Dam Planning Under the Spotlight

A GUIDE TO DAM SANCTIONING IN INDIA

INTERNATIONAL RIVERS
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August 2013

KyonlageeinadibanDibolagiboxomidhanMurbabeProlayer ban
Xek hobo xoralerdhan
XoralixukabonadijaanMaachPutir hobo tan Mur rahukehti,
murHalikhetiBaliey Jodi jai putiApuniahilekenekexuyamjaalpaan

Why build these mega dams? Give us a reason.
Mega dams bring catastrophe. Our food grain stocks will be wiped out.
Dry spells will kill the flowing river and our fish.
And when sediment ruins our harvest and devastates our lives, how will we welcome you to our wretched homes?

- An Assamese song

About International Rivers

International Rivers is a non-governmental organization that protects rivers and defends the rights of communities that dependon them. International Rivers opposes destructive dams and the development model they advance, and encourages betterways of meeting people's needs for water, energy and protection from damaging floods.

Acknowledgement

In this report, I have tried to sum up the overall process of dam sanctioning in India. Although, this involved a lot of personal effort, it still gives me pleasure to acknowledge the support of a few people for their invaluable inputs and timely help.

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Abbreviations and Acronyms

BIS	Bureau of Indian Standards
CBIP	Central Board of Irrigation and Power
CEA	Central Electricity Authority
CWC	Central Water Commission
DPR	Detail Project Report
EAC	Expert Appraisal Committee (of the MoEF)
EIA	Environment Impact Assessment
ICOLD	International Commission On Large Dams
IMD	Indian Meteorological Department
MoEF	Ministry of Environment and Forests
MoP	Ministry of Power
MoU	Memorandum of Understanding
MoWR	Ministry of Water Resources
NRLD	National Register of Large Dams
PFR	Pre-Feasibility Report
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
RTI	Right To Information
SANDRP	South Asia Network on Dams Rivers and People
ToR	Terms of Reference
USBR	United State Bureau of Reclamation

Introduction

Large dams on India's major rivers are perceived as drivers of growth to meet the soaring demand for water and energy. Hydropower now plays a central role in the country's efforts to boost electricity generation. Northeast India is slated to become the future powerhouse of the country.

This guide by International Rivers explains the sanctioning of dams in India. The country is said to rank fourth in the world in terms of its number of dams and the pace of building new ones. Hydropower is now increasingly in focus in India, overtaking thermal power plants in the development agenda. The Indian government introduced a national policy on hydropower development in1998, which prioritises hydropower with emphasis on unharnessed potential, especially in the Northeast region. However, the tragic human and environmental impacts of such development are largely ignored.

Guidelines for the construction of dams remain unclear, and the government bodies involved lack transparency. This guide[1] seeks to inform civil society about the process of dam sanctioning, with a special focus on hydropower projects. It also points to vital issues of public interest including poor and inadequate policies, lack of consultation with affected communities, and disastrous environmental consequences.

Large Dams in India

With only 4% of the world's freshwater, India supports 17% of world population.

In 1947, there were less than 300 large dams in the country. By 2000, there were over 5,000, more than half of them built between 1971 and 1989. There are 5,100 large dams in India according to recent figures. Of these, 4,710 have been built while 390 are under construction. About 10% of these dams are more than 50 years old, and about 2.7% are more than 100 years old.

What is a Large Dam?

According to the Central Water Commission (CWC), a large dam is one that satisfies any one of the following conditions[2] :

- The length of the crest of the dam is not less than 500 metres.
- The capacity of the reservoir formed by the dam is not less than one million cubic metres.
- The maximum flood discharge dealt with by the dam is not less than 2,000 cubic metres per second
- The dam has especially difficult foundation problems.
- The dam is of unusual design.

Irrigation Projects

While many large dams in India were built for flood control, water supply, and hydropower, their primary objective was irrigation. Irrigation projects constitute the following[3] :

- A *Multipurpose River Project* is a dam on a sufficiently large river extended over a large geographical area. These dams are supposed to serve many purposes simultaneously, such as generating hydroelectricity, providing clean drinking water, irrigating fields, as well as checking floods and the flow of river water.
- A *Major Irrigation Project* is one that has a culturable command area of more than 10,000 hectares.
- A *Medium Irrigation* Projectis one that has a culturable command area[4] between 2,000 and 10,000 hectares.
- A *Minor Irrigation* Project is one that has a culturable command areaup to 2,000 hectares.[5]

Most irrigation dams in India are embankment dams. These dams consist of a wall built across a river valley to impound water so as to form a reservoir upstream, and a system of spillways and gates to bypass the wall in order to maintain normal river flow and channel water to a network of canals feeding irrigated regions downstream. The upstream areas that feed the dam and those submerged by its reservoir make up its *catchment area*, while the downstream areas fed by its irrigation canals make up its *command area*.

Irrigation dams are designed to boost agricultural output. There are advantages to these dams over traditionally used small dykes, sprinklers, and drip irrigation systems, which are slow and irrigate only small areas. However, they have severe detrimental impacts. These dams submerge large tracts of arable land and forests. People living in the catchment area lose

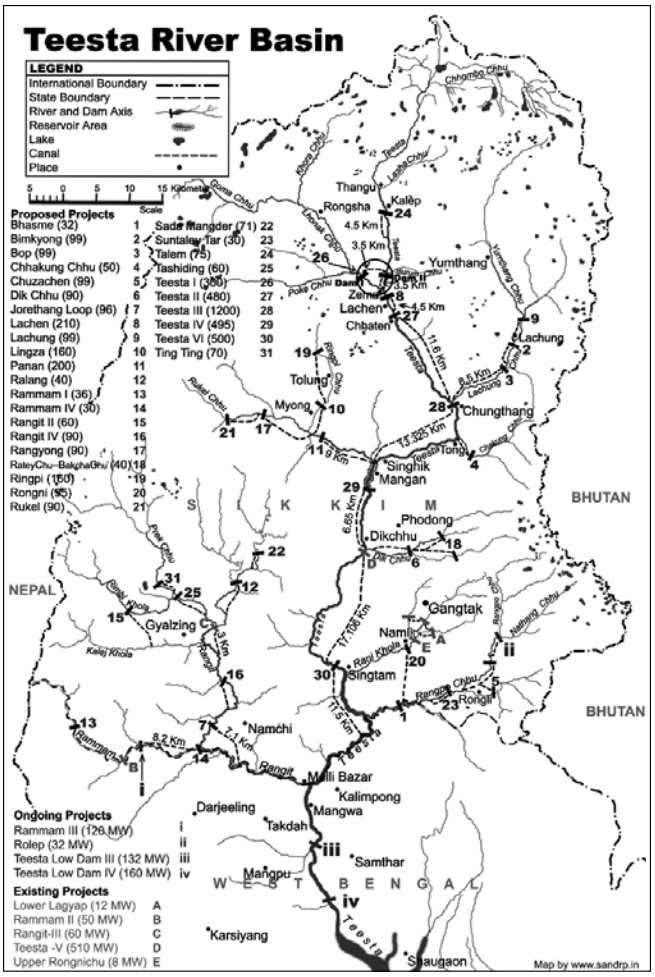
their homes, agricultural lands and livelihoods to the projects, while those in the command area profit from irrigation.

