

**Before**

**UTTARAKHAND ELECTRICITY REGULATORY COMMISSION**

**Petition No. 27 of 2014**

**In the matter of:**

Petition for prior approval of "Capital Investment for Renovation & Modernization" of MB-I (3x30 MW) HEP of UJVN Ltd.

**And**

**In the matter of:**

UJVN Ltd., Dehradun

...Petitioner

**Coram**

<b>Shri Subhash Kumar</b>	<b>Chairman</b>
<b>Shri C.S. Sharma</b>	<b>Member</b>
<b>Shri K.P. Singh</b>	<b>Member</b>

**Date of Order: 30<sup>th</sup> July, 2015**

**ORDER**

This Order relates to the Petition filed by UJVN Ltd. (hereinafter referred to as "UJVN Ltd." or "the Petitioner") under Regulation 25 of UERC (Terms and Conditions for Determination of Tariff) Regulation, 2011 for seeking approval regarding Capital Investment for Renovation & Modernization (R&M) of 3 x 30 MW, MB-I HEP.

2. UJVN Ltd. vide letter No. 160/D(P)/UJVNL/U-6 dated 22.03.2014 filed an Application under Regulation 25 of UERC (Terms and Conditions for Determination of Tariff) Regulation, 2011 for seeking prior approval in the matter of Capital Investment for Renovation & Modernization (R&M) of 3 x 30 MW, MB-I HEP.
3. The works proposed under R&M of MB-I HEP, broadly categorized in Civil & Hydro-mechanical works, Power Plant & Accessories (E&M) alongwith other

various heads viz. office infrastructure, maintenance, establishment, vehicles, furniture and T&P etc. The estimated cost submitted for the proposed works is as follows:

**Table 1: Estimated cost for R&M works proposed by the Petitioner**

Sl. No.	Item	Cost (Lac)
<b>A.</b>	<b>Works</b>	
1.	Preliminary	65.00
2.	Civil & Hydro-mechanical Works	7713.66
3.	Maintenance@1% of Civil Works	77.14
4.	Office infrastructure, Furniture & Vehicles 3 nos.	100.00
5.	Power Plant & Accessories (E&M)	23047.82
	<b>Total A-Works</b>	<b>31003.62</b>
<b>B.</b>	Establishment @4% of Civil Works and E&M (being an RMU project)	1240.14
<b>C.</b>	Ordinary T&P @1% of A-Works	310.04
<b>D.</b>	Losses on stocks @0.25% of Civil Works	18.02
<b>E.</b>	Receipt & Recoveries	(-)92.00
	<b>Total Direct Charges</b>	<b>32479.82</b>
<b>F.</b>	Indirect charges (Audit & Account @1% of A-Works)	310.04
	<b>Grand Total</b>	<b>32789.86</b>
	IDC	5676.39
	<b>Total Cost including IDC</b>	<b>38466.25</b>

Thus, the Petitioner has submitted a proposal of `384.66 Crore (including IDC) for the R&M works of MB-I HEP.

4. The Petitioner has submitted that the project will be financed with debt equity ratio of 70:30 and equity will be provided from budgetary support of GoU while debt to be arranged from the Financial Institution/Banks.
5. The Unit-wise work execution schedule, submitted by the Petitioner is as follows:

**Table 2: Unit-wise work execution schedule proposed by the Petitioner**

Sl. No.	Unit No.	Period in Days
1	Unit I	585
2	Unit II	420
3	Unit III	525

6. The Proposal was examined and following deficiencies were sent to UJVN Ltd. vide letter No. 732 dated 14.07.2014 for submitting the desired information/justification :
  - (1) *...financial tie-up for the proposed works has not been performed. With regard to equity funding, UJVN Ltd. has submitted that the same would be provided by GoU.*

However, UJVN Ltd. has not submitted any document regarding confirmation/assurance of GoU.

