

## CHAPTER - 2

### BEST PRACTICES IN PLANNING & APPRAISAL OF HYDRO ELECTRIC PROJECTS

***“Planning and appraisal of hydro electric projects is a highly specialised task that requires detailed analysis of various integrated operational studies, power potential studies, storage hydro schemes, determination of installed capacity and preparation of detail project reports (DPRs). Once this work is done, DPRs need to be submitted for scrutiny and clearance from various relevant bodies including the Central Electricity Authority (CEA).”***

#### A. PLANNING OF HE PROJECTS

##### 2.1 INTRODUCTION

A hydro electric plant harnesses power from water flowing under pressure through the prime mover known as water turbine. A Hydro Electric Project may be conceived exclusively for power generation or power may be one of the benefits along with flood control, irrigation etc. when it is termed as Multipurpose Project.

The planning is very important component for the optimum development of a hydro electric project in a river basin. A river valley can offer many sites potentially attractive to the planners of hydro electric development. Investigations at these sites can help eliminate certain number of them and the optimum dimensions of dam, reservoir and powerhouse can be worked out that could give the most economical scheme. Process of selecting the best option depends upon the judgement and experience of decision makers.

Hydro Electric Project forms an integral part of overall development of water resources of the river basin. The hydro schemes also form part of

the complex integrated power generation system with diverse power generation resources. In the planning of hydro development and deciding on installed capacity etc, these two inter-connections viz. with the water resources developments of the river basin and with the power system are to be kept in view.

In the overall basin context, the impact of operation of upstream projects, constraints imposed by the downstream projects, irrigation diversions downstream, flood moderation etc. are to be considered. Further, with progressive development of consumptive water use and new water resources based development projects in the river basin, water availability would undergo considerable changes over the life of the plant. These are some of the important aspects which have to be considered while planning hydro electric/multipurpose projects.

## **2.2 TYPES OF H. E. SCHEMES :**

There are many types of hydro electric schemes. Based on the functions, these may be classified as under :-

### **2.2.1 Run-of-River Schemes**

Run-of-River schemes are the schemes either having pondage sufficient



*Barrage of Uri Hydro Power Station - 480 MW (J&K)*

to meet diurnal variation of power demand or no upstream pondage (i.e. all the incoming water is fed into the turbine at the same time).

### **2.2.2 Storage Schemes**

These are the schemes having large storage capacity reservoir to store excess water in monsoon months and to generate power in non-monsoon months .

### **2.2.3 Pumped Storage Schemes**

These are the schemes having two reservoirs, upper & lower. Water flows from upper reservoir to lower for generation during peak hours and vice versa for pumping back water during off-peak hours.

### **2.2.4 Canal Power House Schemes**

These are the schemes utilising irrigation canal flows for power generation.

## **2.3 ESSENTIAL COMPONENTS OF HYDRO ELECTRIC SCHEMES**

### **2.3.1 Storage Reservoir**

It is an essential component of storage based hydro electric schemes. Water available from the catchment area is stored in reservoir during monsoon period so that it can be utilised to run the turbines for generating electric power according to the requirements during lean flow period.

### **2.3.2 Dam**

Dams are the civil structures built across the rivers for intercepting storage of water and also to create head. These are also an important feature of storage based hydroelectric schemes. Run of River scheme normally have Weirs for diversion of river water.

### **2.3.3 Water conductor system**

It is the system through which water is carried from the dam to power house. It may consist of tunnels, canals, forebays, pressure shafts/

penstocks, surge tank and inlet valves etc.

#### **2.3.4 Power House**

Power House is a building housing the turbines, generator, control and protection equipments etc. including auxiliaries for operating the machines.

#### **2.3.5 Tail race**

Tail race carries the water discharged from the turbines to a suitable point where it can be safely disposed off into the river in case of a conventional hydro schemes. In case of a pumped storage schemes, it carries water to tail pool or lower reservoir to be pumped back into the upper reservoir.

#### **2.3.6 Switchyard**

Power generated by the generating units is pooled in the switchyard and transmitted to load points. As far as possible, the switchyard is located near to the Power House.

### **2.4 STEPS INVOLVED IN THE PLANNING OF A HYDRO-ELECTRIC PROJECT**

- i) Site Identification
- ii) Survey & Investigation
- iii) Project Planning and Project Optimisation Studies for determination of optimum Project Parameters
- iv) Assessment of power & energy benefits
- v) Economic Evaluation
- vi) Preparation of Detailed Project Report

### **2.5 SELECTION OF 90 PER CENT DEPENDABLE YEAR**

Planning of HE Project is carried out based on 90 per cent dependability criteria. For determination of 90% dependable year, the total energy generation in all the years for which hydrological data is available (say

N year) is arranged in descending order and the  $(N+1) \times 0.9^{\text{th}}$  year would represent the 90 per cent dependable year. The 90 per cent dependable year is thus, termed as the year in which the annual generation has the probability of being equal to or exceed 90 per cent of the time on annual basis during the expected period of operation of the scheme.

For example, if inflow data is available for a period of 20 years ( $N=20$ ), then,

$$90\% \text{ Dependable year} = (20+1) \times 0.9 = 18.9 = 19^{\text{th}} \text{ yr}$$

## **2.6 POWER POTENTIAL STUDIES**

Power Potential studies are carried out for assessment of available Power Potential of a river/basin based on a set of inflows and available head conditions under various operating policies. These studies play an important role in the optimisation and design of new hydro facilities. They are used for examination of various configurations and their integration into existing networks. The studies are carried out for optimization of project parameters and for evaluation of Energy and Power benefits.

### **2.6.1 ROR Schemes without Pondage**

In case of ROR schemes without pondage, the flow data is arranged hydrological year wise i.e. June to May etc. and Unrestricted Energy Benefits are worked out for all the years. Based on the above, 90% dependable year is selected. To determine the optimum installed capacity, a number of alternatives of installed capacities are considered and energy generation during the 90% dependable year is computed for each of the alternative installed capacity scenario based on average 10-daily inflows. Installed capacity is selected after carrying out Incremental Analysis for the most attractive alternative. The unit size is selected by considering pattern of generation in various periods, transportation constraints, if any, and system considerations etc.

### **2.6.2 ROR Schemes with Pondage**

In case of ROR schemes with pondage, same procedure as explained

for ROR schemes (without pondage) is adopted except that in case of selection of installed capacity, load factor is also considered and studies for cost of alternative Thermal/ Gas and Hydro sometimes carried out in order to work out optimum installed capacity. Hourly operation of the pondage is carried out to work out pondage requirements for peaking. The unit size is selected by considering, transportation constraints, if any, and system considerations etc.

