

**BEFORE THE CENTRAL ELECTRICITY REGULATORY COMMISSION  
NEW DELHI**

**Review Petition No.17/2000**

**Coram**

1. Shri S.L. Rao, Chairman
2. Shri D.P. Sinha, Member
3. Shri G.S. Rajamani, Member
4. Shri A.R. Ramanathan, Member

**In the matter of**

Review of Order dated 4<sup>th</sup> January passed by the Commission on ABT

**And in the matter of**

National Hydroelectric Power Corporation Ltd.

Petitioner

**VS**

Union of India & others

Respondent

The following were present:

- |     |   |            |
|-----|---|------------|
| 1.  | Mr. Christian Guillaud, Engineer, SNC-Lavalin | Petitioner |
| 2.  | Shri V.K. Kanjlia, ED (O&M & Comm), NHPC      | -do-       |
| 3.  | Shri R.K. Sharma, Dir (Tech.), NHPC           | -do-       |
| 4.  | Shri S.K. Agarwal, CE (T), NHPC               | -do-       |
| 5.  | Shri Bhanu Bhushan, Dir (Opn.), Powergrid     | Respondent |
| 6.  | Shri K.K. Das, GM (SO), Powergrid             | -do-       |
| 7.  | Shri H.S. Bedi, Dy. CE, ISB, PSEB             | -do-       |
| 8.  | Shri V.K. Gupta, SB (ISB), RVPN               | -do-       |
| 9.  | Mr.B.Chahar, Advocate, Sikkim Govt.           | -do-       |
| 10. | Ms. Bharti, Advocate, Sikkim Govt.            | -do-       |

## **ORDER**

(Date of Hearing 5<sup>th</sup> October, 2000)

As a part of reform process in power sector, the Government of India had considered introduction of Availability Based Tariff (ABT) structure. However, before the Government could notify ABT, Section 43 A(2) of the Electricity (Supply) Act 1948 was omitted wef 15<sup>th</sup> May, 1999. Therefore, consequent to the omission of Section 43A(2) of the Electricity (Supply) Act, 1948, the matter was referred to the Commission for finalisation after hearing. The Commission considered introduction of ABT in Petition 2/99, which was finally disposed of vide the Commission's Order dated 4<sup>th</sup> January, 2000. The Commission had directed implementation of ABT wef 1<sup>st</sup> April, 2000 in Southern Region and from subsequent dates in other regions. The tariff schedule for thermal stations was annexed to the Order dated 4<sup>th</sup> January, 2000. As regards schedule for hydro stations, the Commission directed that pending further technical discussions the schedule would be released subsequently.

2. While finalisation of schedule for hydro stations was under consideration of the Commission, National Hydroelectric Power Corporation Ltd. (NHPC) filed a review petition (No.17/2000) seeking review of certain aspects of the order dated 4<sup>th</sup> January, 2000 in relation to their applicability to hydro stations. The main issues raised by NHPC are in regard to method of calculating the rate of primary energy; reduction in rate of primary energy and consequential reduction in the rate of secondary energy; application of unscheduled inter change mechanism to hydro stations; PLF for hydro stations; system of payment of incentive and sent out capability of hydro station. As we have noticed earlier the schedule for hydro stations was yet to be finalised. The Commission was, therefore, of the opinion that once the schedule for hydro stations was issued, the issue raised by NHPC in its review petition may get addressed. We, therefore, admitted, the review petition. However, hearing of the review petition was held in abeyance so

that it could be heard along with the proceedings to be held for finalisation of the schedule for hydro stations.

3. The Commission assigned the consultancy for preparation of hydro schedule to M/s. SNC-Lavalin of Canada. The draft schedule submitted by the Consultants to the Commission was circulated to NHPC and other utilities and beneficiaries. The review petition filed by NHPC and the Draft Hydro Schedule submitted by the Consultants were heard together.

4. The response on the Draft Hydro Schedule was filed by NHPC, UPPCL, RVPNL, DVC and PGCIL. The representative of UPPCL and DVC did not participate in the oral hearing, while the representatives of PSEB and CEA took part in the proceedings though no response was filed by them. NHPC in its written submission has pointed out that the method of calculating primary energy as given in ABT Order of the Commission is based on the recommendations of the Committee of NTF on hydro tariff on which no objections were invited by the Commission from the concerned parties. It further stated that the rate of primary energy was taken as 90% of least variable cost of the thermal station. NHPC has objected to consideration of 90% of the least variable cost. According to NHPC, the rate of primary energy could either be equivalent to variable charge of thermal station which has been asked to back down or it could be 100% of the least variable cost. It has pleaded that the energy rate of hydro station should not be fixed lower than the existing rates. NHPC has further pleaded that for old stations, 50% be taken as capacity charge and balance 50% as the energy charge. In regard to unscheduled interchange mechanism, NHPC pointed out that the Commission has ordered that in case of increase in inflow of water, the scheduled generation shall be deemed to have been revised thereby meaning that in case of higher inflow of water the UI mechanism will be zero. In other words, it would imply that the UI mechanism will not be applicable on hydro stations during high inflow period, though it will apply during low inflow period which is to the disadvantage of NHPC. It contended that the UI mechanism should apply uniformly. On the question of checking of spillage of water, NHPC

