CENTRAL ELECTRICITY AUTHORITY

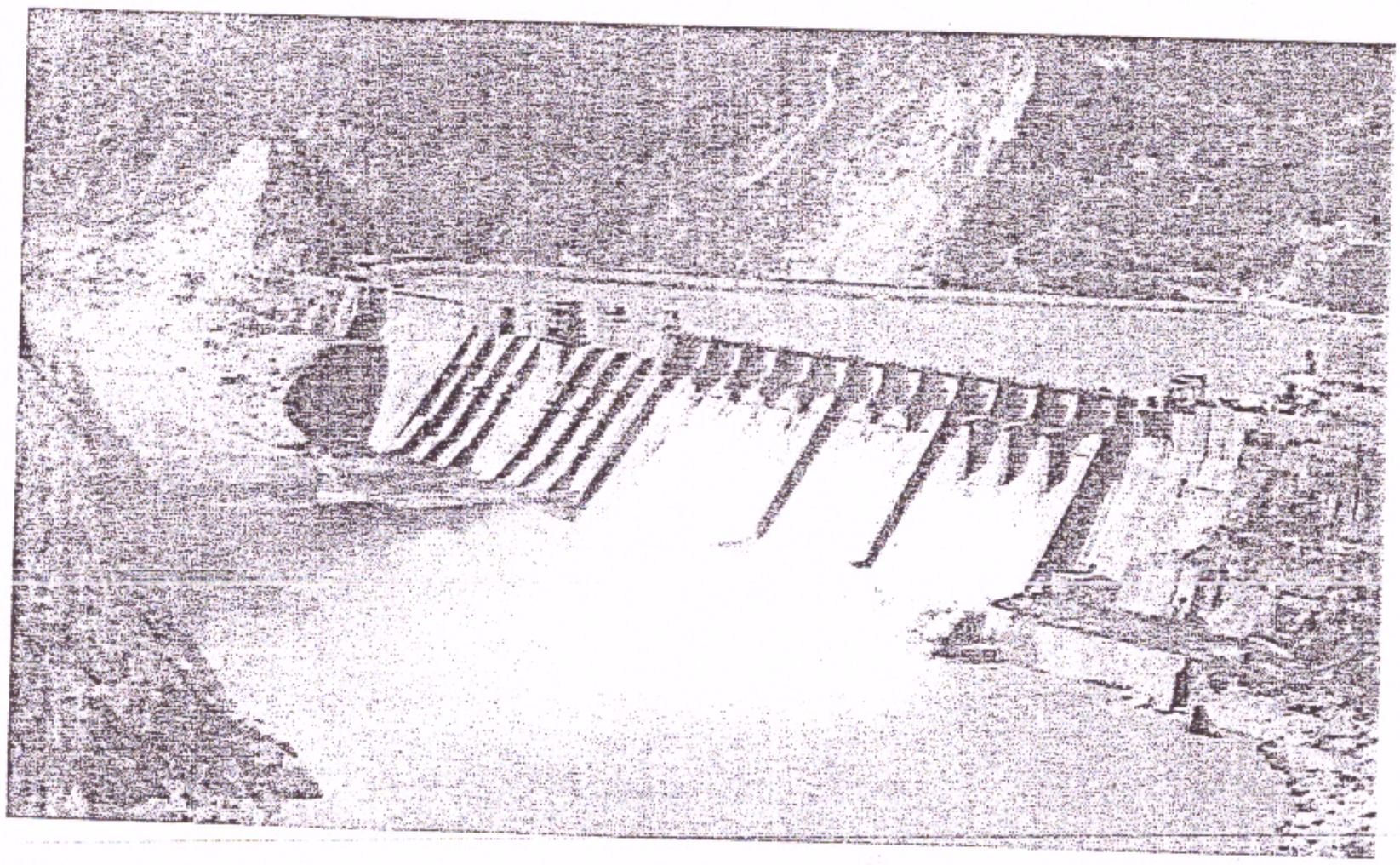
REPORT OF THE COMMITTEE TO FORMULATE GUIDELINES FOR PROCESSING CASES

FOR

REVISION OF DESIGN ENERGY

OF

HYDRO ELECTRIC STATIONS IN OPERATION



AUGUST, 2004
NEW DELHI

REPORT OF THE COMMITTEE FOR REVISION OF DESIGN ENERGY FOR HE STATIONS IN OPERATION

1.0 BACKGROUND:

1.1 CERC in their Order No. 20/3(10)/2001/CERC dated 16.8.2001 (Copy of extracts enclosed as Annex.-IV) desired that design energy benefits of all existing hydro power stations of NHPC & NEEPCO be reviewed by CEA. The following observations were made by CERC on operational norms of hydro power stations under its jurisdiction:

i) Design Energy set out in the Techno-Economic Clearance of the Authority be considered for fixation of tariff.