- (2) In the economic and sensitivity analysis in Section-7 of the Petition, UJVN Ltd. has assumed rate of interest as 12%, while the financial tie-up is yet to be performed. UJVN Ltd. is required to submit the basis for such assumption.
  - (3) As per Regulation 25 of UERC Tariff Regulation, 2011, UJVN Ltd. has not submitted any document regarding consultation with beneficiaries. UJVN Ltd. is required to submit the desired document.
  - (4) With regard to electromechanical equipments, it has been observed that UJVN Ltd. had been carrying out various activities under special M&R in MB-I HEP for last 30 years. UJVN Ltd. is required to submit the deficiencies being encountered in the special M&R due to which the need of R&M works has been felt.
  - (5) UJVN Ltd. at Section-3 of Appendix-II of Technical Report (page-12) has mentioned that recommendations made by the consultant for the plant and equipments are of indicative nature only. UJVN Ltd. is required to clarify whether the proposed works are suggested/confirmed by any third agency i.e. design experts/manufacturers, etc.
  - (6) UJVN Ltd. has mentioned that the new metallurgy is proposed for under-water parts, which is superior to the present metallurgy. UJVN Ltd. is required to submit the necessary documentary evidences/past experience, etc. in support of the same.
  - (7) UJVN Ltd. is required to submit the Bar/PERT chart for execution of the proposed works.
7. Meanwhile, the Commission decided to hear the matter for admissibility on 13.10.2014. Accordingly, the hearing was held on the scheduled date and the Commission issued an Order dated 14.10.2014, wherein, the Application/Petition was allowed for admission alongwith the following direction:

*“A notice be sent alongwith a copy of the Petition to the sole beneficiary namely UPCL for submitting its comments in the matter. UPCL should submit its comments within two months from the date of the Order.”*

8. The above direction of the Commission was complied with and a letter dated 14.10.2014 alongwith copy of Petition was sent to UPCL for submitting its comments within 2 months from the date of the Order. Thereafter, the beneficiary UPCL submitted its comments vide letter No. 136/CE(Com) dated 15.01.2015 stating that

*“UPCL agrees to the above RM&U work with the condition that it may enhance the useful life of the project further 25 years for providing power at optimum rate.”*

9. Further, on the deficiencies, mentioned in para 6 above, UJVN Ltd. submitted its reply vide letter No. 457/D(P)/UJVNL/U-6 dated 27.08.2014, stating that:

- (1) ...The equity component of proposed capital investment for Renovation & Modernization of Tiloth HEP is proposed to be deployed by GoU as Budgetary support through annual plan as is being done for other projects of UJVNL. Required equity component shall be requisitioned from GoU against the sanctioned annual plan.*
- (2) ... the Interest Rate has been assumed as 12% in the Economic & Sensitivity Analysis for RMU works of Tiloth HEP on the lines of the other DPRs of RMU. ...The present prevalent rates are also around 12%. The financial tie-up with M/s PFC for RMU of Khatima is at an interest rate of 12% whereas the same with M/s REC for construction of Vyasi HEP (2x60 MW) is at an interest rate of 11.75%.*

*Therefore, the rate of interest of 12% seems to be justified*

- (3) ... the Maintenance as well as Special M&R efforts of UJVN Ltd. in Tiloth are restricted to repair and maintenance of runner, bottom ring, top cover, labyrinth (upper & lower), brake pads, shaft seal etc.*

*Accordingly, we have been able to preserve the functionality and reliability of the equipment at a reasonable level but following deficiencies still exist:*

- Bhagirathi River is characterized by extremely high loads of suspended sediments especially during the monsoon season. The hydro power stations of Bhagirathi valley, especially MB-I (Tiloth) HEP and MB-II are severely affected/plagued by high sediment/silt content containing quarts.*
- The underwater parts of the turbines have been subject to substantial damages by silt erosion especially the runners. There are total 10 nos. runners at the power house but the condition has worsened due to frequent repairs. Thus complete replacement is required.*
- Excessive wear & tear and erosion/damages of underwater parts. Deterioration of the underwater parts is a major factor for the inefficient operation of the power plant.*
- Old and obsolete Governors and Excitation system.*
- Defunct automation system of the power house, takes more time to start/stop the units.*
- The instrumentation and control systems are of 1980s based on semi-automatic /manual control of the generating units with the major functions such as unit start-up, synchronising, loading and stopping being performed in manually adjusted steps with a minimum of instrumentation.*
- Old and damaged and non functioning Control & Protection Equipment.*
- Non availability of spare parts of outdated systems and equipment.*

- *Problems in spillway and stop log gates of Maneri Dam including Sill beam.*
- *Deposition of RBM in the pond of Maneri Dam.*
- *Damaged wing wall of Tail race channel, Sirror Bridge at Heena, Switchyard of Tiloth Power House.*
- *Silting of tail race channel during floods- Construction of TRC Gate (Back Regulator) at the confluence point of TRC & Bhagirathi River is proposed.*