### **2.6.3 Storage Hydro Schemes (Simulation)**

The storage provided at a site can be either for annual operation which means that every year it would be drawn down to its minimum draw-down level or it may be carried over with a view to carry over waters from good hydrological year to the lean flow year that may follow. The purpose of providing storage is to achieve, wherever economically feasible, higher utilization of the inflows approaching very close to the long term average inflows.

The 90% dependable output in case of carried over storages should be higher than the output which would have been possible on the basis of utilization of inflow available on annual basis.

Minimum draw down level (MDDL) of the reservoir is selected from consideration of estimation of siltation in the reservoir during the life of the project, optimization of power benefits and safe limit of operating heads of turbines taking into consideration site specific constraints, if any.

Full reservoir level (FRL) for the scheme is determined considering geological and other constraints in raising the dam height and also considering various other related aspects of submergence and rehabilitation etc. For selection of FRL, tailrace level of upstream developments whether existing or planned, if any, is also taken into consideration.

For selection of optimum FRL, Reservoir simulation studies are carried out for entire hydrological data for alternative FRL & MDDL scenarios, to

work out firm power and 90% dependable energy generation benefits corresponding to each of these scenarios. The variation in the efficiency of generating unit at heads lower and higher than rated head and variations in tailrace level is also considered in computing energy benefits, if available.

For selection of optimum FRL, the benefits (B) and the cost (C) for each alternative are computed and Incremental Cost and Benefit Studies are carried out to select optimum FRL from the consideration of maximization of benefits.

#### **2.6.4 Data Requirements**

For carrying out Power Potential Studies, the requisite data is entered into the Simulation model under the following categories.

**a) Configuration**

Prior to carrying out simulations, the physical characteristics of the development, its hydraulic links and down stream points of discharges are to be defined.

**b) Hydrological Data**

Hydrological Data consists of sequences of uncontrolled natural inflows into the reservoirs.

**c) Evaporation Data**

The month wise evaporation rate in the reservoir (in mm) is required for simulation.

**d) Physical Characteristics**

The physical dimensions of the reservoir constitutes the basis for the determination of head on the Power Plant. Storage availability has a direct impact on the possible degree of regularization. Area capacity curve, minimum and maximum operating levels for reservoir i.e. Full Reservoir Level (FRL) and Minimum Draw Down Level (MDDL) are required for simulation.

Similarly for power house, the tailrace rating curve, turbine and

alternator efficiency and head losses in water conductor system are taken into account for calculation of power production.

**e) Operating Objectives and Limits**

The objective of the simulation may be the maximisation of firm power, maximisation of average energy production or limitation of the number of energy failures. Similarly the operating limits may also be fixed on the minimum or maximum values of discharges through power house to cater to downstream irrigation requirements etc, if any.

**2.7 DETERMINATION OF INSTALLED CAPACITY**

For selection of installed capacity, benefits from the project with different possible installed capacities are evaluated. Optimum installed capacity is selected after carrying out Incremental analysis for the most attractive alternative and also considering the system load factor (LF). In addition, cost of generation from alternate sources such as coal based thermal, gas turbines, combined cycle gas turbines (CCGT) and hydro are worked out. The least cost of energy from among these options is adopted for evaluating the benefits of the installation. Benefits of the seasonal energy (total annual energy – firm annual energy), which can be absorbed in the system, are evaluated with the average incremental cost of fuel consumed in the alternative plant for generating the same energy.

**2.8 UNIT SIZE**

The units size is determined depending upon the transportation constraints, flexibility of operation and system considerations and geological constraints like permissible cavern size in case of underground power houses.

**2.9 PUMPED STORAGE SCHEMES**

A pumped storage scheme utilises the surplus energy available from base load stations (thermal & nuclear plants) during off-peak hours for pumping the water from a lower reservoir to the upper reservoir and the



same is released during peak hours for generation by running the units in generating mode. The capacity of upper/lower reservoirs, availability of surplus off-peak energy, intended operating pattern of the pumped storage scheme determines its installed capacity. The procedure for optimization of the installed capacity and deciding the number of units is same as applied for run-of-river schemes/ storage based schemes.

## **B. APPRAISAL OF HYDROELECTRIC PROJECTS**

### **2.10 Preparation of Detailed Project Report**

**2.10.1** Hydro electric projects are capital intensive involving high technology and relatively long gestation period. Due to their complex nature, a large amount of preparatory work is done by the project proponents before detailed project report (DPR) is submitted to CEA for clearance. Preparatory work covers detailed field investigations, planning, assessment of benefits, design & engineering studies, detailed cost estimates based on analysis, cost of inputs & equipment, identification and tie up of inputs, project need, justification, economic and environment studies, safety aspects etc.

**2.10.2** The DPRs of Hydro Electric Projects are prepared as per the guidelines issued by Government of India, Ministry of Irrigation (now MOWR) in 1980 and “Guidelines for formulation of Project Reports for Power Projects” issued by CEA in October, 2002. The summary of guidelines for formulation of power projects is given at Annex-I. Broad aspects to be considered and covered in DPR include investigations, data collection & analysis, selection of scheme of development, assessment of benefits, project need & justification, design & engineering, environment & safety aspects, tie-up of inputs, analysis of costs, cost estimates and financial analysis etc.

**2.10.3** Information on environmental aspects of the project are included in DPRs as per the relevant performae/ guidelines of MOEF. As regards the forest clearance, while the basic data (on the forest area) are included in the report, action is taken separately to process the clearance through the State Forest Department under Forest (Conservation) Act, 1980. The

best practice in the preparation of DPRs of Hydro Projects is to follow the guidelines issued by MOWR/ CEA/ MOEF.

## **2.11 Submission of Scheme for Concurrence under Section 8 of Electricity Act, 2003**

**2.11.1** Section 8 of Electricity Act, 2003 provides that “any generating company intending to set up a hydro generating station shall prepare and submit to Authority for its concurrence a scheme estimated to involve a capital expenditure exceeding such sum as may be fixed by Central Government from time to time by notification.

**2.11.2** At present the Central Government have fixed the following cost limits for submission of DPRs for hydroelectric projects for concurrence of the Authority:

- i) In relation to a scheme selected through competitive bidding –Rs 1000 Crores
- ii) In relation to a scheme for which tariff is fixed by CERC/ SERC – Rs 2500 Crores
- iii) In relation to a scheme of company not owned by Central/ State Government for supply of power to more than one state and approved in accordance with a scheme proposed by a committee or body authorized by Central Government –Rs 20000 Crores
- iv) In relation to all other schemes – Rs 250 Crores

All schemes utilizing water of inter-State rivers irrespective of capital cost shall be submitted to the Authority for its concurrence.