ii) In case of multi-unit projects, the Design Energy applicable on commissioning of units shall be as set out for the respective unit in the Techno-Economic Clearance of the Authority.

iii) The Authority may review the Design Energy on completion of the project to consider additional hydrological data which would become available and latest status of completion/ commissioning of upstream projects involving consumptive use of water.

iv) The Authority may also review the Design Energy subsequent to the commissioning of the project as and when any specific information about the change in consumptive use of water upstream or in run off is brought to the notice of the Authority.

v) The design energy presently in use shall continue to be used for tariff purposes. However, the authority may take necessary action to review the design energy of all NHPC and NEEPCO projects within a period of 2 years from the issue of this order.

1.2 The matter for revision of Design Energy was discussed in the CEA, Authority meeting No. 11/2003 held in Dec., 2003 and it was decided that a Committee be constituted to frame guidelines for processing the cases for revision of design energy benefits in respect of existing stations. Committee was constituted for the purpose vide Secretary, CEA Office Order No. 5-41(5)/Secy-2004 (CEA)/61 dated 9.3.04 (Annex.-II).

1.3 COMPOSITION OF THE COMMITTEE

The composition of the Committee is as under:

S. No.	Name & Designation	
1	Sh. S.M. Dhiman, CE (HP&I), CEA	Chairman
2	Sh. M.P. Singh, Director (HPA), CEA	Member
3	Sh. Shankar Mahto, Director, Hyd. (NE), CWC	Member
4	Sh. Naresh Kumar, Director, HCD(N&W), CWC	Member
5	Sh. M.M. Rawal, Director (HP&I), CEA	Member-Secretary

Subsequently with the approval of Member (Hydro), Sh. B. Poddar, Director (HE&RM) was co-opted as member of the Committee vide CE (HP&I) order No. 3/58/2004-HP&I(1)/164-71 dated 25.3.2004 (Annex-III).

1.4 TERMS OF REFERENCE

The terms of reference of the Committee have been defined as :

"The Committee shall study CERC orders in this respect and would formulate comprehensive guidelines for the utilities to facilitate them to prepare proposals for review of design energy of the Hydro Electric Stations and appraisal of the proposal in CEA/ CWC."

1.5 RECOMMENDATIONS OF THE COMMITTEE

The Committee for review of Design Energy held 3 (three) meetings and guidelines proposed by the Committee for submission of proposal for revision of design energy benefits from HE stations in operation are given as Annex-I

(Shankar Mahto) 11/8/2004
Director, Hyd.(NE), CWC
Member

11/8/04
(B. Poddar)
Director (HE&RM),
CEA
Member

(Naresh Kumar) 11/8
Director, HCD(N&W),
CWC
Member

11/8/2004
(M.P. Singh)
Director(HPA), CEA
Member

11/8/04
(M.M. Rawal)
Director (HP&I), CEA
Member-Secretary

S.M. Dhiman
11/8/2004
(S.M. Dhiman)
CE (HP&I), CEA
Chairman

ANNEX.-I

GUIDELINES FOR SUBMISSION OF PROPOSAL FOR REVISION OF DESIGN ENERGY OF HYDRO ELECTRIC STATIONS

1.0 OBJECTIVES

These guidelines have been framed for submission of proposals for review of Design Energy of HE stations in operation for consideration by CEA. Even though efforts have been made to incorporate all the relevant aspects in the guidelines, however, hydro developments being site-specific, it is possible that in some cases, additional information may be required to process the proposals for review in an expeditious manner which would be sought by CEA, wherever required.

2.0 PREPARATION OF PROPOSAL FOR REVISION OF DESIGN ENERGY

The request for revision of design energy from the project authority shall be accompanied with the following:

2.1 Proposal Outline

The proposal for revision of Design Energy shall contain a brief background of the project including layout plan and salient features of the project, as cleared and as finally constructed, reasons for the need to revise Design Energy, upstream and downstream developments since commissioning of the project etc.

