

CHAPTER - 7

RENOVATION AND MODERNISATION AND UPRATING OF HYDRO POWER STATIONS

“Renovation and modernisation (R&M) of hydro power plants is a cost effective way of dealing with the problem of low production levels. It is comparatively easier than constructing new projects and can yield results in about three to four years. The following chapter provides tips on selecting various R&M activities along with residual life assessment studies.”

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

7.4 RESIDUAL LIFE ASSESSMENT (RLA) STUDIES

RLA studies may be carried out so that a realistic picture is available in regard to the residual life/condition of the entire power station equipments, systems and sub systems.

Whole power project is divided into 4 categories for the purpose of RLA studies. These are as under:-

Category I : Hydro turbines, generators, valves, governors, excitation system equipments and station auxiliaries.

Category II : Main power transformers and switchyard equipments

Category III :Hydro mechanical equipments like gates, trash rack, stop logs and gate operating mechanisms

Category IV: Civil engineering elements/components namely dams,

intake, water conductor system, power house building, foundations etc.

i) Besides non-destructive/destructive tests and interpretation of test results, the following should also constitute the RLA study programme:-

- Visual examination
- On line diagnostics
- Review of operational history
- Review of plant documents
- Discussions with plant authorities and O&M staff on the health of the equipments
- Identification of critical components

7.5 STRATEGY OF RM&U & LE PROGRAMME

The strategy of RM&U & LE programme is to determine the optimum RM&U & Life extension works, so as to achieve restoration/enhancement of the plant's average performance, reliability, availability, safety of operation, Life extension for another 20-25 years and updation/upgradation of equipment/system and to determine the potential for uprating the capacity of the units/plant as a whole.

7.6 METHODOLOGY FOR IMPLEMENTATION

- Scope of R&M works and life extension programme in respect of generating units having completed more than 30 years of service life should be firmed up based on RLA studies. Uprating, if feasible shall also be taken up along with life extension programme.
- RLA studies should be got conducted through competent vendors and the Detailed Project Report for the scheme be prepared based on the findings of RLA studies.
- Job of RLA studies and execution of R&M works should be tendered out separately with the later being based on the findings of the first one.
- Prior to undertaking uprating works, it is necessary to go for uprating studies. Uprating studies should be got conducted through reputed agencies like CWPRS, CPRI, BHEL, etc.

- R&M works as firmed up in the detailed project report should preferably be tendered out on turn-key basis to the reputed manufacturers/vendors.
- A high level task force be constituted by the utility for implementation of R&M schemes as per time bound programme.
- Completion of activities as well as performance of the equipment after R&M should be guaranteed through stringent penalty clauses.
- Addition/deletion of R&M activities from those incorporated in the DPR should not be permitted. Allocation of funds should be activity based and implementation of the scheme should be monitored activity-wise.