A Spate of Hydropower Dams in Northeast India

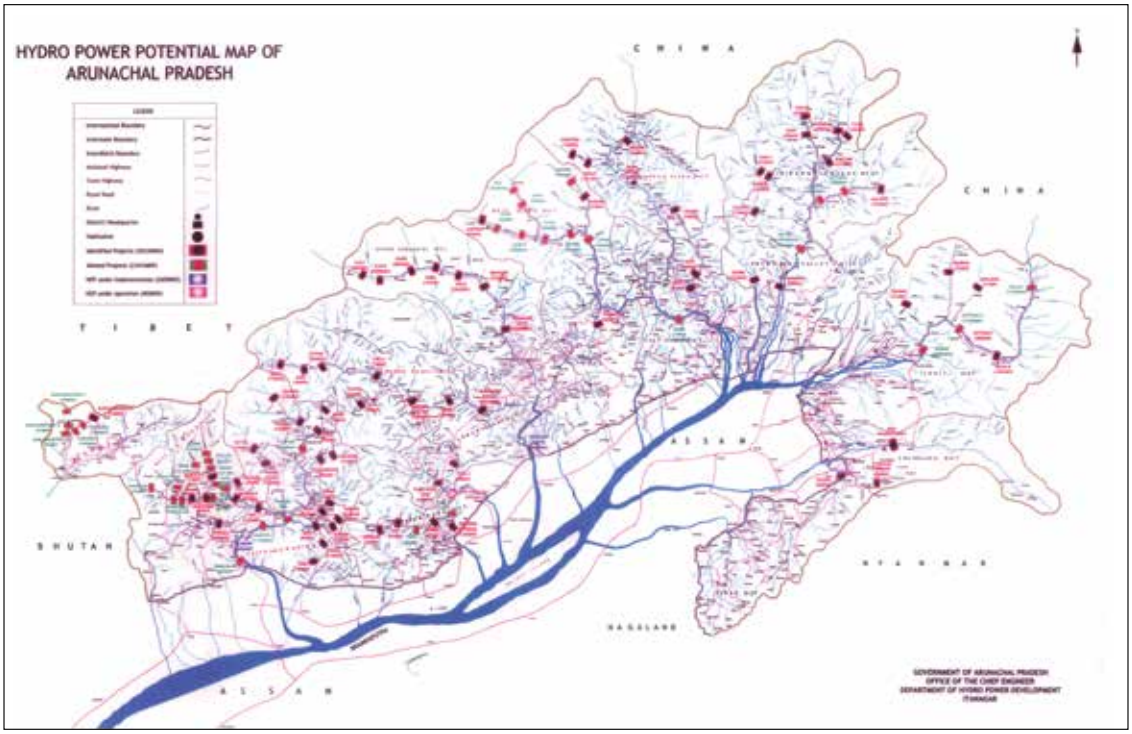
Endowed with rich water resources, Northeast India is fated to become the future source of power for the country. The combined annual water potential of the Brahmaputra and Barak rivers is 586 Billion Cubic Metres (BCM), which is the highest among all rivers basins in India. The government has identified 168 potential large dams with an installed capacity of 63,328 MW in this region.

However, these mega dams are causing conflicts and crises in the Northeast, particularly in the states of Assam, Arunachal Pradesh and Sikkim. Similar conflicts erupt almost every day in the north Himalayan states of Uttarakhand and Himachal Pradesh. Dam engineering in the Himalayas is relatively recent. All aspects of dam building in the Himalayas are not yet fully understood, and the risks not fully appreciated.

Inadequate studies, lack of expertise, and haste in dam building make the situation even worse. Other concerns include the safety of dams and the suitability of their location. Vital considerations of the seismicity of the region and the impacts of climate change are being ignored. While debates about the necessity of dams exacerbate, the concerned ministries in the centre, state departments, and responsible nodal agencies pay no heed to the human and environmental disasters waiting to happen. Despite the controversies they are embroiled in, these dams are being sanctioned and commissioned by state governments at a rapid pace.



Dams proposed in the Teesta River basin.
Map courtesy of SANDRP www.sandrp.in



Hydropower Projects in the 12th Five-Year Plan (2012-17)[6]

The total hydropower potential of identified river basins based on a reassessment study of the Central Electricity Authority (CEA) in 1987 was 94,000 MW. In a 2001 study, the CEA further classified the sites based on certain criteria and increased the total potential to 107,000 MW.

To achieve the ambitious programme of hydropower capacity addition in the 12th Five-Year Plan period (2012-2017), in 2006-07 the CEA identified hydropower projects with an aggregate installed capacity of 58,573 MW. The status of the preparation of the Detailed Project Reports for these projects is being monitored by the CEA on a regular basis. These projects include some very large dams identified in Arunachal Pradesh: Etalin (4,000 MW), Demwe (3,000 MW), Dibang (3,000 MW), and Lohit (3,000 MW). It remains to be seen when and whether they will actually be completed.

Of the planned capacity addition of 90,000 MW at the end of the 12th Five-Year Plan, about 30,000 MW is planned from hydropower.[7]

River Basin	Number of Schemes	Probable Installed Capacity (MW)
Indus	190	33,382
Brahmaputra	226	66,065
Ganga	142	20,711
Central Indian River System	53	4,152
West Flowing Rivers of Southern India	94	94,300
East Flowing Rivers of Southern India	140	14,511
TOTAL	**845**	**148,701**
Pumped Storage Schemes	56	94,000

Table 1: Number of schemes for various river basins with probable installed capacity[8]

Dam Sanctioning in India

The process of dam sanctioning in India involves many institutions, as well as several complex steps and clearances. A snapshot of this process is provided in this guide, based on conversations with representatives of government institutions including the Central Electricity Authority (CEA), the Central Water Commission, and the Central Board of Irrigation and Power (CBIP), as well as non-governmental organisations, academics and researchers. Substantial information was also obtained through applications filed under the Right to Information (RTI) Act, 2005.