**2.11.3** For private sector Hydro Electric Projects, the clearance from the SEB/ State Government would be required in the area of water availability, Rehabilitation & Resettlement (R&R) of displaced persons, land availability and environment & forest clearance. The Report duly accepted by SEB/State Government is to be submitted to CEA.

**2.11.4** Section 10 (3) (a) of Electricity Act, 2003 provides that “Every Generating Company shall submit technical details regarding the generating station to the Appropriate Commission and the Authority”.

## **2.12 Appraisal of Schemes**

In order to cut short the time in CEA clearance the revised procedure for examination of project reports & its time frame for Hydro Projects have been finalised and procedure have been made interactive. CEA has drawn up a time bound procedure for processing of DPR so as to complete the examination of DPR in a period of 3 months or less as per the time schedules. This will be possible only when the project report is complete with all the details and all the requisite clearances are available at the time of submission/ registration of DPR in CEA. The project developers are required to strictly adhere to the time schedules for furnishing clarifications and attending to Standing Projects Appraisal Committee and TEC meetings in CEA.

Appraisal of Schemes shall be in following parts -

- i) Three stage clearance for Central Sector Hydro Electric Schemes.
  - Cost estimates for Stage –I activities
  - Feasibility Report (FR) for assessing commercial viability
  - Cost estimates for Stage –II activities
- ii) Appraisal of Hydroelectric Schemes for concurrence (Detailed Project Report)

### **2.12.1 Three Stage Clearance for Central Sector Hydro Electric Schemes**

Three-stage development procedure for Central Sector Hydro Electric Schemes shall be as follows:

#### **(a) Cost Estimates for Stage-I Activities**

- The generating company shall prepare and submit cost estimates of Stage-I activities of the project included in National Electricity

Plan for vetting by the Authority.

- The report shall contain the justification for taking up the proposed scheme for survey & investigation.
- The activities to be carried out during Stage-I are:
  - Data collection/preparation of application for site clearance by MOEF.
  - Establishment of gauge and discharge sites and meteorological observatories. Hydrological measurements and meteorological observations continue till construction of the project.
  - Obtaining of site clearance from MOEF
  - Essential geological exploration for establishing type of dam and its foundation and other civil structures
  - Topographic survey of the project area and detailed survey for the purpose of preliminary layouts of dam, water conductor system, power house etc.
  - Essential temporary infrastructure/access required for carrying out the above works
  - Commencement of Environmental Impact Assessment Studies (EIA) and Environmental Management Plan (EMP) studies.
  - Formulation of feasibility report for assessment of commercial viability of the project.
  - Preparation of estimates for Stage-II activities and their submission to the Authority (CEA).
- The activities under Stage-I shall be completed within one year from the date of sanction.

**(b) Commercial Viability on Feasibility Report**

- The generating company shall prepare a Feasibility Report (FR)

and submit for accord of the commercial viability by the Authority (CEA).

- The FR should establish whether the scheme is conceptually sound and feasible.
- The report shall also specify downstream benefits, if any. The report shall contain the chapters on Introduction, Salient features, Scheme Cost, Hydrology, Power Optimization Studies, Geology and Construction Material, Design of Civil Engineering structures, Hydro Mechanical Equipment, Power Plant- Electrical and Mechanical Equipment, Environmental aspects, Infrastructure facilities, Construction Methodology, Equipment Planning and Construction Schedule, Economic Evaluation.
- The report shall also contain the Vicinity Map, Scheme Layout plan, Geological Plan of Scheme, Index Plan of Borrow Area, Diversion Structure Plan, Diversion Structure - Longitudinal Section, Water Conductor system - Longitudinal Section, Power House – General Arrangement & Cross Section, Construction Schedule.

The schemes which have been found to be commercially viable and have obtained site clearance from MOEF would be considered for stage-II development.

**(c) Cost Estimates for Stage-II Activities**

- The generating company shall prepare and submit cost estimates of Stage-II activities for vetting by the Authority (CEA). The activities under Stage-II are:
  - ❖ Essential survey and investigation works comprising of the following:
    - Detailed topographical survey of reservoir area and project area.
    - Procurement of satellite imageries including aerial maps wherever required

- Geo-physical surveys comprising seismic and resistivity tests etc.
- Hydro-meteorological observations
- Collection of silt data and its analysis
- Geological exploration comprising surface mapping, drilling, drifting and their logging etc.
- Construction material survey, both quantitative and qualitative
- ❖ Preparation of Detailed Project Report (DPR)
- ❖ Submission of DPR to the Authority (CEA) and obtaining its Techno-Economic Clearance.
- ❖ Submission of Environmental Impact Assessment (CEA) and Environmental Management Plan (EMP) to MOEF and obtaining environment and forest clearances of the project.
- ❖ Temporary/permanent buildings (residential and non-residential)
- ❖ Roads and permanent bridges as may be required for approaching work sites and transportation of heavy equipment.
- ❖ Acquisition of land required for the execution of the project. Initiating the process of acquisition of land for the reservoir submergence area.
- ❖ Arrangement of construction power.
- ❖ Preparation of tender specifications and bid documents.
- ❖ Submission of PIB Memo/CCEA Note

Stage-II activities shall normally be completed in 1½ years from the date of sanction.

### **2.12.2 Appraisal of Detailed Project Report**

Techno- economic examination of project reports of hydro electric/ multipurpose project is an interactive and complex process and involves



*Baspa HEP - A view of the Machine Hall in Dist. Kinnaur (H.P.)*

various disciplines like hydrology, civil design, electrical & mechanical design, geology etc. DPRs are examined in specialized formations in CEA and CWC with a view to finalize the features of the project based on the optimal plan development of water resources and also considering techno-economic feasibility and requirements of system. All the multi-purpose project proposals with power component are first appraised by CWC, then by Advisory Committee in Irrigation, Flood Control and Multi-purpose Projects of Ministry of Water Resources. After clearance of the Advisory Committee, CEA examines and clears the power component of the scheme.

### **Appraisal Procedure**

CEA acts as single agency as far as clearance of techno-economic aspects of the projects is concerned. CEA coordinates the examination of DPRs with CWC and GSI on aspects pertaining to water availability, design and cost estimates of civil engineering works, inter-state/ international aspects and geological aspects.