The proposal should be accompanied by copy of letter of TEC (along with enclosures, if any) accorded by CEA to the project and all the relevant data including the following as considered for assessment of energy benefits at the time of TEC :

- Hydrological flow series and Hydrological year
- Design/ rated head
- Tail water Level and Rating Curve
- Area-Capacity characteristics of reservoir/ pondage, if necessary
- Losses in Water Conductor system
- Overall TG efficiency
- D/S releases for sustaining acquatic life or for any other purposes, if any
- Flushing discharges, if any

2.2 Hydrological Data

For the Review of Design Energy, it is essential to have site-specific Hydrometeorological data. It is therefore, desirable that the Hydro-meteorological sites established for the project at the DPR/ construction stage should remain in operation even during operation of the station for subsequent review of Design Energy, if any. Following aspects need to to be considered while framing proposal for Review of Design Energy :

i) If the project was conceived based on other than site specific or synthetic data and at the review stage if site specific data are available, then before clubbing both set of data, their validation is essential. In case of discrepancy, the precedence should be given to the site-specific data.

ii) The flow series to be utilized for estimation/Review of Design Energy should be continuous in time, as far as possible.

iii) All locations of sites and observations shall be as per ISI/IMD standards. Methodology adopted shall be described.

iv) A brief note about quality, consistency, processing of data including filling of gap etc should be prepared & enclosed with data/study set.

2.3 Hydro-meteorological data

2.3.1 General Information about the Region

The proposal should contain sufficient information about the types of climate, season, type of monsoon causing rainfall and general hydrologic regime of the river. In addition, following maps and tables should be included to support these details:

- Index map showing the boundaries of all the areas and reaches of interest
- Annual normal rainfall map of the region
- Table or bar charts showing monthly, normal and extremes of rainfall-number of rainy days
- Average ten daily, monthly and annual flow data
- River profile, cross-section and roughness coefficient for the reaches relevant to the project.

2.3.2 Presentation of Hydrological and Meteorological Data

Description of the available hydrological and meteorological data, supported by inventories in the form of bar diagram indicating

source-location and altitude ... the station drainage ... within the areas of interest and surrounding region shall be furnished in respect of the following.

- Rainfall and Snowfall
- Pan Evaporation
- River Gauge and Discharge

A map to a scale of 1:50,000 depending upon the size of the area involved, showing the location of relevant hydrological and meteorological stations, shall be furnished with the proposal.

2.3.3 Period and Frequency of Hydro-Meteorological Data

Broad guidelines regarding the length and frequency of hydrological observations are indicated below:

Sr. No.	Type of Information	Desirable length (years)	Frequency
I	River gauge data	10	Daily at 0800 hrs. During monsoon at hourly interval. Either manually or by automatic water level recorder.
II	River flow discharge	10	Daily. Preferably by area velocity method by using current meter.
III	Rainfall by ORG (Ordinary Rain Gauge)	10	Daily. By ordinary Rain Gauges and concurrent with flow data.
IV	Rainfall by SRRG (Self Recording Rain Gauge)	10	Continuously in calibration with ORG
V	Pan Evaporation	3	Daily

For Storage Based Reservoir Schemes, hydro-meteorological data need to be considered for a longer period of about 25 years.

2.4 Abstraction

Details of abstraction in upper reaches should be simultaneously collected to help work out water availability series at the point of interest.

2.5 Losses in Water Conductor System

Project Authorities shall submit drawings of water conductor System right from the intake to exit point in the power house indicating final length and layout including bends and diameter of various sections including constrictions and expansions and type of lining etc. Project Authorities shall also furnish details of Water Conductor System considered at the time of techno-economic clearance of the Project.

Project Authorities shall furnish head loss, as considered while deciding the net heads. Detailed calculations of head loss shall be worked out corresponding to full load and design discharges as per established practices/ formulae and submitted alongwith proposal.

2.6 Head

Project Authorities shall supply the following information pertaining to head :

- Minimum net head (m) (as per original design)
- Maximum net head (m) (as per original design)
- Rated design head (m) (as per original design)
- Minimum net head (m) available at site
- Maximum net head (m) available at site
- Measured head (m) available at site and reasons for deviations, if any

2.7 Tail Water Level

Project Authorities shall supply tail water rating curve at Power House site. In addition, based on the above, following levels may also be indicated :

- Minimum water level (one unit discharge without any load)
- Maximum water level (with all units discharge at full load)
- Water levels at
  - One unit full discharge
  - Two units full discharge
  - Three units full discharge etc.

