following a shortage to compensate, to some extent, the energy shortage and associated revenue shortfall.

The current tariff regime results in an asymmetric division of risks between the hydro-power producers and the buyers. As we have seen above, the company is compensated if the actual energy produced is less than the design energy. However, for the years when energy produced is greater than the design energy, the generating company keeps the additional revenue. Effectively, the entire down-side of hydrological risk is borne by the consumers, while the up-side benefits are kept by the producer. This is not a fair policy. We suggest that developers should bear the risk of generation that is less than the design energy. For a properly designed system, developers would incur losses only in 10% of the years, whereas in 90% of the years they would get an incentive.

The skewed distribution of risks and rewards also results in the lack of an economic incentive for using 'realistic' hydrological data or 'optimum' designs for dams and hydropower plants. Several dams are delivering electricity benefits much lower than the estimate, which indicates there is a problem. Tables 1 and 2 show the extent of under-performance relative to the design energy. Table 1 shows that only 11 percent of the hydro projects meet or exceed the design energy. Table 2 shows that more than 50 percent hydro projects have a 90 percent dependable energy production that is not even half of the projected level.

Table 1. Share of Under-Performing Hydro Projects

	No. of projects	Share of total (percent)
Total Number of Projects	246	
Number Projects Analyzed	215	
Number Projects Not Analyzed*	31	
Actual 90% energy greater than Design Energy	24	11%
Actual 90% energy less than Design Energy	191	89%

* Projects which were not analyzed because of non-availability of data or misleading data

Source: Unpublished Analysis by South Asia Network on Dams, Rivers and People (SANDRP)

Table 2. Level of Under-Performance of Hydro Projects with 90% Point Less Than DE

Level of Under Performance Actual 90% Energy/Design Energy (percent)	Number of Projects	Number of Projects	Share of Total (percent)
0-9	18	119	55%
10-19	16		
20-29	36		
30-39	25		
40-49	24		
50-59	24	72	33%
60-69	13		
70-79	9		
80-89	15		
90-99	11		

Note: While this table deals only with those projects where the 90 percent point is below the design energy, the share of total in the last column is the share of all 215 projects that were analysed.
Source: Unpublished Analysis by South Asia Network on Dams, Rivers and People (SANDRP)

The under-performance by hydro projects is an indicator of the extent of over-design of projects. Such over-design leads to a waste of resources. First, costs of hydro energy increase, burdening consumers with higher tariffs than necessary. Even more worrisome is the increased environmental and social damage due to larger than necessary tunnels, excessive forest clearance and land acquisition that accompany such over-design. The fact that much of the new hydro is likely to come up in areas with fragile eco-systems exacerbates the problem.

Removing the asymmetry and providing fair treatment to consumers will give a much-needed incentive for optimum design of dams and avoid wastage of public resources and reduce environmental and social damage. CERC should modify its hydro-tariff regulations to incorporate such a change at the earliest. We recognize that it may be difficult to shift the risk to the generators for existing plants because given the level of over-design, many generators may have large shortfalls in revenue. But it must be done for new hydro plants. If this is not done, there is a grave danger that the over-designed dams and power plants, resulting from optimistic (or unrealistic) assumptions regarding hydrological data will waste large public resources and cause large unnecessary environmental damage. The risk is amplified as the hydrological data in North-East as well as Himalayan region is not sufficiently robust. The Commission may also want to consider a lower threshold for design energy than the 90 percent dependable year as given in the draft regulations.

During the meeting of the Central Advisory Committee (CAC) on June 1st, 2007, the Commission had discussed this issue and had said in the background note that it would set this right by passing on part of the hydrological risk to the generators. However, the amended tariffs did not include any change related to this issue. In the Statement of Objects and Reasons for the Tariff Regulations issued in 2009, the Commission referred to comments by generating companies that passing hydrological risk to generators would affect hydro development, particularly if any risk of revenue shortfall could occur in the first ten years of operation. The Commission felt that hydro capacity additions were important and therefore decided not to pass on any hydrological risk to the generators.

As we have shown here, the risk to the generators would be minimal given that design energy is based on a 90 percent dependable year. On the other hand, the removal of this asymmetry in risks will result in the promotion of efficiency, economy and equity in the sector, and therefore, we urge the Commission to include provisions in the tariff regulations to balance the risks that are borne by consumers and generators.

4. Conclusions

There is considerable dysfunction in the power sector such as problems in coal quality and delivery, and grossly inaccurate estimates of energy from hydro projects. Because *prima facie* some of these problems are seen as uncontrollable by the generators and other players, regulations have been designed to soften the impact of some of these factors on the generators. Unfortunately, in those cases, the consumers end up bearing the entire burden of the dysfunction. However, the environment in the sector is changing, and generators can ensure somewhat more accountability from fuel suppliers and providers of critical data, for example on hydrological flows. The CCI order regarding supply of coal by CIL to Mahagenco is one example of measures being taken to make players in the sector accountable. This should help generators get a better and more timely supply of coal.

Our recommendation on norms for heat rates for coal plants builds on this push for greater accountability, and incentivizes better monitoring and control by generators on the operations of their plants. The study by CPRI for MSPGCL should provide useful guidance. Implementation of our proposal for heat rates should bring about a rapid move to higher levels of efficiency for coal plants which is critical for ensuring low costs, security of supply and reduced environmental impacts.
Similarly, our recommendation for an appropriate sharing of risks for hydro plants will ensure greater accountability for hydro generators for the data they use and the performance of their plants. This is essential to lower costs of hydro power and reduce unnecessary waste of resources and damage to the environment.

In addition, we recommend that the Commission calculate return on the net equity and not gross equity. This is the conceptually correct way of calculating return. Using gross equity as the base for calculation is a non-transparent way of augmenting the return received by generators. The Commission should also clarify what happens to the ownership of the plant at the end of its book life.

5. References

(Chikkatur, et.al. 2007). Ananth P. Chikkatur, Ambuj D. Sagar, Nikit Abhyankar; and N. Sreekumar, 'Tariff-based incentives for improving coal-power-plant efficiencies in India,' *Energy Policy* (2007)doi:10.1016/j.enpol.2007.01.006.

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