### 2.12.2.1 Appraisal of DPR by CWC

#### Demarcation of responsibilities in Govt. of India

As per the demarcation of responsibilities in Govt. of India, the following are some of the aspects related to hydro projects assigned to MOWR:

- Hydrology of the project
- Hydraulic Structures for hydropower
- Water Management
- Flood Control
- Dam Safety
- Regulation and development of inter-state rivers and river basins
- Water laws legislation
- International water laws
- The matter regarding rivers common to India and neighboring countries: Joint River Commission for Bangladesh and India, Indus Water Treaty, Indus Commission

The above aspects are being looked into by CWC and wherever necessary in consultation with MOWR. It is therefore necessary to have approval of CWC/ MOWR for these issues i.e. hydrology of the project, clearance from inter-state/international angles, hydraulic structures and dam safety aspects etc.

#### Aspects Appraised by CWC

- i) **Hydrology:** CWC appraises the hydrological inputs and carry out hydrological studies as they play a vital role in the planning of hydroelectric projects and the design of various hydraulic structures. An over estimate of water availability may lead to larger investment and project may become costlier resulting in a higher installation. On the other hand, a lower estimate of water availability may result in a wastage of some hydro potential and non- utilization of selected site optimally. Hydrological studies include assessment of quantities of available water at the project site and time variation, estimation



of design flood, silt studies for estimation of life of the project etc.

- ii) **Construction Machinery:** CWC carries out detailed planning and appraisal of the construction machinery and construction methodology, number of equipment required, use rate of equipment, unit rates of work etc in order to have a realistic estimates of the cost of the project and the time required for construction.
- iii) **Foundation Engineering, Dam Safety and Civil Design Aspects:** CWC have specialized formations to examine foundation engineering aspects and civil design aspects of civil structures including dam safety aspects for various structures related with hydroelectric schemes.
- iv) **Inter-State/ International Aspects:** CWC also examines inter-State/ inter-national aspects related with a hydroelectric project in consultation with Ministry of Water Resources, if considered necessary and provides necessary suggestions to CEA.
- v) **Cost Estimates of Civil Works:** Before cost estimates of civil works are cleared by CWC, the project is evaluated from the angle of various aspects like hydrology, civil design, dams design, gates design, dam safety, foundation engineering, power plant engineering, barrage & canal design, construction machinery aspects etc. by CWC. It is essential because the cost depends upon all the above mentioned clearances. A change in these may affect the cost of aspect.

Once all the aspects are finalized, the cost estimates included in DPR are verified. To verify the estimated cost of civil works, hourly use rates of equipment and analysis of rate of main works like excavation, concreting, RCC works, stripping, filling, grouting etc. are determined for each activity. Based on the construction designs finalized, the quantities of the items required are worked out. Based on these, the estimated cost of civil works proposed in DPR is reviewed/ finalized.

### 2.12.2.2 Aspects Appraised by CEA

- i) **Legal Aspects:** CEA examines and ensures whether the project authorities have complied with all the legal provisions as stipulated in Electricity Act, 2003.
- ii) **Justification of the Project:** CEA carry out studies and forecasts the 'Power Supply Position' with and without the proposed project and examines the need/ justification of the project from system demand point of view. Necessary inputs/ information regarding future system demand in both peak demand and energy requirement for these studies are provided by Electric Power Survey Report published by CEA.
- iii) **Hydro Power Planning Aspects:** CEA examines the general layout of the hydro scheme as proposed by the project authorities and suggest modification, if any. CEA also examines the power potential studies carried out by the project authorities for all the years for which hydrological data is available, proposed installed capacity & unit size etc. CEA also examines the basin development and how the project proposal fits into it.
- iv) **Designs Aspects of E & M Works:** CEA examines design aspects pertaining to various electrical/ mechanical equipment of the power house and switchyard i.e. turbine or pump/turbine (for Pump Storage Schemes), generator or motor/generator (for Pump Storage Schemes), main step-up transformer with cooling water arrangement, switch-yard equipment (conventional or gas insulated switch gear), control and protection equipment, electrical and mechanical equipment for auxiliaries and power house and switchyard layouts, single line relaying and metering scheme and aspects relating to transportation etc as mentioned in the DPR.
- v) **Cost of Electro- Mechanical Works:** For E & M Works, estimated cost is verified by CEA based on cost data of similar equipment available in CEA.

- vi) Evacuation of Power:** CEA examines the adequacy of power evacuation system proposed by the project authorities to evacuate the power generated by the project and suggests necessary modifications.
- vii) Construction Programme:** CEA examines activity-wise, item-wise and year-wise targets/ schedule of construction for each of the major components of the project, which are based on detailed Bar/PERT Chart. The completion cost of the scheme is worked out based on detailed construction Programme.
- viii) Financial and Commercial Aspects:** Financial and commercial aspects of a hydro electric projects are examined by CEA which includes examination of financial package, calculation of interest during construction based on different financial packages, year-wise tariff calculation for the entire life of the project, levellised tariff calculation etc.

#### **2.12.2.3 Appraisal of DPR by GSI**

The geological aspects are appraised by Geological Survey of India

#### **2.12.2.4 Clearance from MOEF**

Development of hydroelectric projects have also adverse impacts on the surrounding environment. Hydroelectric projects may involve submergence causing environmental & ecological aspects, rehabilitation & resettlement and forestland. This necessitates scrutiny and clearance from Ministry of Environment & Forest. In case the projects involves diversion of forestland, clearance is also required from forest angle from MOEF under Forest Conservation Act, 1980.

#### **2.12.2.5 Clearance from Defence**

If a hydroelectric project involves defence aspects, then the clearance from Ministry of Defence is also required from Defence angle. The request is made to Ministry of Power to take up the case with Ministry of Defence.

#### **2.12.2.6 Techno Economic Clearance of CEA**

After CEA is satisfied about the technical and economic viability of the project and if necessary inputs/ clearances for the scheme are tied up, it accords TEC to the proposal as proposed or subject to some conditions as an interim step prior to its concurrence. The intimation regarding according of TEC for hydroelectric projects are given to the Project Authorities, Ministry of Power, Planning Commission and other Government Departments for further action to obtain investment sanction/ approval.

#### **2.12.2.7 Techno Economic Concurrence of CEA**

After all the specified statutory sanctions and clearance from various Government Departments/Organizations have been obtained, CEA's concurrence is conveyed as per Section 8 (2) of Electricity Act, 2003.