argued that the operators of the plant could be directed to make daily record of gate opening to know about the extent of spillage, if it occurs. According to NHPC the concept of PLF is alien to hydro stations. On the questions of incentive payment and sent out capability, NHPC is satisfied that these have been taken care of in the draft schedule.

5. PGCIL in its written submission pleaded that the concept of "maximum available capacity" as a component of Capacity Index as per the draft hydro schedule be replaced by the concept of "rated output capacity". It has also argued in favour of omission of factor of  $(1 - r)$  used as denominator for computation of primary energy rate. It has further stated that the spillage of water caused by the system constraints should not be to the beneficiaries account since the generator is being allowed an easily achievable capacity index target of 85% and a provision regarding extra income through secondary energy revenue in 9 out of 10 years has already been made. According to PGCIL, in the case of old plants when all the charges have been paid off, the incentive payment would work out to be negative and in that case the capacity charge would be set to zero, which will not provide any incentive to the generator to maintain its machines.

6. PSEB in its oral submissions, has submitted that incentive should be calculated based on the actual PLF and not on the basis of capacity index. It has argued that the charges equivalent to 90% of the least variable cost of the thermal power stations in a region should be kept as the upper limit of primary energy charges of hydro stations. PSEB at hearing also argued in favour of deletion of factor  $(1 - r)$  for the purpose of calculating energy charges, particularly the secondary energy charge, as the secondary energy is produced at a zero cost. In any case PSEB argued in favour of limiting the secondary energy rate to 5 paise per unit for the existing stations. PSEB also pleaded that in a situation when actual energy generation falls short of design energy, the implementation schedule may specify that this facility will no longer be available

to old hydro stations which have completed 7 years of commercial operation. DVC in its response argued in favour of limiting the unscheduled interchange charges, restricting RoE to 12% and for fixing normative target availability for hydro stations at 90%. It has also submitted that the charges on account of loss of generation for the reasons attributable to a party should be borne by that party alone. It has also suggested certain changes to the formula for calculation of incentive payment. RVPNL has generally agreed with the submissions made on behalf of PSEB.

7. UPPCL has argued that incentive earned in a year should be paid in the next year since the provision for payment of incentive on monthly basis included in the draft schedule amounts to advance payment of incentive. It has also stated that cost of deemed generation on account of transmission constraints be borne by the transmission utility and the amount paid to the generator on account of deemed generation should be deducted from the Annual Fixed Charges in the formula for capacity charge. It has pleaded for incorporation of a provision for disincentive in case generator fails to achieve 100% capacity index. UPPCL has also argued against equating secondary energy charges with cost of primary energy and has pleaded that the secondary energy rate should be restricted to 10% of unit cost of primary energy. It has also argued in favour of replacement of "normative availability" by "0.95" which is the availability of the plant at which design energy is set to be generated as per techno-economic clearance given by CEA.

8. CEA in its oral submissions has pointed out that by adjusting for 12% free energy for the home state i.e. by dividing the primary energy rate for hydro plant by factor  $(1-r)$  hydro is no longer the cheapest source of power. According to the CEA, the inclusion of system electrical conditions in the scheduling will complicate the scheduling procedure. CEA has also argued that an appropriate methodology for monitoring the spillage from hydro plants should be introduced.

9. We have carefully considered the contentions raised on behalf of the parties in their written submissions as also the submissions made at the hearing. On the objection raised by NHPC regarding denial of reasonable opportunity for filing objections to the recommendations of Committee on Hydro Tariff on the questions of method of calculating rate of primary energy, we find that NHPC was represented on the said Committee. As a member of the Committee, NHPC was fully aware of the issues discussed and its recommendations. As such, NHPC cannot be permitted to raise this issue at this stage.