Authorities Regulating the Sanctioning of Dams

The Ministry of Water Resources (MoWR), Central Water Commission, Ministry of Power (MoP) and Central Electricity Authority are the principle agencies which regulate water resources in India. By way of specific legislations, the Indian government regulates dam projects through these bodies, as well as the Ministry of Environment and Forests (MoEF) which deals with environmental impacts and their mitigation.

Listed as a concurrent subject in the Indian Constitution, electricity generation and transmission is regulated both by central and state authorities, with the states playing the primary role. With the central policy providing the overall direction for development, states determine the power generation, distribution and management systems. The development of water resources lies with the state governments (See Appendix 3 "Water in the Indian Constitution"). Since hydropower development involves water resources, state agencies are primarily responsible for its development as well.

The regulatory authorities and their roles are described briefly below:

Ministry of Water Resources

The MoWR is responsible for the following aspects of hydropower projects:

- hydraulic structures
- water management
- flood control
- dam safety
- regulation and development of inter-state rivers and river basins
- water laws
- international water laws for trans-boundary rivers

Central Water Commission

The River Management Wing of the CWC has the following responsibilities:

- collection, compilation, storage and retrieval of hydrological and hydro-meteorological data including water quality monitoring
- formulation and issue of flood forecast on all major flood prone rivers and inflow forecasts for selected important reservoirs
- providing guidance to states in technical matters on different aspects of river and flood management in the country
- regulation of multipurpose reservoirs
- river morphology studies
- techno-economic appraisal of various flood management schemes received from the state governments
- providing advice to coastal states on issues related to coastal erosion problems including preparation of the National Coastal Protection Project for coastal protection works
- survey and investigation of water resources development projects in India and neighbouring countries
- monitoring of schemes under the centrally sponsored Command Area Development Programme and the Accelerated Irrigation Benefit Programme
- revival and restoration of water bodies through field units of the River Management Wing
- international cooperation with neighbouring countries for flood forecasting

The CWC receives DPRs of irrigation and multipurpose projects. Also, the CEA consults the CWC on issues related to inter-state and international clearances, dam design and safety, hydrology, hydraulic structures, construction material and machinery, and cost of civil works.

Ministry of Power

The Mo Pis a nodal agency involved in power sector planning and development at the central level.

Central Electricity Authority

The CEA is also a nodal agency responsible for power sector and development at the central level. The CEA deals with electrical power from all sources, including coal, petroleum, gas, hydro, and non-conventional sources. Detailed Project Reports (DPRs) of hydroelectric projects are submitted to the CEA.

Ministry of Environment and Forests

The Environmental Impact Assessment (EIA) and Environmental Management Plan are prepared by consultants hired by project proponents in accordance with the Environment Impact Assessment Notification, 2006. As per the notification, the MoEF has set up a number of Expert Appraisal Committees (EACs) for various sectors, such as river valley and hydropower projects, thermal power projects, etc. The EIAs are scrutinised by the respective EACs. Both the environment and forest clearances are vetted separately by the MoEF. The report covers socio-economic impacts, impacts on flora, fauna, and endangered species, etc. If the project threatens to eliminate any species which is found only in the project area, then the MoEF is supposed to raise objections,which has apparently happened in a few cases. According to the CWC and MoEF, quite a few lucrative projects had to be shelved due to their location in national parks or wildlife sanctuaries.

Other Institutions

In addition to the bodies described above, the following institutions are involved in the regulation of dam projects:

- National Committee on Seismic Design Parameters
- Central Soil Materials Research Station
- Centre for Survey Research and Management Services
- National Institute of Rock Mechanics
- Geological Survey of India
- Central Pollution Control Board
- State Pollution Control Boards
- Department of Environment in the states

The Legislative and Policy Framework

The relevant national policies, acts and notifications are:

- Environment (Protection) Act, 1986
- Forest Conservation Act, 1980
- Water (Prevention and Control of Pollution) Act, 1974
- The Air (Prevention and Control of Pollution) Act, 1981
- The National Rehabilitation and Resettlement Policy, 2007
- Environmental Impact Assessment Notification, 2006

Siang River near Pasighat where the 2,700 MW Lower Siang Hydro Electric project is planned. Photo credit: Samir Mehta

Locating a Dam

The location of a dam is identified taking into consideration its use, as well as structural and economic viability.[9] A specific determinant of dam placement is geographic suitability. The river gradient is an important factor in identifying the dam's location. A river with a moderate gradient favours irrigation dams, whereas a fast flowing river with a steeper gradient favours hydropower dams.

Teesta V in Sikkim. It is in the middle of cascade of dams in Sikkim. Upstream are under construction Teesta III and proposed Teesta IV. Downstream are under construction Teesta VI and Teesta Low Dam III and Teesta Low Dam IV; the latter two being in West Bengal Photo credit: Samir Mehta

In India, many locations have been identified based on desktop studies carried out by the erstwhile Central Water and Power Commission from 1953 to 1959. These preliminary desktop studies analysed existing data in the public domain, scientific and commercial databases, and available project sources for early planning and engineering.

Studies for reassessment of hydroelectric potential were undertaken by the CEA from 1978 to 1987 when additional sites were identified.

Additionally, many states carry out independent studies to locate new hydropower projects sites. Desktop studies to identify new sites are carried out with available maps and toposheets.

After a project developer identifies a potential site, extensive investigations are carried out before a final decision is made. The developer collects as much data and information as possible from various sources and carries out a preliminary study to estimate the possible potential, along with evaluating pros and cons of the site. A scouting survey of the proposed site is also conducted.

If conditions at the site are found to be favourable for a hydropower project, necessary studies and steps are taken to prepare the Preliminary Feasibility Report.

A developer usually carries out detailed evaluations of the location considering the topographical, hydrological,

geological and geo-technical parameters based on the following criteria:

1) Topographical Criteria

There should be good abutment rocks on both banks of the river. The rock foundations and abutments should be able to take the load and thrust of the dam structure and the pressure of water being impounded in it.

Ideally, an optimum river cross section with a narrow gorge site is preferred by developers so that the construction cost of the dam is reduced. The topography of the proposed dam area should be such that it can hold water as per the proposed design and function of the dam.