#### **2.12.2.8 Final Financial Package**

CEA also examines the final financial package submitted by the project authorities and accord its approval.

#### **2.12.2.9 Issues Related With Techno-Economic Appraisal of Hydro Schemes**

- i) Often it is found that the DPR submitted by the Project Authorities lack details required for proper examination and finalization of the project features. Some DPRs lack proper surveys and investigations studies, hydrological data/ studies, design details, proper power potential studies, proper evaluation of quantities of civil works, detailed cost estimates etc.
- ii) During the course of examination when deficiencies involving data/ investigation etc. are found, back references are made to the project authorities for obtaining complete information and it normally takes some time for them to attend to such observations. In case the DPRs of hydroelectric projects are prepared as per the guidelines of CWC and various queries/ clarifications raised by CEA/ CWC/ GSI are

replied promptly by the Project Authorities, a scheme could be accorded TEC by CEA within a short period after the receipt of DPR.

### **2.13 Concurrence to Revised Cost Estimates**

- In every case where the project cost over-run is 20% and is accompanied by time over-run of over 10% or such other time and cost over-run norms as may be deemed appropriate by the Authority, the revised cost estimates shall be prepared by the generating company and submitted to the Authority for approval including cost estimates for civil works and Electrical & Mechanical works.
- For the works, which have already been completed and for the material already received, actual cost incurred shall be incorporated in the RCE.
- For the balance of material and works, the cost should be on the basis of orders placed. In case orders for certain materials have not been placed, the prevalent market rate should be adopted.
- The establishment charges in case of RCE should be on the basis of actual expenditure and quantities up to the time of preparation of RCE and for the balance period on the basis of projections. The establishment charges in RCEs should not be based on the percentage of the revised cost of the works.
- The increase in the estimated cost over the sanctioned estimates should be computed under the following heads. Detailed reasons for such increases should also be given:
  - Cost increase due to exchange rate variation (if applicable)
  - Cost increase due to escalation of prices or material, equipment and labour
  - Cost increase due to inadequate provisions/new items
  - Cost increase due to change in quantities/scope/design parameters; and

- Cost increase due to other reasons (to be specified)
- In case the time gap between the techno-economic approval of the scheme by CEA and actual start of work on the project is three years or more, the scheme with the Revised Cost Estimates should be submitted to CEA for fresh techno-economic approval before starting the works.
- Where expenditure much in excess of the approved cost of a project has been incurred without getting the approval of the Revised Cost Estimates, the Head of the Department/Project would have to satisfy himself about the reasonableness of the same, as CEA would not be able to examine such fait accompli Revised Cost Estimates.
- Generating Company shall include Financial package in the RCE
- Generating Company shall include tariff calculations – first year tariff and levellised tariff in the RCE.
- RCE shall conform to the checklist prescribed by the Authority.

#### **2.14 Concurrence to Final Completion Cost**

- As per the Tariff Notification of Govt. of India dated 30<sup>th</sup> March, 1992 (as amended from time to time), the actual capital expenditure incurred on completion of the project shall be the criterion for fixation of tariff. Where the actual expenditure exceeds the approved project cost, the excess expenditure over & above that approved by the Authority shall be deemed to be the actual capital expenditure for the purpose of determining the tariff, provided that such excess expenditure is not attributable to the generating company or supplier of contractors.
- The notification also provides that where a power purchase agreement entered between the generating company and the Board prescribed a ceiling on capital expenditure, capital expenditure shall not exceed such ceiling. In case of multi unit projects, the percentage of capital cost is specified in the techno-economic clearance, which

is considered for fixation of tariff after commercial operation date (COD) of the progressive units. In case of delay in commissioning of second or subsequent unit from the schedule dates, the project cost for the period of delay shall be retrospectively approved for the tariff purpose in the ratio of proportionate allocation of units.

- In order to meet the above obligations, the following conditions are stipulated in the Office Memorandums conveying TEC to the generating projects:
  - The completion cost of the scheme shall be submitted to the Authority duly recommended by competent Government for approval as soon as possible after the commercial operation date (COD) of the plant but not later than three months from the COD of the plant.
  - Completion cost of the scheme shall not exceed the TEC approved cost except on account of variation in foreign exchange. Change in rates of statutory taxes and duties and changes in Indian Law resulting in change in cost.
- The generating company shall prepare Final Completion Cost of Hydroelectric Scheme including cost estimates for civil works and Electrical & Mechanical works as per “Guidelines for Submission of Completed Cost for Hydroelectric Schemes” published by Central Electricity Authority.
- The increase in completed cost on account of the delay in following shall not be taken into account:
  - Acquisition of land
  - Finalization of Power Purchase Agreement
  - Financial Closure

## **2.15 Modalities of Simplified Transfer of Techno –Economic Clearance**

CEA has evolved Modalities of Simplified Transfer of Techno – Economic Clearance of Hydroelectric Schemes already cleared by

CEA in the name of other Agency. These modalities are below:

### **2.15.1 For Schemes without any change in Scheme Features and Cost Estimates**

- i) In case the new agency furnishes a certificate to the effect that there is no change in the cost estimates and in the project features as was approved by the Authority originally, the TEC will be transferred to it by the Authority on receipt of the following:
  - a) A request by the new agency for transfer of TEC.
  - b) Approval of the Competent Government(s) for transfer of the scheme to the new agency.
  - c) Approval of the Competent Government(s) in favour of the new agency.
  - d) Implementation Agreement between the new agency and the Competent Government(s).
  - e) Compliance of Electricity Act, 2003.
- ii) The above transfer of TEC shall be subject to furnishing the following by the new agency within **ONE YEAR** of the transfer of TEC.
  - a) Clearance of CWC from Inter-State/Country aspects.
  - b) Consent of beneficiaries to purchase power from the project.
  - c) Valid Environment and Forest clearance in the name of the new agency.

### **2.15.2 Schemes Envisaging Changes in Scheme Features and/or Cost Estimates**

- i) In case the new agency envisages changes in the scheme cost estimates and/or changes in the scheme parameters of the project with respect to the Techno-Economic Clearance already accorded by the Authority, the transfer of TEC in the name of new agency shall be effected, on submission of the documents mentioned at 1(i) (a) to (e). Such transfer shall be valid for a period of **TWO YEARS**, within which, the new agency shall furnish the following in respect



of the revised scheme, for consideration of fresh Techno-Economic Clearance, by the Authority:

- a) Cost estimates, updated hydrology, optimization studies, technical parameters, etc. with supporting details and justification.
- b) Compliance of Electricity Act, 2003.
- c) Clearance of CWC from Inter-State/Country aspects.
- d) Consent of beneficiaries to purchase power from the project.
- e) Valid Environment and Forest clearance in the name of the new agency.