10. On the question of calculating availability, we have two methods before us. One is the conventional method and the other one is based on Capacity Index as incorporated in the draft hydro schedule prepared by the consultants. NHPC has favoured the concept of Capacity Index suggested by the consultants (SNC-Lavalin), since it takes care of most of the issues raised by NHPC in its review petition. **We are satisfied that the concept of calculating capacity index marks an improvement over the conventional method and, therefore, decide in its favour.**

11. During the hearing on review petition we had asked NHPC to devise a system by which the inflows likely to be available within the next 24 hours and particularly during the next 3-4 hours should be forecast. We had desired that NHPC should intimate to the Commission about the estimated time frame for the implementation of such scheme. NHPC has submitted in writing that they propose to establish the inflow measurement units at the upstream of the storage structure by providing inflow measurement equipment, communication wireless equipment and the staff to operate the same. For establishment of these units, required action will be taken in a phased manner. **As an interim measure, NHPC will also explore the possibility of getting the inflow data from other sources like Central Water Commission (CWC), local state authorities, etc. who may be carrying out such measurements upstream of various NHPC projects in their normal performance of duties. Meanwhile, NHPC is**

**directed to prepare a comprehensive scheme, with associated costs involved for forecasting/ measurement of inflows for all the projects and submit the same for the approval of Commission. The Central Water Commission, Ministry of Water Resources shall provide to NHPC the data of inflows of its projects to help in forecasting of inflows for maximising generation at its power stations.**

12. The consultants in their recommendations have stated that the declared capacity/ maximum available capacity for calculation of Capacity Index should include prevailing electrical conditions of the system, including voltage, frequency and power factor. However, proper scheme/ methodology for declaration of declared capacity as well as the maximum available capacity duly taking into account the above parameters is not available. In the absence of an accepted scheme required to carry out the corrections under the desired conditions of the system as mentioned above, these may give rise to practical difficulties rather than improving the existing arrangement. **We are , therefore, of the view that the capacity index of the hydro plant shall exclude the provisions of system electrical conditions.**

13. Incentives for hydro stations are linked with capacity index, capacity charge and primary energy charge. In the Commission's Order dated 4<sup>th</sup> January, 2000 the rate for primary energy is stated to be 90% of the least variable cost of Central Sector thermal plants of the concerned region. It is likely that with the inflation in the economy, the variable charge of thermal plants may increase from time to time thereby causing increase in primary energy charge. This will consequently result in reduction in the incentives with no fault on the part of generator. To remove this anomaly, **it is directed that the primary energy rate of the hydro plants for the first year of the tariff period shall be kept constant throughout the entire tariff period for incentive purposes based on capacity index only. However, for calculation of primary energy charge, 90% of the least variable cost of Central Sector thermal plants of the**

**concerned region from year to year shall be adopted as already ordered by the Commission in its Order dated 4.1.2000.**

14. We agree with the submissions made by some of the beneficiaries that concept of deemed generation should not be allowed. We consider that in case of failure of hydrology, if the generator is able to maintain availability of its machines and utilises all the available water for production of electricity, it may be able to achieve the normative capacity index and recover full capacity charges. **As such, the concept of deemed generation for the purpose of capacity charges need not be adopted any more because of protection available to the generator under the new concept of capacity index. However, in case of reduced generation due to the reasons beyond the control of generating company and non-availability of board's transmission lines or on receipt of backing down instructions from the concerned Regional Load Despatch Centre and if it results in spillage of water, the energy charges on account of such spillage shall also be payable to the generator. Apportionment of energy charges for such spillage among the beneficiaries shall be in proportion to their shares in saleable capacity of the station. We further direct that such energy charges shall not be admissible if the energy generation during the year is equal to or more than design energy.**

15. CEA, PGCIL and PSEB have raised objection on dividing the primary energy rate and secondary energy rate with factor (1-r) in computation of primary and secondary energy charge in para 8 of the schedule. To facilitate merit order despatch for hydro stations, we had decided to fix the rate for primary energy at 90% of the lowest variable charge of the thermal station of the concerned region in our ABT order dated 4.1.2000. **The factor (1-r) shall however be used with both primary as well as secondary energy rates( to take into account the free power delivered to the home state) both for primary & secondary energy charges.**

16. **The Commission has decided to implement the concept of Capacity Index in place of 'Availability'. The basic criteria for Capacity index are :**

- a) **Water spillage must be minimized**
- b) **As far as possible, the peak capacity of each plant must be available when most required by the system.**

17. Availability of a hydro station for any period shall be based on the Capacity Index (CI) declared for the day. CI is defined as follows :

$$\text{Capacity Index} = \frac{\text{Declared Capacity (MW)}}{\text{Maximum Available Capacity (MW)}} \times 100$$

Where,

Declared capacity (MW) is the capacity to be available from the plant over the peaking hours of the next day, as declared by the generator. The peaking hours shall be not less than 3 hours within a 24 hour period, and

Maximum available capacity (MW) is the maximum capacity the plant could generate with all units running, under the prevailing conditions of water levels, flows and with 100% gate openings.