2) Geological Characteristics

Suitable availability of construction material and aggregates is considered. Developers check whether the composition of underlying or adjacent geological strata (rock, gravel, silt, sand, clay etc.) has adequate capability to support the foundation and anchor abutments of the proposed dam type. Locations are identified at those sites where sufficient water-head for turbines is available. This helps turbines to work with maximum efficiency.

3) Submergence Criteria

The possibility of submergence of important features, forest area, and human settlements is considered.

Koteshwer Hydroelectric Project on the Bhagirathiganga River, downstream of the Tehri Hydroelectric Project
Photo courtesy: www.matuganga.blogspot.in

4) Socio-economic Criteria

The socio-economic status of the site is of relevance to developers. If a particular site is identified to have good power potential, but demands high rehabilitation costs owing to a huge population that needs to be displaced, then the site is deemed to be economically unfit.

Dams require a huge quantity of construction aggregate, hence developers check for its adequate availability. Many developers are said to face a lot of constraints owing to the rigid technical norms for suitability of construction aggregate, which the majority of Himalayan rocks do not pass.

For each type of dam such as a gravity, buttress or arched dam, the geology of the site is of paramount importance.[10]

While identifying a potential dam site, a team of experts comprising geologists, hydrologists and civil engineers visit the location. Government developers like the National Hydroelectric Power Corporation use the services of in-house experts, whereas private dam developers use government accredited consultants. There are many manuals that are followed in the identification process, for instance, the *Handbook of Hydro Electric Engineering* by P. S. Nigam.[11]

The project is also evaluated considering its merits and demerits with reference to the techno-economic feasibility of the dam site. The techno-economic feasibility determines the viability of the project technically as well as commercially. According to sources in the CEA and the EAC for River Valley and Hydropower Projects of the MoEF, there is currently no strict formula for the cost-benefit analysis of a project, and hence it is being done arbitrarily.

Procedure for a Developer to Apply for a Project

As per the Electricity Act, 2003, the power to allot hydropower projects is vested with the state governments. Private and public sector developers are supposed to approach the concerned state government for this purpose.

A developer carries out preliminary assessment studies of the site where it wishes to build a hydropower project. The percentage of expected power generation and the upfront premium to be paid to the state government is negotiated.

There are no separate rules laid down for financial transactions between a developer and government authorities. Therefore, transactions follow the prudent commercial practices adopted for the development of a project. It is not mandatory for all developers to pay an upfront premium. So far, there are no records of upfront money paid by government developers like the North Eastern Electric Power Corporation, the National Hydroelectric Power Corporation, etc. Various private developers in Arunachal Pradesh have made upfront premium payments in crores[12] of rupees[13] to the state government.

As a rule, the state government gets a fixed percentage of the total power generated from a project. If a mutual agreement is reached, the developer can proceed to preparing reports and obtaining clearances.

Pricing of Electricity and Profits for a Developer

The pricing of electricity or the tariff is governed by the prevailing guidelines of the Central Electricity Regulatory Commission (Terms and Conditions of Tariff) Regulations, 2009.

The pricing depends on the mode of allotment of the project to the developer.

If the project has been allotted to the developer through a Memorandum of Understanding (MoU), the profit margin of the developer is determined by the appropriate regulatory commission[14] on a cost-plus approach. More generally, in a cost-plus approach, certain other permitted costs, such as interest, are added to the capital costs. A profit margin of 16% is then calculated on the total cost.

If the project has been allotted to the developer based on a tariff-based bidding process, market forces determine the tariff.

If the development of the project is neither through an MoU nor through government allotment, then the power is sold as merchant power. In this case, the tariff is determined by market forces.

The Policy on Hydro Power Development, 2008 notified by the Indian government on March 31, 2008 aims to provide a "level playing field to private developers and … transparent selection criteria for awarding sites to private developers". The policy allows for the provision of merchant sales of up to a maximum of 40% of the saleable energy. This has been done to enable the public as well as private sector hydropower developers to recover the costs incurred in developing the project.

The allotment of a project by a state to a developer is based on the bidding criteria of a single quantifiable parameter, which can either be free power to the state, equity participation by the state, or upfront payment.

No license fee is given by the developer to the central or state authorities to produce and sell power from hydropower dam sites.

Stages of Clearances for a Proposed Dam

There are two main stages of project clearances for proposed dams.[15] The first stage is based on the Pre-Feasibility Report (PFR) of the project,while the second stage follows the Detailed Project Report (DPR).

The main clearances include environment and forest clearances from the MoEF, a Techno-Economic Clearance from the CEA, and clearances from the CWC, the Public Investment Board and the Cabinet Committee on Economic Affairs, which is the final approving authority.

The sequence of events is as follows:

- A Pre-Feasibility Report is prepared based on the collection of requisite information, surveys and investigations. The report includes the following:
  - general data
  - general planning
  - inter-state and international aspects
  - hydrology
  - environmental and ecological aspects
  - surveys and investigations including geological investigation, seismic investigation, foundation investigation, construction material survey, hydrological and meteorological investigations, etc.
- PFRs for hydropower projects are submitted to the CEA, while those for irrigation and multipurpose projects are submitted to the CWC. The CEA takes three weeks to approve the commercial viability of the project. The commercial viability is ascertained on the basis of a rough ground study carried out by the project proponent, and using general available data which is provided by the proponent as well. The CWC takes 18 weeks to accord in-principle consent, which is valid for three years.[16]
- The EAC then approves the Terms of Reference (ToR) of the EIA report. The EIA report is to be completed within 18 months of the approval of the ToR. Along with the EIA report, the Rehabilitation and Resettlement Plan and the Environment and Disaster Management Plan are also prepared.
- A DPR is to be prepared within 18 months of approval of the PFR. For preparing the DPR of hydropower projects, the developer consults the "Guidelines for Formulation of Detailed Project Reports for Hydro-Electric Schemes, their acceptance and examination for concurrence" issued by the CEA.[17] For DPR of irrigation and multipurpose dams, the developer consults the "Guidelines for preparation of Detailed Project Reports of Irrigation and Multipurpose Projects" issued by the MoWR (erstwhile Ministry of Irrigation) in 1980.
- The CEA approves or rejects the Techno-Economic Clearance within three months of the submission of a DPR. The Techno-Economic Clearance, if approved, is valid for 3 years.
- The MoEF grants or rejects Environmental Clearance within three months of the submission of an EIA report. The Environment Clearance, if granted, is valid for 10 years, as per the provisions of the EIA Notification.
- The MoEF grants or rejects Forest Clearance if forest lands are involved.
- If tribals and/or their lands are involved, then the Rehabilitation and Resettlement Plan is submitted to the Ministry of Tribal Affairs. There is no fixed time line for this step. The CWC is responsible for ensuring the approval of the Ministry of Tribal Affairs when tribal land is involved.
- The MoP submits a memorandum to the Public Investment Board within a month of the receipt of clearances from the CEA and MoEF.
- The Public Investment Board grants clearance within four weeks of the submission of a memorandum by the MoP.
- The MoP submits a note to the Cabinet Committee on Economic Affairs within 30 days of receipt of the clearance from the Public Investment Board.