**2.15.3.** Authority shall have the right to revoke the transfer of TEC, if any of the conditions stipulated in para 1 & 2 above are not fulfilled.

## **2.16 Estimation of Realistic Cost**

While estimating the cost of civil and electro-mechanical works, the generating company shall take into account the following for arriving at the realistic cost of the scheme:

- The layout of the dam, water conductor system and powerhouse should be optimum.
- New technology in designs of various structures and construction of various components of the projects shall be adopted.
- Adequate techno- economic analysis shall be carried out for adopting turnkey based contract or with many packages.
- Adequate designs shall be carried out for realistic estimation of quantities of civil works.
- The rating of Electro-mechanical equipment shall be optimum.

**SUMMARY OF GUIDELINES FOR FORMULATION OF PROJECT REPORTS OF HYDRO ELECTRIC POWER PROJECTS**

**1. INTRODUCTION**

Hydro Power Schemes are broadly classified as run-of-river schemes and storage schemes. The Detailed Project Report (DPR) for these works should be formulated by the State Electricity Boards (SEBs), Public Sector Undertakings, Private Sector/ Joint Sector Utilities/ Companies who intend taking up the projects for implementation and forward to CEA for techno-economic concurrence. DPR for hydroelectric schemes would be submitted to CEA, while DPRs for multi-purpose project would be submitted to Central Water Commission. Submission of the Schemes shall be as follows (i) Three stage clearance for Central Sector Hydro Electric Schemes (Cost estimates for Stage –I activities, Feasibility Report (FR) for assessing commercial viability, Cost estimates for Stage –II activities) (ii) Appraisal of Hydroelectric Schemes for concurrence (Detailed Project Report).

**2. POWER POTENTIAL STUDIES**

In order to optimize installed capacity, Power Potential Studies should be carried out based on the 90% dependable flows, considering number of alternatives of installed capacities. The total energy generation during the 90% dependable year is computed for each of the alternatives of installed capacity. The benefits of the project with different installed capacities should be evaluated to determine the optimum installed capacity. For this purpose, the costs of generation from alternative sources such as coal based thermal, gas turbines and combined cycle gas turbine are worked out. The least cost of energy from among the three options (Thermal, GT and CCGT) is adopted for evaluating the benefits of installation considering the corresponding load factors of operation.

**3. ALTERNATIVE & STATE OF PREPAREDNESS**

In the DPR, various alternatives studied and justification for the finally

accepted proposal should be clearly brought out. The state of preparedness and infra-structural back up should be spelt out. It is advised that the promoters/ developers of power projects familiarize themselves with updated relevant documents and prepare DPR as per latest practice.

#### **4. FINANCIAL LIMITS**

Government of India has fixed Rs 1000 crores in relation to hydroelectric generating stations prepared by a Generating company selected through a process of competitive bidding by competent Government or Governments, Rs 2500 crores for generating stations where tariff for sale of electricity is determined by CERC/ SERC, Rs 20,000 crores for a generating company not owned by Government for supply to more than one state and approved in accordance with a scheme proposed by a committee authorized by Central Government and Rs. 250 crores for other hydro-electric schemes, as sum of capital expenditure exceeding which the scheme shall be submitted to Central Electricity Authority for its concurrence. However, all hydroelectric schemes utilizing waters of inter-state rivers shall be submitted to CEA for its concurrence.

#### **5. THREE STAGE DEVELOPMENT FOR CENTRAL SECTOR PROJECTS**

Three-stage development procedure for Central Sector Hydro Electric Schemes shall be as follows:

##### **(a) Cost Estimates for Stage-I Activities**

- The generating company shall prepare and submit cost estimates of Stage-I activities of the projects included in National Electricity Plan for vetting by the Authority (CEA).
- The report shall contain the justification for taking up of the proposed scheme for survey & investigation.
- The activities under Stage-I shall be completed within one year from the date of sanction.

**(b) Commercial Viability on Feasibility Report**

- The generating company shall prepare a Feasibility Report (FR) and submit for according the commercial viability by the Authority (CEA).
- The FR should establish whether the scheme is conceptually sound and feasible.

**(c) Cost Estimates for Stage-II Activities**

- The generating company shall prepare and submit cost estimates of Stage-II activities for vetting by the Authority.
- Stage-II activities shall normally be completed in 1½ years from the date of sanction

**6. SUBMISSION OF SCHEME FOR CONCURRENCE UNDER SECTION 8 OF ELECTRICITY ACT 2003**

The Developer / State Governments after completing essential site survey and investigation will prepare Detailed Project Report (DPR) of Hydroelectric Project in accordance with the “Guidelines lines for preparation of Detailed Project Report of Irrigation & Multipurpose Projects” published by erstwhile Ministry of Irrigation (Now MOWR)/ Central Water Commission (revised from time to time). Cost estimates of civil works in DPR shall be as per “Guide lines for preparation of Estimates for River Valley Projects (latest edition)” published by Central Water Commission. The Electrical & Mechanical cost estimates shall be prepared as per CEA formats. Developer/State Government after obtaining the required clearances shall submit to the Central Electricity Authority the complete DPR for obtaining Techno Economic Clearance.

To ensure speedy processing, CEA on its part has prescribed the following procedure/ sequence of activities and timeframe for processing:

<b>Sl. No.</b>	<b>Activity</b>	<b>Time (Days)</b>
1.	Registration, first stage checking of legal and other major inputs/ clearances as per check list.	3
2.	Distribution of DPR	2
3.	Second stage checking of the completeness of DPR	7
4.	Detailed Examination of DPR in various specialized formations of CEA/CWC/GSI (as applicable) and issue of comments	21
5.	Furnishing of clarifications by Utilities	7
6.	Pre-SPAC discussions/Site visit	10
7.	Notice period for SPAC Meeting	5
8.	SPAC meeting and issue of Minutes	5
9.	Furnishing of clarifications by Utilities	7
10.	Examination of Clarification and Notice period for TEC Meeting	7
11.	TEC Meeting/ resolving of issues raised in the meeting and Finalization/ Issue of Minutes	10
12.	Issue of TEC letter	6
	<b>Total</b>	<b>90</b>

In order to facilitate quick examination and processing of the Detailed Project Report (DPR) for Techno-economic clearance of CEA, formats and procedure have been devised and included in the Guidelines. Two check lists have also been included to be filled in and submitted along with DPR. To facilitate simultaneous examination of the DPR in different formations, sixteen copies are required to be submitted. The DPR should conform to the stipulations made in the Check List-A and Check List-B. The complete details of the check list are given in the document "Guidelines for formulation of Project Reports for Power Projects" issued by CEA in October, 2002.