The annual capacity index is the average of the daily capacity indices over a full year.

18. The various aspects of capacity index during monsoon and dry season are:

- i) During the monsoon, full capacity of each type of station is required for the full day.
- ii) For the dry season, run-of- river plant (without pondage) is required to the extent that no water is spilled. This means that provided turbine/ generators are available for all the water in the river, the plant is considered 100% available. For the plants that have

storage (pondage type), since these may be despatched at any time of the day, all machines are required to be available. However, due to limited storage available, they may be required to run for only 3 hours per day (peak period). In the case of large dams, where water levels in the reservoir vary during the year affecting storage capacity, the current storage capacity of the dam is to be considered.

19. To summarize, during the monsoon period all machines are required to be available 24 hours per day for all types of plants. Apart from the run-of –river plant, during the dry season all machines are required to provide maximum capacity for at least 3 hours per day.

20. The concept of Capacity Index is further explained with the help of following table:

Evaluation of CI for a plant with reservoir/ pond  
Typical case of Chamera (3x180 MW)  
(For illustration purposes only)

| Reservoir Level (M) | Units Available | Maximum Capacity(MW) | Declared Capacity(MW) | Capacity Index |
|---------------------|-----------------|----------------------|-----------------------|----------------|
| 760                 | 3               | 540                  | 540                   | 100            |
| 760                 | 2               | 540                  | 360                   | 67             |
| 756                 | 3               | 524                  | 524                   | 100            |
| 752                 | 3               | 509                  | 509                   | 100            |
| 750                 | 3               | 501                  | 501                   | 100            |
| 747                 | 3               | 490                  | 490                   | 100            |
| 747                 | 1               | 490                  | 163                   | 33             |

21. It may be seen from the above table that :

- (a) When all the three generating units are available to utilize water available corresponding to full reservoir level (760m), the station would achieve 100% Capacity Index.

- (b) When two out of total three units are available, corresponding to the same reservoir level of 760 m, the declared capacity will be less than in the previous case, thereby causing reduction in the capacity index.
- (c) When all the generating units are available but the water in the reservoir is less than that required to run all the machines (corresponding to reservoir level of 747 M), 100% capacity index can be claimed by the generator.

22. **In order to earn the incentive, a generator has to achieve higher capacity index above the normative value of 85%. This would require extra efforts on the part of the generator to maintain the availability of its machines.**

23. In the light of the foregoing discussion, we have finalised the Schedule for Hydro Stations of NHPC in Northern and Eastern Regions which is annexed to this order. **The schedule for Hydro Stations in NE Region shall be issued separately.**

24. **The Hydro Schedule annexed to this order shall form part of the ABT order dated 4-1-2000.**

#### **Modifications to ABT Order**

25. As a consequence of finalisation of the schedule, certain amendments to original ABT Order dated 4.1.2000 have become necessary. These are as follows:

- i) In Para 5.12.5 (i), following shall be added at the end :

The same shall be applicable in case of less inflows in dry season as well.

- ii) Para 5.12.5 (v) pertaining to the method of reckoning the incentive stands deleted.
- iii) The word 'PLF' wherever appearing in the context of hydro stations shall be construed as "Capacity Index".

**26. We direct NHPC to prepare a comprehensive scheme, with associated costs involved, etc, for forecasting/ measurement of inflows for all the projects and submit the same for the approval of Commission. Central Water Commission, Ministry of Water Resources, shall provide to the NHPC the available inflows data of its projects to help them in the forecasting of inflows for maximising generation at their power stations. The concerned RLDCs shall provide the necessary certification of deemed generation in the light of directions contained in para 14 of this order.**

**27. The schedule for hydro stations shall take effect from 1.4.2001.**

28. With the above order, Review Petition No.17/2000 stands disposed of.

29. A copy of this order shall be sent to Ministry of Water Resources and Central Water Commission for their necessary action.

|   |   |                                      |                                      |
|---|---|--------------------------------------|--------------------------------------|
| <b>Sd/-</b>                               | <b>Sd/-</b>                             | <b>Sd/-</b>                          | <b>Sd/-</b>                          |
| <b>(A.R. Ramanathan)</b><br><b>Member</b> | <b>(G.S. Rajamani)</b><br><b>Member</b> | <b>(D.P. Sinha)</b><br><b>Member</b> | <b>(S.L. Rao)</b><br><b>Chairman</b> |

New Delhi dated 8<sup>th</sup> December ,2000.