*Due to operation of about 30 years, the operating efficiency of the machines has gone down considerably and the condition of their auxiliaries, instruments, protective relays and control equipment has deteriorated. Moreover, the adverse condition of the equipment is leading to unsafe operation, besides frequent breakdowns.*

*The above said deficiencies cannot be rectified during maintenance and special M&R and thus require extensive RM&U of the Units, balance of plan, hydro-mechanical equipment & Civil structures to obtain the maximum output along with life extension of machine & plant.*

- (4) *... RMU of Tiloth HEP was under KfW funded projects and the DPR was prepared by the Consultant, M/s Lahmeyer International (India) Pvt. Ltd., in 2010. The Consultant M/s Lahmeyer International (India) Pvt. Ltd. visited the Maneri Dam and the Tiloth Power Station in the period July/August 2008, to conduct a plant audit in the framework established of the M&U study under consideration.*

*Based on the findings of the plant assessment and in consideration of the surveys, investigations and tests performed by the Consultant M/s Lahmeyer International (India) Pvt. Ltd. (Hydrological/Hydraulic study, Investigation & Test reports and Bathymetric & Topographic survey reports were submitted by the consultant as volume 5,6 & 7 of the original DPR).*

*On the basis of the plant assessment including plant history and tests/reports conducted for the Tiloth Hydroelectric Project, the Consultant M/s Lahmeyer International (India) Pvt. Ltd. had indicated three options to carry out RMU. Final decision on the options indicated in previous experience of RMU of old power stations UJVNL, after extensive discussions, repair/refurbishment of Hydro-Mechanical Works. The Indicative works on the cover page of Section-3 have been elaborated exhaustively with detailing & recommendation of RMU works thereafter.*

- (5) *... in respect of water quality of Bhagirathi River, as discussed above, the Consultant M/s Lahmeyer International (India) Pvt. Ltd. had suggested new metallurgy for underwater parts including metallic coating to be taken during tendering stage. HVOF Coating has been included in the technical specifications and pre-bid has also been held on 21.05.2014. Prospective bidders have not suggested any new metallurgy as such. Stainless steel Ni & Cr as 13% & 4% has been considered with HVOF Coating of underwater parts.*
- (6) *...that benchmarks have been enclosed whereas the bar-chart shall be submitted by the bidders/contractor as per benchmarks.*

10. On examination of the above reply of UJVN Ltd., the Commission observed following anomalies/deficiencies, which were forwarded to UJVN Ltd. vide letter

No. 1873 dated 13.01.2015 for submitting information/clarification:

- “1. Earlier with regard to the equity funding of `115.40 Crore, UJVN Ltd. was asked to submit the document pertaining to assurance/confirmation of GoU, however, the same has not been submitted yet. UJVN Ltd. is required to submit the same.
  2. UJVN Ltd. is required to submit the basis for taking the prices of Khatima HEP as reference prices for estimating the cost and also required to submit the reasons for not preferring the option of budgetary offers from reputed manufacturers/ suppliers of the plants.
  3. UJVN Ltd. has submitted in its reply that the extensive RMU has been initiated due to excessive wear and tear/abrasion of underwater parts, due to quartz particles in river Bhagirathi. UJVN Ltd. is required to justify, how the underwater parts with same metallurgy and proposed HVOF coating would be helpful in substantial reduction in deterioration of the under water parts. The proven results of hard coating of the under water parts under similar conditions, if any, may be produced in support of the above.
  4. UJVN Ltd. has assumed the average energy generation as 499.70 GWh with the assumption of 100% plant availability and no planned outages and shown it as enhancement in power generation, while the historical figure of the maximum power generation is as 403.4 GWh. UJVN Ltd. is required to justify the same, keeping in view of the planned/fixed outages of last 10 years.
  5. Based on the studies carried out in past, UJVN Ltd. should clarify the maximum tunnel discharge envisaged for proposed maximum enhanced capacity and is required to submit the report/results of model study, if any, conducted in past.”
11. In response to the above observations of the Commission, UJVN Ltd. has submitted its reply vide letter No. 65/UJVN/03/D(P)/D-5 dated 12.02.2015, stating that:
1. ... the equity component of proposed capital investment for Renovation & Modernization of Tiloth HEP is proposed to be deployed by Govt. of Uttarakhand through annual plan as is being done for other RMU & Greenfield projects of UJVN ltd. viz, Khatima, Vyasi & Lakhwar Projects. As such no document pertaining to assurance/confirmation of GoU has been issued for the above projects & it is not envisaged to obtain any such document for Tiloth. The required equity component is generally requisitioned from GoU against the sanctioned annual plan but no equity contribution has been taken from GoU in 2014-15 in view of the pending investment approval from the Hon'ble UERC. However, GoU has been requested to include the equity contribution for Tiloth in the annual plan of 2015-16.