Small hydropower projects up to 25 MW can be set up by the private sector without the central government's involvement.

The Techno-Economic Clearance needs to be obtained from the CEA if the estimated cost of the project exceeds Rs. 250 crores, and/or if there are inter-state issues involved.

Clearance from the Cabinet Committee on Economic Affairs is mandatory for large projects with a capacity of more than 1,000 MW. The committee focuses on the policy issues and economic value aspects of a project. In case of large projects, factors like changes in the demography, housing requirements, new shops and scope for temporary settlement of new workers lead to dramatic changes in the economy of the project area. Therefore, approval from the committee is needed in these cases.

Project proponents also need to get a clearance from the Ministry of Home Affairs or the Ministry of Defence in certain cases, for example, for dams that are close to the Chinese border. At the time of going to press, the 1,750 MW Lower Demwe Project had received the Environment Clearance and Forest Clearance from the MoEF, but was still awaiting the Forest Clearance from the state government and approval from the Ministry of Home Affairs.

Sources of Data

The baseline study on social, socio-economic, ecological and environmental aspects involves the collection of existing data maintained by state government departments such as the state Forest Department, Department of Statistics, and the Department of Social Welfare. The baseline study also involves direct observations and studies at the dam site.

The social, socio-economic and environmental impact assessments are outsourced and carried out by government licensed agencies. It is not clear how and from where these agencies are obtaining data.

The hydrological and geological data are collected from various state and central departments including the CWC, the Indian Meteorological Department, state government departments maintaining hydro-meteorological data, the Geological Survey of India, and Irrigation and Public Health departments. The hydrological data is also obtained from the Indian Meteorological Department or from gauge stations situated near the project area and owned by the CWC and the respective state government. A gauging site is also established by the developer at the dam site, and a number of gauge stations are set up to monitor the discharge and water availability in the river basin throughout the year.

In addition, developers carry out their own surveys and investigations for the collection of site-specific data. Geological studies are carried out by geologists in consultation with experts from universities, and a number of in situ tests are also conducted. Geological data is collected by the developer through drilling and drifting.[18] There is a full-fledged chapter in the DPR dedicated solely to geological studies. The report contains detailed geological mapping of all the requisite aspects.

The Detailed Project Report (DPR)

A DPR is required to be submitted by a developer once the project is assigned to it. It covers the following aspects in depth:

- engineering
- cost
- socio-environmental impacts
- hazards associated
- impact on flora and fauna due to submergence
- people to be directly or indirectly affected
- beneficiaries
- benefits from the dam in terms of power and revenue for the state and the developer

A DPR also contains a detailed dam-break analysis of the impacts and mitigation measures should the dam break due to unforeseen natural calamities like floods, earthquakes and cyclones.

To sum up, the following aspects are incorporated in a DPR for a hydropower project:

- project background
- surveys and investigations, which include topographical survey, hydro-meteorological observations, geological investigations, seismicity studies, construction material surveys, power evacuation surveys and market surveys
- hydrological studies, which include water availability studies, design flood studies and silt aspects
- power potential studies
- design of civil engineering structures, hydro-mechanical works and electro-mechanical works
- communication and infrastructural works
- construction planning and equipment
- environment and ecology
- detailed cost estimate and financial analysis

According to the rules laid down by the CEA, the DPR should include the following chapters. The sections of the "Guidelines for preparation of Detailed Project Report of Irrigation and Multipurpose Projects" issued by the CWC to be referred to are indicated in brackets.

Chapter 1 Introduction

Chapter 2 Justification of Project from Power Supply Angle

Chapter 3 Basin Development

Chapter 4 Inter-state/International Aspects

Chapter 5 Survey and Investigation (Section 3.4)

Chapter 6 Hydrology (Section 3.5)

Chapter 7 Reservoir (Section 3.7)

Chapter 8 Power Potential and Installed Capacity

Chapter 9 Design of Civil Structures (Section 3.6)

Chapter 10 Electrical and Mechanical Designs

Chapter 11 Transmission of Power and Communication Facilities

Chapter 12 Construction Programme and Plant Planning (Section 3.13)

Chapter 13 Project Organisation

Chapter 14 Infrastructural Facilities

Chapter 15 Environmental and Ecological Aspects

Chapter 16 Cost Estimates

Chapter 17 Allocation of Cost

Chapter 18 Economic Evaluation

Chapter 19 Future Utilisation of Buildings (Section 3.20)

Chapter 20 Recommendations

Chapter 21 Clearances / Inputs

Examination of Detailed Project Reports

The project developer submits 21 copies of the DPR to the CEA for review. According to the Central Electricity Act, 2003, the CEA together with the CWC, the Geological Survey of India and other bodies examines whether the information, data and certificates are in accordance with the checklists in the CEA guidelines. The process is supposed to take place within three weeks.

DPR of Multipurpose Projects

DPRs of multipurpose projects involving drinking water, irrigation, power, flood control, and navigation are to be submitted to the CWC for clearance by the Technical Advisory Committee of the MoWR. In case the DPRs of these schemes are submitted to the CEA, the CEA redirects them to the CWC. The views of the CEA on the power portion of the scheme, i.e. power planning and cost estimates, are submitted by the Technical Advisory Committee to the CWC for clearance.

DPRs of power projects involving only flood moderation aspects in addition to power generation are accepted by the CEA and referred to the CWC for the examination of the flood moderation aspects. Subsequently, the CEA also examines such schemes in detail. The date on which the CEA accepts such a scheme for appraisal is the date of clearance of the flood moderation aspects by the CWC.

DPR of Hydropower Projects

The CEA acts as a single agency responsible for hydropower projects. The techno-economic examination of a hydroelectric scheme is an interactive process that involves the appraisal of various aspects like hydrology, design and safety, civil design, electro-mechanical design, geology, cost and project financing. After examination, the project developer is supposed to reply to all queries and concerns raised by the CEA within 15 working days, failing which the DPR is returned to the project developer.