The DPR (complete document) may also be submitted on Compact Disk (CD) for facilitating quick examination/ checking. The power potential calculations etc may be submitted in Microsoft office (Excel) format.

The Check List-A is for checking of legal and other major clearances at the time of receipt/registration of DPR. If the requirements as per Check List-A are not met, the proposal would not be accepted for processing in CEA. If the requirements as per Check List-A are met, the proposal would be examined for meeting the requirement as per Check List-B. The Check List-B is for checking of the completeness of the DPR. If the requirements as per Check List-B are not there, the proposal would be returned.

If the proposal is found to be meeting the requirements as per Check List-A and Check List-B, it would be further processed and clarifications/ additional information, if necessary, may be sought. If the clarifications/ additional information needed by CEA are not received within the time stipulated by CEA, the proposal will be deemed as returned.

For such proposals deemed as returned, project authorities would be required to submit the proposals afresh and the case would be processed afresh.

## **7. CONTENTS OF DPR**

Detailed Project Report for hydro electric schemes submitted in the CEA for techno-economic clearance should cover the following information:

- Detailed Salient features of the project
- Description of the project proposals
- Cost Estimate for the proposals, Interest during construction & Tariff, etc.
- Phasing of Expenditure, Mode of Funding and Sensitivity Analysis.
- Environment & Forest clearance aspect
- Drawings and PERT Chart

The brief description of the requirements to be mentioned in the DPRs for each of the above aspects is given in following sub paras :

## **7.1 SALIENT FEATURES**

Detailed salient features of the project i.e. Location, Hydrology and climate, Dam, Reservoir, Spillway, Submergence, Diversion/Head Race Tunnel, Sediment chamber, Surge shaft, Penstock, Power house, Tailrace, Switchyard, Power benefits etc. should be mentioned.

## **7.2 DESCRIPTION OF PROJECT PROPOSAL**

Full description of the HE Project viz. Type, Location, Background history, infrastructure Need & Justification of the Scheme from power supply– demand consideration, Population effected by the project, submergence, Inter-state/ International aspects etc. should be given.

Full details of river Basin development, Chapters on Geology, Survey & Investigation, infrastructure works Hydrology, Dam/ Reservoir, Power Potential studies, Project optimization studies, Civil structures, Design of Electrical & Mechanical Equipment, Transmission lines & Telecommunication system, Construction programme, Construction equipment & Plant Planning, Construction Materials, Manpower Planning, Chapter on Economic & Financial studies, Calculations for tariff, Financial packages, Chapter on Environment & Forest aspects, R&R aspects, Calculations for quantities of civil works, Design calculation for Dam, Civil structure etc. should also be submitted.

Preparedness of the project authorities for implementation of the project should be brought out. The DPR should indicate whether necessary studies and investigation have been completed. Alternatives considered and justification for the finally accepted proposal & whether it is least cost option, should be clearly brought out.

## **7.3 COST ESTIMATES, INTEREST DURING CONSTRUCTION AND TARIFF**

The cost estimate for Civil, E&M works along with General Abstract of cost should be prepared on the basis of “Guidelines for Preparation of Project Estimates for River Valley Projects” March 1997 issued by

Central Water Commission. The details of cost of generation/sale rate, tariff, depreciation etc. should be as per various GOI Notifications & Guidelines and incorporated in the project report. The cost estimates of Electrical & Mechanical equipment shall be prepared as per CEA formats.

The cost estimates should be prepared on the basis of prevailing prices of various materials and equipment/budgetary offers at the time of preparation of the estimates. The price level reference currencies alongwith their exchange rates and their reference period, contingencies adopted for working out cost estimates should also be furnished in the project report. The foreign exchange requirement and details of important equipment may be separately indicated in the prescribed formats of CEA.

The cost estimates should also include Interest During Construction (IDC) and detailed calculations thereof should be furnished in the project report, clearly indicating the extent of equity and debt. Completed cost (for private generating companies), Present Day Cost (both for SEBs and for Generating Companies in Public Sector) may be incorporated as per various prescribed formats in the report. Chapter on Economic & Financial studies, Calculations for tariff & Financial packages should also be included.

#### **7.4 PHASING OF EXPENDITURE, MODE OF FUNDING & SENSITIVITY ANALYSIS**

Year-wise and work-wise requirements of funds for execution of the project may be worked out and indicated in the Report. Details as to how the cost of the project would be financed should be clearly indicated.

Although the Project Report is prepared on the basis of realistic assumptions/ estimates, there is every possibility that these assumptions may undergo change. It may therefore, be necessary to carry out sensitivity analysis to indicate the projects financial viability of the project when there are changes in the estimates of any parameters



such as Capital Costs, Foreign Exchange Component, Operating Cost, etc. The extent of changes could be based on past experience.

## 7.5 ENVIRONMENT AND FOREST CLEARANCE ASPECT

All hydro- electric projects, with investment of Rs 50 crores or more, require the clearance of the Ministry of Environment and Forest from the environmental angle. A notification issued by MOE&F, on 27.1.94 has made environment clearance statutory for river valley, hydro electric and major irrigation projects and their combination including flood control projects. In April, 1997, MOEF had made public hearing as statutory for all departmental projects including hydro-electric projects.

In case the construction of hydro projects involves diversion of forest land for non-forest use, its clearance is required from MOE&F in terms of Forest (Conservation) Act, 1980 (reported under revision).



*View of Balimela P.H. Orissa (6 x 60 MW)*

## 7.6 DRAWINGS & PERT CHART

All drawings including Location Map, Index Map, Hydrological Map, Contour Plans, various drawings of dam/civil structure, Layouts of the power house, head works, water conductor system, transmission lines, Single Line Diagram for Relaying & Metering for the power house should be furnished. Single line diagram of the layout of the sub-station and a PERT Chart for the project execution activities may also be furnished.