2. ... the estimation of cost for RMU of Tiloth was done on the basis of Khatima HEP which was the latest ongoing/awarded RMU project in UJVN Ltd. the budgetary offer could also have been the basis of taking the prices of Khatima HEP but was not specifically sought for Tiloth as the manufacturers are generally reluctant to submit the same due to lot of technical requirement & analysis and the same was experienced while determining the cost of RMU works of Ramganga HEP. Only one firm had responded against the budgetary offer for Ramganga and took time. Therefore, it was more appropriate to consider the prices of Khatima HEP as reference prices for estimating the cost of Tiloth. Moreover, prices on the basis of awarded projects shall be comparatively firm than the prices from the budgetary offer which are based on certain assumptions. The comparison was not carried out with the budgetary offer obtained for Ramganga as the scope of work was different & the operating conditions were also different whereas conditions of erosion were quite similar at Khatima & Tiloth. So, the prices of Khatima HEP were taken as reference prices for estimating the cost to keep it more towards actual.
3. ... Wear & tear/abrasion of underwater parts due to quartz particles is a normal phenomenon. We have not come across any method which guarantees full protection against erosion due to silt/quartz particles but HVOF coating has been applied at various power stations with fair success rate. It is being used at Nathpa Jhakri HEP of SJVNL and HVOF coating on the underwater parts of Unit-1 was carried out once at Tiloth HEP also in the year 2010-11 and the report on the performance of Machine no. 1 with HVOF coating received from General Manager (Ganga Valley) vide letter No. 3878/GM(GV)/A-12 dated 21.09.11 is enclosed herewith at Annexure-I for kind information.

Recently, papers were presented on HVOF coating during the "International Conference on Hydropower for Sustainable Development" which was organized jointly by Government of Uttarakhand & AHEC, IIT Roorkee at Dehradun from 5<sup>th</sup>-7<sup>th</sup> of February, 2015. It was informed by SJVNL officers that they have installed the HVOF coating plant at their power station & the performance has been very good. The manufacturers of hydro turbine also shared their views regarding HVOF coating & it was informed that the life of the machine had increased by applying the coating.

New designed runner (profile) and HVOF coating has been proposed on the underwater parts to reduce the deterioration. Also, due to long run & wear/tear/abrasion, profiles of

water passage, under water parts (water conductor system) viz. runner blades/runner chamber/pivot ring/guide vanes etc. have been damaged badly and their replacement along with coating is likely to give improved performance.

4. ... the annual energy generation of 499.7GWh is the simulated value while considering reduced closure period of around 30 days during monsoon whereas for the base case this value comes out to be 484 GWh for the period 1986-2007 with no unplanned outages and full plant availability except for the closure period during July & August. It has been considered that all the planned outages fall during the closure period. We intend to reduce the planned outages of the machines/power station by carrying out RMU to some extent. Average historical energy is 403.4 GWh for the period 1986-2007 and is not the maximum power generation. The planned outages wef 2005-06 are as follows:

S. No.	Year	Total Planned Outages (hrs)	S. No.	Year	Total Planned Outages (hrs)
1	2005-06	6121	6	2010-11	5506
2	2006-07	6312	7	2011-12	5374
3	2007-08	6552	8	2012-13	3404
4	2008-09	7111	9	2013-14	3048
5	2009-10	5750	10	2014-15	4237

The outage for 45 days during July & August comes to 3240 hours and we have been around those values in 2012-13 & 2013-14 as per above table. Planned outage is normally considered in Monsoon i.e. July-August as well as the lean discharge period i.e. October to April. The outages during lean period will not affect the generation due to availability of lesser discharge in river Bhagirathi. Therefore, the generations as envisaged in the DPR as per various cases seem to be feasible.

The average energy generation in the period 1984-85 to 2012-13 is 396.75 MU which can be improved to simulated generation values between 467.2-499.7 MU for different cases.