Though the CEA is responsible for hydropower projects, as per the demarcation of responsibilities by the Government of India, the following aspects related to hydropower schemes are assigned to the MoWR:

- hydraulic structures for hydropower
- water management
- flood control
- dam safety
- regulation and development of inter-state rivers and river basins
- legislation of water laws
- international water laws relevant to trans-boundary rivers

The aspects which require to be appraised are:

1. **Hydrology:** The CWC appraises the project's hydrology including water availability studies, design flood estimation and sedimentation studies for estimating the life of the project. An accurate assessment of the hydrology at the project site is crucial for planning of hydropower schemes and hydrological designs since an overestimate of water availability may lead to higher installation and larger investment, whereas a lower estimate may result in non-utilisation of optimal potential.
2. **Hydropower Planning:** Power potential studies, including studies on the number and size of generation units, are carried out for all hydrological years for which data is available. The general layout of the design is also examined to assess if it fits into the overall basin development plan.
3. **Dam and Head Works:** The design and safety of the dam and appurtenant works are examined by the CWC.
4. **Hydraulic Structures or Hydel Civil Design:** A techno-economic evaluation of the water conductor system and power house comprising intake, de-silting arrangement, head race tunnel, surge shaft, pressure shaft or penstock, tailrace tunnel/channel, and the layout and dimensions of the power house is undertaken to ensure that the surveys and investigations carried out to finalise the layout and designs are adequate. The CWC ensures that the layout is optimal, that the project components are safe, and that planning and design have been carried out utilising state-of-the-art technology and relevant standards.
5. **Geology:** The geology of the project site is appraised to ensure that detailed geological mapping and geophysical surveys have been done, drilling and drifting have been carried out, and structural features like thrusts, folds and faults have been studied in detail to eliminate problems during construction. The geological aspects are scrutinised by the Geological Survey of India, the Central Soil and Materials Research Station and the National Institute of Rock Mechanics.

6. **Seismicity:** The seismicity studies conducted by developers are approved by the National Committee on Seismic Design Parameters.

7. **Electro-mechanical Design:** The design and layout of turbine-generator sets, main step-up transformer, auxiliary equipment in the power house and switchyard/ gas insulated switchgear room, etc. are appraised.

8. **Justification for the Project:** The CEA examines the need and justification for the project from the perspective of the anticipated power demand (both base and peak) and the tariff of energy generation.

9. **Construction Material and Machinery:** The CEA appraises the construction methodology and equipment used in the project, the quality and quantity of the local construction material available at the project site, and the properties of rock/soil for foundation of the structures.

10. **Inter-state/International Aspects:** The CEA examines the inter-state/international aspects in consultation with the MoWR, which provides necessary suggestions. International water laws are considered in case of trans-boundary rivers. For trans-boundary rivers between India and Bangladesh, the Joint River Commission is consulted. For rivers covered by the Indus Water Treaty, the Indus Water Commission is consulted.

11. **Cost Estimates of Civil Works:** Civil works like excavation, concreting, RCC works, stripping, filling and grouting based on hourly use rates of equipment are undertaken, and the estimated cost of civil works proposed in the DPR is approved by the CWC.

12. **Cost of Electro-mechanical Works:** The CEA examines cost estimates of electro-mechanical works, based on the cost data of other projects for which orders have been recently placed.

13. **Evacuation of Power:** The CEA examines the adequacy of power evacuation arrangements proposed in the DPR.

14. **Construction Schedule:** Activity-wise, item-wise and year-wise targets/schedule of construction for each of the major components of works as per the detailed Project Evaluation and Review Technique chart are examined.

15. **Financial and Commercial Aspects:** Financing and financial analysis of the project including financial charges, tariff and interest during construction are examined.

16. **Construction Materials:** Proposed rock parameters and construction materials for building a dam are examined by the Central Soil Materials Research Station.

The developer is also required to submit the updated DPR to the concerned state government, the state Regulatory Commission and the Transmission Utility along with intimating the CEA.

Determining the Life of a Dam

While determining the life of a dam, its utility and the economic realisation of the investment are the key factors taken into consideration. As per the CEA, CWC and government dam developers, calculations are generally based on a 50 year life cycle.[19] Private dam developers mostly consider the life of a dam to be 25 to 30 years.[20]

The life of a dam is usually calculated using various empirical formulae from relevant books, papers, and expert guidelines available on the internet and in libraries. One such source is the *Erosion and Sedimentation Manual* of the US Bureau of Reclamation, which is referred to by many developers including the Tehri Hydroelectric Development Corporation. The sedimentation of the reservoir, the type of structure, and the construction materials used are crucial factors in determining the life of a dam.

According to CWC sources, any dam is considered "a permanent structure that is meant to last forever". Dam proponents also believe that once a dam is built, the structure of the dam is permanent and is meant to last forever. This is contrary to their practice of considering the life of a dam to be between 25 and 50 years.

The often repaired 115 year old Mullaperiyar Dam in Kerala. Photo credit: Latha Anantha

Dam Safety Requirements

The CEA and the CWC are the nodal bodies which deal with dam safety.

Codes of the Bureau of Indian Standards on water resources are required to be followed in the design of a dam to ensure its safety. [21]

The DPR for a hydropower project includes the design of various hydraulic structures as well as electro-mechanical and hydro-mechanical equipment with safety provisions. For the safety of structures against the risk of earthquakes, developers carry out seismic studies. These studies are undertaken by the developers themselves, or consultants such as the Department of Earthquake Engineering, IIT Roorkee are hired. These studies are approved by the National Committee on Seismic Design Parameters, MoWR.

Concerns about a dam's safety and its impacts are addressed during the public hearing which is required under the EIA Notification. After a dam is commissioned, a dam safety team visits the sites to look into any problems encountered during the project's operations.

People's Involvement

According to government sources, updated information about any hydropower project can be found on the websites of the MoP and MoWR. Also, according to the CWC, public intervention is possible at any stage of the dam building process. However, the ground reality is far from these assertions.

Public Participation in the Functioning of Regulatory Authorities

There is no scope for public consultation in the functioning of the MoP and MoWR.[22] Also, there is no public participation or involvement in the functioning of the CEA and CWC.