2.8 Efficiency Data

Weighted average efficiency of turbine and generator as available in the Guaranteed Technical Particulars of the suppliers based on which overall efficiency computed and utilised for design energy

review may be specified. Copy of Guaranteed Technical Particular of suppliers may be furnished. Overall TG efficiency considered for assessment of benefits at the time of accord of TEC may also be furnished. Further, efficiency curves at full load and part loads may also be included in the proposal.

2.9 Data pertaining to Storage Based Schemes

In case of reservoir storage hydro schemes, detailed reservoir simulation studies needs to be carried out considering hydrological series based on actual observed flow data. Simulation studies should take into account:

i) Rule curve for reservoir operation,
ii) Flood moderation aspects,
iii) Committed releases for irrigation or any other use in the downstream,
iv) Additional/ regulated flows made available by upstream developments, if any.

In addition following information, based on which studies have been carried out, may also be incorporated :

- Sedimentation studies
- Original & Revised Elevation-Area-Capacity curve of the Reservoir. Methodology used for developing revised curve.
- Actual Live storage available
- Impact on down stream developments
- Evaporation Losses

2.10 Power Benefits

2.10.1 As per norms issued by Govt. of India, "**Design Energy**" means the quantum of energy, which could be generated in a 90 percent dependable year with 95 percent availability of installed capacity of the station:

Explanation- If the total energy generation in the years for which hydrological data is available (say N years) is arranged in descending order, the (N+1) x 0.9 th year would represent the 90 per cent dependable year. The 90 per cent dependable year is a year in which the annual energy generation has the probability of being equal to or in excess of 90 per cent of the expected period of operation of the scheme.

Based on revised hydrological flow series at the project site (taking into consideration abstractions upstream, if any) design energy benefits from the project would be estimated by Project Authorities for 90% dependable year and presented in the proposal. Project Authorities would also furnish design energy benefits from the project as approved at the time of techno-economic clearance by CEA or subsequent design energy reviews, if any. Additional energy generation from the project achieved after carrying out R&M works on the Units, if any, may also be indicated.

2.9.2 In case there is less energy than the design energy as approved during TEC, reasons for the same need also to be elaborated in the proposal.

2.11 General Information

- Date of Commissioning of the units/ Station.
- Annual Generation since commissioning.
- Past performance of the station incuding any major break-down faced by the station.
- Loss of generation due to power evacuation problem.
- Variations in features of the scheme vis-à-vis that incorporated in the approved DPR, if any.

3.0 FREQUENCY OF DESIGN ENERGY REVIEWS

3.1 As per CERC orders, review of Design Energy of the station may undertaken as below:

- After every five years
- Upon completion of the project to consider additional hydrological data which would become available and latest status of completion/ commissioning of upstream projects involving consumptive use of water
- subsequent to the commissioning of the project or as and when any specific information about the change in consumptive use of water upstream or in run off is brought to the notice of the Authority

4.0 VISIT TO HYDRO-METEOROLOGICAL SITE

4.1 A list of projects to be taken up for review of the Design Energy would be prepared by Project Authorities in advance and submitted to CEA indicating names of G&D sites and rainfall stations whose data will be utilized for the review to enable timely review of hydrological data.

4.2 Officers of CWC/ CEA may visit the Hydro-meteorological sites of the project to satisfy themselves about the correctness/ adequacy of the observations as also the maintenance of these sites. The team may also like to examine the methodology being used for taking inflows/ other data and procedure of computations and may suggest measures for proper observation & maintenance. To enable CEA/ CWC to examine these aspects, project authority must indicate their intention of revising the design energy at least 2 years in advance. The concerned organization may nominate a nodal officer to facilitate proper coordination in the matter.

5. FINANCIAL IMPLICATION

Changes in design energy from the project may result in financial implications in respect of sale of power from the station. A note in this regard would need to be appended with the proposal.

6. LEGAL IMPLICATIONS

The revision in the design energy may have implications on the station tariff and may invite legal proceedings from the buyers. A note in this regard would need to be appended with the proposal.

7. OBSERVATIONS OF OTHER UTILITIES/ DEPARTMENTS

In case of change in design energy, if any other Utilities/IPPs/ Deptts. are affected, the same may be clearly brought out in the proposal.

8. OPTIMUM ALTERNATIVES AVAILABLE WITH CONSEQUENCES

Studies may be carried out by the project authorities considering updated/ modified flow series and the results of the same with analysis may be furnished

9. OTHER RELEVANT INFORMATION:

Other relevant information which the project authorities may consider pertinent to the subject may be supplied.