5. ... Studies/practical experiments were carried out in Tiloth & it was observed that the machines could be operated at higher capacities with a particular set of runners. However, the tunnel capacity has been considered as 71.3 m<sup>3</sup>/s in view of the tunnel discharges for the period 1995-2004. Now the runners as well as the underwater parts have been damaged badly & the newly designed runners with improved profile & HVOF coating will be in a position to operate at enhanced capacity as & when required. The operation at enhanced capacity will be guided by the head loss & other technical parameters but this will be really useful during lean discharge periods.
12. The submission dated 12.02.2015 and subsequent presentation made by UJVN Ltd. on 13.03.2015, the Commission forwarded a Report (containing the observations) to UJVN Ltd. vide reference No. 2241 dated 23.03.2015 for submitting point-wise

information/justification/clarification on the issues observed.

13. In compliance to the Commission's above letter No. 2241 dated 23.03.2015, UJVN Ltd., submitted its reply on affidavit vide letter No. 204/UJVNL/03/D(P)/D-5 dated 11.05.2015. On examination of the reply, it has been observed that on most of the observations, namely need, equity funding, basis of cost estimate, replacement of underwater parts with HVOF coating, UJVN Ltd. has reiterated its earlier submissions. However, on certain issues related to justification of need, Energy Potential after RMU, justification with regard to 'Option 3', i.e. need of replacement of complete Generator and Generator Transformers, Civil and Hydro-mechanical works, UJVN Ltd. has further submitted the following:

- (1) The Energy Potential after RMU is projected as 461.4 MU and in the Economic Analysis, the figure of 456.79 MU with RMU is the total saleable energy after considering 1% auxiliary consumption & losses (4.61 MU). The incremental energy is 64.65 MU on the basis of average energy of 396.75 MU from 1984-85 to 2012-13.
- (2) The Generator Transformers were manufactured in 1976 and commissioned in 1984 and are in use with regular upkeep and maintenance. Since these have been in operation for a very long time and the previous experience of extensive damages to Generator Transformers at Khatima HEP, it is proposed to replace 3 nos. of 11/230 kV, 40 MVA transformer capable of 10% overload of the machines.
- (3) The estimates for Civil Works have been prepared on the basis of Schedule of Rates of PWD, Uttarakhand. As regards the Hydro-mechanical works, the budgetary offer for the work of "construction of TRC gate at the confluence point of TRC of Tiloth Power House & Bhagirathi River" was obtained from Erection Division, Irrigation Department, Uttarakhand, Roorkee.
- (4) The Options suggested/recommended by M/s Lahmeyer are as follows:

**Option 1:**

Replacement of the station auxiliary systems as far as required and refurbishment of the other parts of the equipment. This option shall comprise the replacement of all equipment, whose maintenance cost are extraordinarily high.

**Option 2:**

Same as option 1 plus replacement of vital parts of the generating units such as turbine runners, guide vanes, governors and excitation system.

**Option 3:**

Full replacement of the generating units with all station auxiliaries. Estimated cost proposed for this option is Rs. 384.66 Crore.

Among the above Options, UJVN Ltd. has submitted that Option 2 aims at enhancing the efficiency of the Generating Units upto an acceptable level whereas Option 3 aims at the achievement of the maximum power Generation of the Plant. Further, UJVN Ltd. has submitted that in order to increase the availability and reliability of the machines with capability of running at 10% overload the need for complete replacement (i.e. Option 3) of Turbine, Generator, Underwater parts, Auxiliaries will be required, as:

- (a) Old and inefficient turbines drawing more discharge for rated output, thus putting more stress on water conductor system, underwater parts and causing operation under risk. Erosion is prominent at stations with generic problem of silt which reduces efficiency.
- (b) Poor insulation of generators can result in frequent faults/breakdowns & fire and ultimately result in reduction of capacity. Similarly, damages in Old Generator Transformers, commissioned way back in 1975, may also occur which has already happened at Khatima.
- (c) Old and inefficient governing & excitation system which are essential for operation and machines are under manual operation.
- (d) Old and obsolete Switchyard equipment & power house auxiliaries viz Control & Protection equipment, AC/DC systems, Drainage/Dewatering

system, compressed air system etc. failure of which cause shutdown of machines/powerhouse.

- (e) Non-availability of spare parts of old & outdated systems even from their Original Equipment Manufacturers (OEMs).
- (f) Damage to the Civil structures viz. Dam/barrage, power channel, power house, Tail race etc.
- (g) Deterioration of old Generating Units which lead to their premature retiring.

