

The background of the slide is an aerial photograph of a large hydroelectric dam. The dam is a long, concrete structure with multiple spillways, situated in a deep valley. Water is seen cascading over the spillways, creating white foam. The surrounding landscape is lush green with dense vegetation. The sky is clear and blue.

**RMU & LE OF HYDRO POWER  
STATIONS :-  
BIDDING PROCESS, BROAD  
PARAMETERS & PERFORMANCE  
GUARANTEE**

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## **RMU & LE – A NEED**

- The normative operative life of hydroelectric power plant is 35 years.
- CERC Tariff Regulations, 2014 also allow for RMU & LE for the purpose of tariff.
- RMU & LE of old hydro electric power projects is a cost effective option to ensure efficiency, better availability and also to augment capacity addition.
- This is a faster and cheaper way of capacity addition than installing new capacity.
- Obsolescence of spare parts justifies the need of RMU & LE

## **RMU & LE – A NEED**

- As per global experience, approx. 5 to 10 % capacity addition can be achieved by simply encroaching upon overload margins, safety factors, if the same was not already used due to actual site & layout conditions.
- Capacity addition up to 10 to 20% is achievable by changing the F-class insulation of the stator and by changing the Hydraulic profile of the runner
- Capacity addition up to 15 - 30% is achievable by changing the complete unit and retaining only embedded parts.

## **RMU & LE – A NEED**

- The plant commissioned in eighties have completed their normal life but civil structures are still having balance useful life.
- For the hydro plants in Himalayan and sub-Himalayan regions, the excessive silt causes extensive damages to the underwater parts and justifies replacement.
- Old generators having lower insulation class is prone to faults over the years of operation. Generator could be replaced with class “F” insulation and low core losses due to improvement in material technology etc.

## **RMU & LE – A NEED**

- Tremendous technological advancement in last couple of decades, necessitates the renovation along with capacity addition of such plants in the same hydraulic space and available resources.
- The conventional mechanical governor, excitation, control and protection systems does not support the new guidelines of grid operation such as RGMO / FGMO.
- On-line monitoring systems, static / numeric relays, data loggers, SCADA system help in enhancing the plants availability and reliability.

# **BROAD PARAMETERS FOR ACHIEVING PERFORMANCE**

- The performance of generating units can be considered as guiding factor for deciding extent of R&M schemes.
- RLA may be carried out (if need be) depending upon the extent of RMU and replacement
- RLA studies may not be required for the parts needing up-rating as these parts are required to be replaced.
- Emphasis should be on achieving up-rating benefits, wherever possible
- Study of existing equipment is required for its suitability with capacity addition and identification of most troubled items for its replacement / refurbishment for higher ratings.

# **BROAD PARAMETERS FOR ACHIEVING PERFORMANCE**

- Based upon operation & inflow data, revised study of losses and availability of net head and accordingly uprating within the constraints of civil structure such as velocity etc. is to be decided.
- Study is required in regard to percentage speed and pressure rise due to new modified runner with respect to the existing water conductor system.
- MW and design energy to be finalized by taking latest efficiency of turbine & generator and by considering the inflow data duly maintained by power station for last 30-40 years.
- Major parameters such as output & efficiency of turbine & generator vis-à-vis whole of plant is to be specified

# BROAD PARAMETERS FOR ACHIEVING PERFORMANCE

## SUB SYSTEM OF HYDRO POWER PLANT

|                       |   |
|-----------------------|---|
| Generator transformer | Must be very cautious decision. Replacement should depend upon operational data of past performance & RLA |
| Bus Duct              | Does not require complete replacement   |
| MIV                   | Refurbishment only after study of valve condition & plate thickness                                       |
| Cooling water system  | Depending upon condition of equipment and revised need of cooling capacity                                |
| EOT Crane             | The major components can be retained, however, auxiliary systems to be replaced                           |
| Other Systems         | As per need and suitability to up-rated unit  |



# **BIDDING PROCESS**

## **PROPOSED PACKAGES**

- Segregation of work w.r.t layout & time schedule.
- Civil Works :-
  - Dam / Barrage
  - HRT / TRT / Tailrace as the case
  - Power house

Decision of single or different packages - depends upon value & availability of contractors

- Infrastructure Works :- Single package
- Hydro-Mechanical Works :- Single Package

# **BIDDING PROCESS**

## **PROPOSED PACKAGES**

- Electro-Mechanical Works
  - Core Package (Turbine, MIV, Governor, Generator, Excitation, Bus duct, Control & protection, Cooling water system, Cables etc.) – Single Package contract
  - Other BOP Package (GSU transformer, Switchyard, DC system, LV & MV system, Drainage & dewatering system, compressed air system, DG set, EOT crane, HVAC, Fire Fighting, Elevator etc.) – Each as separate package depending upon value & availability of contractors.

# **BIDDING PROCESS**

## **EXECUTION ASPECTS**

- Complete shutdown of power plant for undertaking all common works of power house, all major works of Dam / HRT/TRT and HM works should be kept as minimum.
- Works required for water path isolation of units from upstream / downstream side (Penstock valve & Draft tube / TRT gates etc.) , should be under taken during the period of complete shut down.
- Works of MIV, switchyard, DC system, Drainage & dewatering system, MV & LV switchgear, Compressed air system is required to be undertaken during the period of complete shut down.
- Unit wise dismantling / installation, keeping other units in operation, is preferred to minimise the generation loss.

# **BIDDING PROCESS**

## **EXECUTION ASPECTS**

- Works of EOT crane, being non linked system, should be completed before start of other R&M works.
- Works of other system such as DG sets, illumination system, HVAC system, fire fighting system, elevator etc. are not linked with shut down of unit. As such works can be planned accordingly.
- Works of Turbine, Governor, Generator, Excitation, Bus duct, GSU transformer, Cooling water system, Control & Protection system need to be undertaken during unit wise shut down of the power plant

# **BIDDING PROCESS**

## **SPECIFICATION ASPECTS**

- Specification should have the clarity in the scope of works for RM&U
- Specification need to be framed based upon detailed O&M feedback and details of RLA studies.
- Specifications need to indicate whether machines was generating at its rated capacity or below. Probable reasons for not achieving rated capacity can also be given for study by manufacturer.
- Full technical data of the power station should be given in the tender documents
- Equipment identified for reimbursement should have clear and limit of scope of work.

# **BIDDING PROCESS**

## **SPECIFICATION ASPECTS**

- Terms and conditions should be clear. Ambiguities should be avoided.
- Bid document shall clearly indicate the terms & condition in respect of following:-
  - Shut down & handing over
  - Taking over
  - Payment and other terms
  - Performance guarantee test
  - Rectification period in the event of deficient performance
  - Liquidated damages and limitation of liabilities
  - Warranty obligation arising out of change of Laws, regulation, etc.

# **BIDDING PROCESS**

## **PERFORMANCE GUARANTEE ASPECTS**

- Performance and output guarantees.
- Penalty for non achieving the guaranteed output.
- Penalty for non achieving the guaranteed efficiency.
- Conditions for meeting the cavitation guarantee.

# **BIDDING PROCESS**

## **PERFORMANCE GUARANTEE ASPECTS**

- Penalty for delays and liquidated damages- Time as essence of Contract.
- Mechanism to deal unforeseen items, which become necessary during execution.
- Inclusion of the milestones vis-à-vis stage payments for supply, erection and handing over for better contract management.



# CONCLUSION

Renovation and modernization coupled with capacity addition of all the older hydro plants becomes compulsion for faster growth of hydro power.

**THANK YOU**