However, according to sources at the CWC, the village head is notified before any project is undertaken. Also, according to these sources, this is followed by a public hearing held by the dam developers in the presence of government representatives, as it is mandatory under the EIA Notification. According to the CWC, "Anyone from any part of the world can raise any issue in the public hearing." Ironically, the public hearing is considered a grievance redressal mechanism wherein villagers can send in their complaints related to the project in case they apprehend any adverse impact or are concerned about the results of the project.

The MoEF is supposed to ensure that the project proponents have satisfactorily addressed people's concerns before granting the Environmental Clearance.

Public Hearings

Before a hydropower project is granted clearance by the MoEF, public hearings are required to be conducted in order to ascertain the concerns of local people. If the project involves the displacement of tribals or the occupation of tribal land, the Ministry of Tribal Affairs is required to participate in the public hearing process. The public hearings are conducted as per the provisions of the EIA Notification, 2006.

According to this notification, the developer makes a request through a letter to the Member Secretary of the State Pollution Control Board or the Union Territory Pollution Control Committee in whose jurisdiction the project is located, to arrange for a public hearing within the prescribed statutory period. If the project site covers more than one district, state or union territory, a public hearing must be conducted in each district, state or union territory in which the project is located.

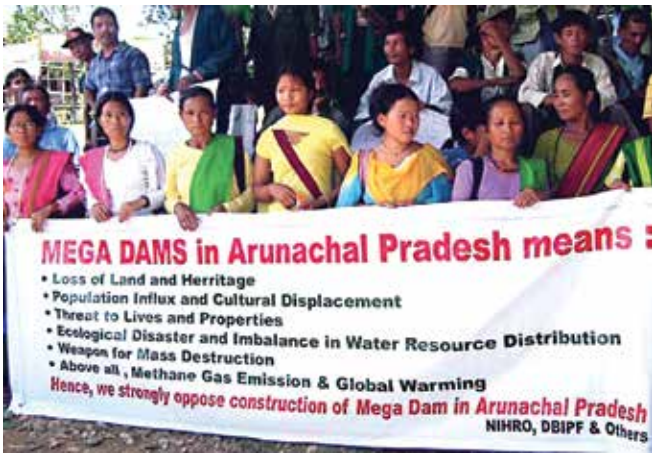


Photo courtesy: www.peasantautonomy.org

The EIA Report along with the Summary EIA Report needs to be submitted to the following authorities and offices within whose jurisdiction the project will be located:

- District Magistrate/District Collector/Deputy Commissioner(s)
- Zilla Parishad or Municipal Corporation or Panchayat Union
- District Industries Office
- Urban Local Bodies/concerned Panchayati Raj Institutions/development authorities
- concerned regional office of the Ministry of Environment and Forests

On receiving the draft EIA report, these authorities, except the regional office of the MoEF, are required to arrange to widely publicise it within their respective jurisdictions, and request interested persons to send their comments to the regulatory authorities. They are also required to make the draft

EIA Report in English available for inspection electronically or otherwise to the public during normal office hours till the public hearing is over.

The Member-Secretary of the concerned Pollution Control Board(s) needs to finalise the date, time and exact venue of the public hearing within seven days of receipt of the draft EIA report from the project proponent. This official should also advertise the public hearing in one major national daily and one regional vernacular daily newspaper. The public gets a minimum notice period of 30 days for their responses. The advertisement shall also inform the public about the places or offices where the public can access the draft EIA report. In remote areas, the public is also to be informed by the beating of drums and advertisement through radio and television.

The District Magistrate or the Deputy Commissioner, assisted by a representative of the Pollution Control Board, supervise and preside over the public hearing process. This process is required to be completed within 45 days from the date on which the request letter is received from the project developer.

Although the people living upstream of a dam are consulted during the public hearing process, those living in the downstream are usually left out. According to officials of the Dams and Research Wing of the CWC, the water flow in any mountainous terrain is mostly affected in the upstream and not the downstream area. Therefore, a public hearing is not necessary in downstream areas.

Public Awareness of Dam Projects

The implementation of the public hearing process is extremely poor. Improper public hearings are a major concern, and lead to numerous protests.

Projected affected people usually learn of dam projects when the site is frequently visited by officials during the reconnaissance survey. These communities who run the risk of losing their agricultural lands and livelihoods to the projects are usually not even informed, leave alone consulted.

The 1,750 MW Lower Demwe Project is being planned close to the holy site of ParshuramKund in the Lohit district of Arunachal Pradesh state. The project is currently awaiting the last stage of forest clearance. The picture shows the Shankaracharya of GovindanPeeth, Odisha (dressed in saffron) visiting the holy site in January 2012.
Photo credit: Urmi Bhattacharjee

Redressal of Grievances

Rehabilitation and Resettlement Committee at the Project Level[23]

For each project which involves involuntary displacement of four hundred or more families in the plains, or two hundred or more families in tribal or hilly areas, or areas mentioned in the Schedule V or Schedule VI of the Constitution, the state government as a rule needs to constitute a committee for rehabilitation and resettlement. This committee is to be chaired by a senior government official. This committee is supposed to monitor and review the progress of implementation of the scheme or plan of rehabilitation and resettlement of the affected families, and to carry out post-implementation social audits.

The committee, as per rules of the CWC, should include the following members:

- a representative of women residing in the affected area
- a representative of each of the scheduled castes and scheduled tribes residing in the affected area
- a representative of a voluntary organisation
- a representative of the lead bank
- chairpersons of the panchayats and municipalities located in the affected area, or their nominees
- members of parliament and members of the legislative assembly of the affected area
- officer of the project

Rehabilitation and Resettlement (R&R) Committee at the District Level

The state government has to constitute a Standing Rehabilitation and Resettlement Committee in each district under the chairpersonship of the deputy commissioner of the district. The committee is supposed to monitor and review the progress of rehabilitation and resettlement of the affected families in the district.

The composition, powers, functions and other matters relating to the functioning of the rehabilitation and resettlement committee at the district level are supposed to be decided by the state government.

As a rule an Ombudsman should also be appointed by the state government for the time-bound disposal of grievances arising out of the matters covered by this policy. Any affected person, if aggrieved about not being offered the admissible rehabilitation and resettlement benefits, may move an appropriate petition for redressal of his or her grievances to the Ombudsman. The Ombudsman considers all complaints and issues directions to the administrator for appropriate redressal of grievance.

Disputes related to the compensation award for land or other property acquired will be disposed off according to the provisions of the Land Acquisition Act, 1894, or any other Act of the union or state in force for the time being, under which the acquisition of land is undertaken. Land and property compensation disputes are outside the purview of the functions of the Ombudsman.