Based on the above submissions, UJVNL Ltd. has proposed that R&M with **replacement of all parts i.e. Option 3** provides a cost effective solution to enhance capacity, efficiency and life of HEPs with no risk and minimum gestation period and requested the Commission to allow the same at an estimated cost of Rs. 384.66 Crore (including IDC).

### **Commission's Analysis and Views**

14. On examination/scrutiny of the above Petition including additional submissions made by UJVNL Ltd., the Commission has observed that the original Design Energy of MB-I HEP is 546 MU while the annual generation achieved since the year of commissioning of the Plant is as follows:

**Table 3: Annual Generation since date of commissioning of MB-I**

<b>FY</b>	<b>Generation (MU)</b>	<b>FY</b>	<b>Generation (MU)</b>	<b>FY</b>	<b>Generation (MU)</b>
1984-85	113.90	1995-96	196.03	2006-07	467.50
1985-86	177.82	1996-97	252.39	2007-08	466.14
1986-87	299.18	1997-98	446.41	2008-09	403.8
1987-88	341.35	1998-99	470.77	2009-10	449.07
1988-89	466.99	1999-00	419.07	2010-11	504.41
1989-90	449.97	2000-01	408.52	2011-12	516.11
1990-91	382.77	2001-02	372.64	2012-13	454.96
1991-92	426.73	2002-03	457.47	2013-14	382.18
1992-93	347.82	2003-04	488.39	2014-15	380.55
1993-94	476.02	2004-05	456.54		
1994-95	417.09	2005-06	456.32		

Since creation of UJVNL Ltd., w.e.f. FY 2001-02, the average generation upto FY 2014-15 has been 444.30 MU. While, in the Petition, post R&M generation projected by UJVNL Ltd. is 461.4 MU. On comparing the actual average generation of the Plant

during last 15 years with the projected generation post R&M, the increase in generation posed is not significant. The R&M proposal submitted by the Petitioner appears to be more for the purpose of extending the life of the Plant alone.

15. The proposal has further been analysed vis-à-vis guidelines issued by CEA with regard to 'Best practices and Benchmarking' of R&M of HEP's. The relevant conditions of the guidelines are reproduced below:

*"7.1 -Renovation & Modernisation (R&M) of old plants is considered to be the best option to bridge the wide gap between demand and supply of power as R&M programmes are cost effective having much lower gestation period compared to setting up of new plants."*

*- Renovation, modernization and uprating of hydro generating units (RM&U) which have outlived their normative operating life and the relatively new machines with generic problems are recognized to yield considerable additional benefits of energy at minimum cost. RM&U programmes can be expected to yield benefits in about 3 to 4 years as against installation period for new hydro generating capacity of 6 to 7 years.*

*- RM&U programmes may be taken up timely to prevent deterioration in operation of generating units which may lead to their premature retiring. By undertaking timely RM&U & Life extension programme, the generating plant can be made to operate for another extended period of 20 to 25 years with improved reliability and availability.*

## **7.2 NEED FOR RENOVATION, MODERNISATION & UPRATING OF HYDRO POWER PLANTS**

*-The normative operative life of hydro electric power plant is 30 to 35 years after which it normally requires Life extension through renovation.*

*-By undertaking activities involving replacement of worn out or damaged components the availability of the generating unit and to some extent its life would be increased but no improvement in output or efficiency can be expected.*

*-The output and efficiency of generating units can be increased by replacing old or damaged components by redesigned components using State of the art materials. Especially in old equipment a significant increase in output and/or efficiency can be achieved by the use of new materials and advanced engineering methods. In addition, the overall life expectancy of the equipment will also be increased.*

*-By undertaking uprating programmes it is possible to uprate the generating capacity of*

existing units by 10 to 30% based on the water availability, operating margin and technological upgradation. This programme may be involving rewinding of stator from Class B to Class F, restoring stator core, improving air gap, replacing turbine runner with advanced blade profile and material while carrying out uprating of the plant, modernization by replacing conventional excitation system with static excitation system, replacing conventional governing system with micro processor based electro hydraulic governing system, retrofitting existing control and protection system to modern state of the art system etc. may also be undertaken for improvement of reliability in operation of the plant. However, uprating of generating capacity may be taken up after detailed investigations and studies.