### **CHECK LIST-A FIRST STAGE CHECK LIST FOR HYDRO ELECTRIC PROJECTS**

- a) Registration of the Company as per the Company Act and authorization of the State Government/Central Government as the case may be in accordance with “Electricity Act, 2003”.
- b) Compliance of “Electricity Act, 2003”, with reference to the Publication of the scheme in State Gazette and newspaper.
- c) Land & water availability certificate from State Government.
- d) Clearance from Ministry of Environment and Forest, Govt. of India.
- e) Justification of the Scheme from power supply demand consideration
- f) Completed cost , Present Day Cost (for SEBs) and both for Generating Companies in Public Sector as per CEA formats.
- g) Financial & Commercial aspects as per CEA format.
- h) Defence clearance if applicable.
- i) Salient features as per CEA format
- j) Cost estimates as per CEA format.

### **Legal Aspects (As applicable)**

- Compliance as per Electricity Act, 2003
- Power Purchase Agreement (PPA)

- Tariff Notification
- Equity Participation
- Change of name of implementing agency
- General / Specific conditions

## **CHECK LIST-B SECOND STAGE CHECK LIST FOR HYDRO ELECTRIC PROJECTS**

### **A Hydro Electric Schemes Description**

- a) General Data of Project (Location, State, District etc.)
- b) Registration of the Company as per the Company Act and authorization of the State Government/Central Government as the case may be in accordance with “Electricity Act, 2003”.
- c) Compliance of “Electricity Act, 2003”, with reference to the Publication of the scheme in State Gazette and newspaper.
- d) Land & water availability certificate from State Government.
- e) Clearance from Ministry of Environment and Forest, Govt. of India.
- f) Justification of the Scheme from power supply – demand consideration
- g) Completed cost, Present Day Cost (for SEBs) and both for Generating Companies in Public Sector as per CEA formats.
- h) Financial & Commercial aspects as per CEA format.
- i) Rehabilitation and resettlement plan from State Revenue Department.
- j) Defence clearance if applicable.
- k) “Electricity Act, 2003” (for private sector projects).
- l) Competent Government’s recommendation of DPR and cost (in case of private generating companies).
- m) Detailed information regarding the following aspects of concerned H.E. Project must be incorporated in the Detailed Project Report/ Feasibility Report:
  - i) Planning

- ii) Inter-state/ International aspects
- iii) Surveys (Topographical, construction material etc.)
- iv) Investigations (Geological, Seismic, Foundation, Hydrological and Meteorological etc.)
- v) Hydrology
- vi) Land acquisition and resettlement of oustees
- vii) Design & model studies carried out
- viii) Flood control & Drainage
- ix) Power planning & related proposals regarding transmission system, energy charges etc.
- x) Construction programme and man power & plant planning.
- xi) Foreign exchange & financial resources
- xii) Estimates
- xiii) B.C. Ratio & Revenue.
- xiv) Ecological aspects & Soil Conservation (if needed).

**B Details of financial package**

- a) Financial package should be in CEA prescribed Performa 1001-1004 filled up as under
  - 1001 Financial package Summary.
  - 1002 Financial Package Abstract.
    - Broad details of hard cost, interest during construction and financing charges.
  - 1002 Financial Package Abstract.
    - Financial structure i.e. Amount of foreign/domestic debt and equity (foreign/ domestic/ promoters/ other partners), exchange rates etc.
  - 1003 Financial Package Details.

- Details of each debt package (amount, source, interest rate, repayment period, moratorium period, financing charges etc.)
- 1004 - Phasing of expenditure & drawl of fund statement.
- b) Commitment letters from foreign/ domestic lenders along with their terms and conditions.
- c) Equity partner agreement
- d) Package wise Interest during Construction (in respective currency) along with detailed calculations.
- e) Package wise Financing Charges (in respective currency) including guarantee fee and commitment charges along with calculations.
- f) In case of projects of SEBs / Central Sector the calculations of IDC and financing charges are required both at current and completed costs.

### **C Break up of Cost Estimates**

Break up of Cost Estimates of Electrical & Mechanical and Civil works of Hydro Electric Project as per CEA format / CWC Guidelines.

### **15. CONCURRENCE TO REVISED COST ESTIMATES**

In every case where the project cost over-run is 20% and is accompanied by time over-run of over 10% or such other time and cost over-run norms as may be deemed appropriate by the Authority, the revised cost estimates shall be prepared by the generating company and submitted to the Authority for approval including cost estimates for civil works and Electrical & Mechanical works.

- The increase in the estimated cost over the sanctioned estimates should be computed under the following heads. Detailed reasons

for such increases should be also be given:

- Cost increase due to exchange rate variation (if applicable)
  - Cost increase due to escalation of prices or material, equipment and labour
  - Cost increase due to inadequate provisions/new items
  - Cost increase due to change in quantities/scope/design parameters; and
  - Cost increase due to other reasons (to be specified)
- In case the time gap between the techno-economic approval of the scheme by CEA and actual start of work on the project is three years or more, the scheme with the Revised Cost Estimates should be submitted to CEA for fresh techno-economic approval before starting the works.

## **16 CONCURRENCE TO FINAL COMPLETION COST**

- As per the Tariff Notification of Govt. of India dated 30<sup>th</sup> March, 1992 (as amended from time to time), the actual capital expenditure incurred on completion of the project shall be the criterion for fixation of tariff. Where the actual expenditure exceeds the approved project cost, the excess as approved by the Authority shall be deemed to be the actual capital expenditure for the purpose of determining the tariff. Provided that such excess expenditure is not attributable to the generating company or supplier of contractors.
- The notification also provides that where a power purchase agreement entered between the generating company and the Board prescribed a ceiling on capital expenditure, capital expenditure shall not exceed such ceiling. In case of multi unit projects, the percentage of capital cost is specified in the techno-economic clearance, which is considered for fixation of tariff after commercial operation date (COD) of the progressive units. In case

of delay in commissioning of second or subsequent unit from the schedule dates, the project cost for the period of delay shall be retrospectively approved for the tariff purpose in the ratio of proportionate allocation of units.

- In order to meet the above obligations, the following conditions are stipulated in the Office Memorandums conveying TEC to the generating projects:
  - The completion cost of the scheme shall be submitted to the Authority duly recommended by competent Government for approval as soon as possible after the commercial operation date (COD) of the plant but not later than three months from the COD of the plant.
  - Completion cost of the scheme shall not exceed the TEC approved cost except on account of variation in foreign exchange. Change in rates of statutory taxes and duties and changes in Indian Law resulting in change in cost.

## **17 MODALITIES OF SIMPLIFIED TRANSFER OF TECHNO – ECONOMIC CLEARANCE**

CEA has evolved Modalities of Simplified Transfer of Techno – Economic Clearance of Hydroelectric Schemes already cleared by CEA in the name of other Agency.