### **7.3 APPROACH FOR SELECTING R&M ACTIVITIES**

The performance of the generating units should be the guiding factor in selection of R&M activities rather than the period of their operation. The following aspects/requirements to be kept in view while selecting R&M activities:-

- Activities covering main equipment i.e. turbine, generator and C&I equipment and other plant equipment essential for efficient and sustained performance of the units as well as station be identified.

- Activities which have direct impact on improvement of generation, efficiency, machine availability etc. be assigned higher priority.

- Activities which yield uprating benefits because of rewinding with Class F insulation, runner with improved profile be given priority.

- For silt prone hydro power stations, R&D activities on advanced techniques like plasma coating on under water parts of turbine, and development of new materials may be given priority. Adoption of closed circuit cooling system, Cu-Ni tubes for coolers etc. may also be considered.

- Activities which include state of the art equipment such as electronic governors, static excitation system, micro processor based controlled high speed static relays, on line monitoring devices and silt content in water.

- Activities like augmentation of water conductor system which may increase the discharge/head & hence the peaking capacity & additional generation of the generation station."

16. Based on the above conditions of the guidelines w.r.t. the need and selection of activities to be included in RMU for the life extension of MB-I HEP, the Commission has taken note of various options recommended by the Consultant M/s Lahmeyer discussed above at para 13, and is of the view that submission of Petitioner proposing Option 3 amongst the recommended Options is not justified, since M/s Lahmeyer itself has suggested Option 2 as most viable Option. On examining Option 2 & Option 3 w.r.t. the extent of RMU works, it has been observed that 'acceptable level of generation' and 'achievement of maximum power generation' as proposed in Option 2 and Option 3 respectively do not have much difference. Thus, exercising an option requiring higher capital expenditure even though the benefits w.r.t. generation augmentation are almost of same magnitude is not justified.

In accordance with the CEA guidelines in the matter, RMU works should yield considerable additional generation at minimum cost. Hence, selection of the activities to be covered under RMU by a generation utility should be based on least cost provided expected performance is not adversely affected, RMU of old plants is considered to be the cost effective option due to its short gestation period besides resulting in augmentation of generation and life extension at minimum cost. Thus, replacement of existing equipment should only be proposed for those vital equipments which have direct bearing on the generation loss or where the repair and maintenance cost works out to be extraordinarily high. Based on the above, Option 2 appears to be more appropriate RMU option which is also consistent with approach suggested in the CEA guidelines for deciding the scope of work within the RMU activity.

17. Notwithstanding the above views, the Commission also analyses proposed RMU activities namely replacement of Turbine, Generator, Generating Transformers, underwater parts, station auxiliaries with respect to performance of these equipments over its past period of operations and observed that in MB-I HEP the silt content of Bhagirathi river is full of quartz particles of substantial hardness in Mohr's scale, which is a major cause of heavy and rapid erosion of underwater parts. This rapid wear & tear and abrasion of Turbine and other underwater parts is one of the major reasons for generation loss. Since the Plant is in operation for more

than 31 years under such silt conditions, therefore, with a view to enable life extension of the Plant, the Commission finds the proposal for replacement of underwater parts justified.

18. With regard to the proposal of HVOF coating, the Commission has observed that in past years namely during FY 2010-11 and FY 2011-12, application of HVOF coating has contributed towards substantial increase in annual generation of this HEP and which have been highest ever generation years since the commissioning of the Project. The generation figures of these years are presented below:

<b>FY</b>	<b>Energy (MU)</b>
2010-11	504.41
2011-12	516.11

Hence, the need of HVOF coating of underwater parts is considered justified.

19. However, with regard to the activities proposed for Generator, the Commission observed that in the operating life of last 30 years, loss in generation due to the breakdown of generator with existing class-B insulation is negligible and the respective Generators of all the Units have proven its reliability during FY 2010-11 and FY 2011-12 wherein, HVOF coating resulted in substantial increase in generation. Therefore, by undertaking the following revamping activities namely Stator and Rotor poles from class-B to class-F insulation including other revamping works, replacement of conventional Excitation System with Static Excitation System, replacement of conventional Governing System with Micro-processor based electro hydraulic Governing system would increase the reliability in operation as well as result in life extension of the HEP.

Therefore, the Commission holds that replacement of Generator at this juncture is not needed revamping of the existing Generators of all the Units with modernization of Excitation System would suffice which is consistent with option 2 suggested by the Consultant.

20. With regard to the replacement of Generator Transformers and other auxiliaries, it is observed that the reasons stated in the Petitioner's proposal and its subsequent submissions do not substantiate the need for complete replacement of static electrical equipments. UJVN Ltd. should rather go for revamping generator

transformers with insulation up-gradations and replacement of accessories, if required. Similarly, with regard to Power House Auxiliaries, Control and Protection Equipments and Switch-yard Equipments, UJVN Ltd. should explore cost effective solutions and should replace only those equipment where the cost of replacement is lesser than the cost of revamping of these equipments without compromising the quality and design of the system.

21. With regard to the works proposed under Civil and Hydro-mechanical, the Commission has taken note of the submission of UJVN Ltd. and is aware of the fact that over period of time there could have been damages in the Dam structures and Hydro-mechanical structure/equipments and such damages in the structure/equipment might be causing heavy leakages resulting in continuous loss of generation. Therefore, the Commission agrees that proposed refurbishment works of Civil and Hydro-mechanical system would be required, however, the works proposed under this head namely office building, residential building and play ground etc. do not qualify for the works to be included under the proposed RMU of the HEP.
22. With regard to the approval of overall estimated cost of the Project under RMU, the cost estimate submitted by the UJVN Ltd. for MB-I is based on the projection of the awarded prices of the items of RMU of Khatima HEP. It is known that both the said HEPs are entirely different in their design, type, capacity, water conducting system, head, silt conditions, type of Turbine & Locations, therefore, the Commission is of the view that taking the reference of the prices of Khatima HEP for estimation of cost of MB-I HEP is not proper.

Further, the submission of UJVN Ltd. in support of the parametric evaluation that getting offers from reputed manufacturers takes a long time as the manufacturers are reluctant to give the offer and taking the prices of awarded projects as base cost will be more firm than the budgetary offer, does not seem to be a reasonable approach for cost estimation of entirely different HEP as possibility of error/deviation in parametric evaluation is quite higher for two unlike/divergent Plants.

UJVN Ltd. has taken the total cost on straight line method for all equipments namely Generating equipments, Transformers, Switchyard equipments, Power House Auxiliary equipments, etc. while, the cost estimation could be made more realistic by taking the offer for equipment or based on prevalent Cost Schedules for these equipments in other power utilities except for main generating equipment as these are Plant specific.

As discussed above, taking reference of the canal based low head Plant which is entirely different in terms of technical and geographical parameters is not reasonable, therefore, the Commission feels that Budgetary offer, as basis for estimating cost of proposed RMU of MB-I, should have been the best approach. However, since the Commission has not considered Option 3 proposed by UJVN Ltd. as such and has allowed specific activities within the overall RMU proposed by the Petitioner, therefore, working out the total estimated cost to be approved is not being undertaken.

23. Based on the above discussion, the Commission grants *in-principle* approval for the works discussed above and summarized below:

- (1) Replacement of underwater parts with HVOF coating.
- (2) Revamping of Generators, Generator Transformers and other station auxiliaries
- (3) Replacement of excitation system
- (4) Replacement of governing system
- (5) Revamping of cooling system
- (6) Refurbishing works of Civil and Hydro-mechanical system proposed under this Petition except office & residential building and play ground.

24. The above *in-principle* approval is being granted subject to following:

- (1) The Petitioner is directed to obtain the prices through competitive bidding for the works allowed by the Commission under the prevailing rules & regulations and prudence of the prices will be scrutinised at the time of fixation of tariff after completion of the R&M works.

- (2) All the loan conditions as may be laid down by the funding agency in their detailed sanction letter are strictly complied with. However, the Petitioner is directed to explore the possibility of swapping the loan with cheaper debt option available in the market.
- (3) The Petitioner shall, within one month of the Order, submit letter from the State Government or any such documentary evidence in support of its claim for equity funding agreed by the State Government or any other source in respect of the proposed R&M works.
- (4) After completion of the aforesaid R&M works, the Petitioner shall submit the completed cost and financing of the project.
- (5) The cost of servicing the project cost shall be allowed in the Annual Revenue Requirement of the petitioner after the assets are capitalized and subject to prudence check of cost incurred.
- (6) The norms of performance of the Plant shall be appropriately re-fixed after completion of RMU.

**(K.P. Singh)**  
Member

**(C.S. Sharma)**  
Member

**(Subhash Kumar)**  
Chairman