Inter-state Projects

For projects that involve more than one state or union territory where the project-affected families are either residing or proposed to be resettled, the Department of Land Resources, Ministry of Rural Development, in consultation with the concerned state or union territories, appoints the Administrator and Commissioner for Rehabilitation and Resettlement.

The method of implementation of the rehabilitation and resettlement schemes, mutually discussed by the state governments, are supposed to be notified by the Administrator.

Hurdles while implementing the rehabilitation and resettlement schemes or plans are supposed to be referred to the Department of Land Resources, Ministry of Rural Development, for its decision.

Thrust for Fast-tracking Hydropower Projects

Several committees have been constituted to accelerate hydropower projects by removing impediments and fast-tracking clearances, so that benefits accrue in the 11th and 12th Five-Year Plan periods.

A task force under the chairmanship of the Union Minister of Power with the Deputy Chairman, Planning Commission, the Minister of Water Resources, the Minister of New and Renewable Energy, the Minister of Environment and Forests and Ministers of Power from states rich in water resources, has been constituted to look into all issues relating to the development of hydropower. Also, an advisory group has been set up under the chairmanship of the Minister of Power to advise concerned bodies so that they can complete ongoing power generation projects expeditiously.

A special monitoring group under the chairmanship of the Secretary (Power) has been constituted to discuss and sort out various issues concerning Jammu and Kashmir and the Northeast. This discussion is carried out through video-conferencing. Additionally, a committee of secretaries on hydropower has been constituted by the Government of India.

The CEA is required to promote and assist in the timely completion of schemes and projects, according to Section 73(f) of the Electricity Act, 2003. The progress of each project is monitored continuously through frequent site visits, interaction with developers, and a critical study of monthly

progress reports. The Chairperson of the CEA holds review meetings with the developers and other stakeholders to sort out critical issues. In addition to the task force mentioned above, regular meetings are held by the chairperson of the CEA to review the status of future hydropower projects allotted to various developers, such as the preparation of DPRs, the status of environment and forest clearances, the likely dates of placing orders, etc.

A power project monitoring panel has been set up by the MoP to independently monitor the progress of hydropower projects. Review meetings are regularly held by the MoP with the concerned officers of the CEA, equipment manufacturers, state utilities, central public sector undertakings, and project developers.

The state governments regularly review implementation aspects of all projects on a quarterly basis. In the review meetings, senior officers from the CEA, MoWR and the Power Grid Corporation of India are also invited. In addition to reviewing progress, issues related to various clearances from central and state government organisations are also identified. Other impediments for these projects are also considered, and help is extended to the developers to overcome them.

For state level clearance, in most states, a committee under the chairmanship of the Chief Secretary meets regularly, and cases are cleared in the shortest possible time.

Decommissioning of Dams

There is a lack of awareness in India about the necessity to decommission dams. The idea is considered unacceptable in government and bureaucratic circles. The costs of dismantling or decommissioning remain largely unknown to developers. There are no fixed government guidelines available on dam decommissioning either.

Raging controversy over whether the over 115 year old Mullaperiyar Dam in Karala should be decommissioned.
Photo credit: Latha Anantha

CWC sources argue that in a country like India, it is not possible to decommission dams because the growing population demands continuous water supply which can only be ensured by storage dams. According to these sources, there is population pressure, given that the country supports 17% of world population with only 4% of the total water available in the world.

The EAC recognises the possible negative outcomes of existing hydropower projects that were sanctioned without cumulative impact assessment studies. Even so, it does not consider the need to decommission projects. Rakesh Nath, Chairman of the EAC, said, "There is of course a need to study the cumulative impact of a project. Though it was not considered important initially, the social and environment effects that have come out in various places indicate that a cumulative impact study is indeed necessary. What we can do is to take care of cumulative impact studies in future projects." Despite his statement, projects are sanctioned by the EAC without cumulative impact studies.

According to members of the EAC, climate change has resulted in shifting monsoons leading to concentrated rainfall within a relatively short span, and large storage reservoirs are the most effective solution. Trying to decommission these dams would only serve to aggravate economic and environment losses. It should be noted here that though the EAC acknowledges the impacts of climate change, it does not prescribe that these impacts should be studied in the EIA.

CWC sources, however, say that in the early stages of construction, it is possible to consider decommissioning if there are unforeseen calamities like massive earthquakes.

According to dam developers, when a dam has lived up to its life, or has become unusable due to siltation,[24] deterioration of the structures or other socio-economic reasons, it may be considered for decommissioning. In the techno-economic model, the life of a hydropower dam is considered to be 50 years. A dead or dying dam may have silted up, stopped producing electricity, or become increasingly unsafe, at which point it may be considered for removal.

When it comes to decommissioning dams, environment and wildlife concerns are yet to be considered.

Not all dams slated for removal are for reasons of safety. A major reason prompting activists to call for the removal of dams is the decimation of fisheries. Although dams have been found unsafe or destructive of fish habitat, a few major dams are yet to be removed on such grounds. The engineering of dam removal is still untried, and the requisite costs are still ignored when construction costs are estimated. Vital aspects of dam removal including the exact procedure to dismantle a dam, what to do with the sediment clogging the reservoir behind it, and the cost of the operation, are largely unknown. Removing a hydropower dam could even cost more than building one, especially where reservoir sediments contain heavy metals and other toxic contaminants.

When a dam is structurally at the verge of breaking, it is usually strengthened. The Government of India has emphasised quick and cost-effective renovation, modernisation and up-rating. The cost per megawatt of a new hydroelectric project works out to about Rs. 4 to 5 crores, whereas the cost per megawatt of capacity addition through renovation, modernisation and up-rating of an old hydropower project is about five times lower. The time of completion of renovation, modernisation and up-rating is only one to three years, compared to new projects, which take about six to seven years.

For the 11th Five-Year Plan (2007-12), a total of 59 hydroelectric projects with an installed capacity of 10,325 MW are programmed for the completion of renovation, modernisation and up-rating works, to create an additional capacity of 5,461 MW.

Concerns about the Dam Sanctioning Process in India

Protest during public hearing of Luhri Project. Photo credit: Nidhi Agarwal

Although dams are considered to play a key role in the country's development, the implementation of projects is mired in a range of problems. Numerous studies have observed that the destructive impacts of large dams often outweigh their benefits. In the case of hydropower dams, states where these dams are being built are in fact meeting the power needs of other states. In the process, forests are destroyed, the ecology is impacted, and the displaced lose their homes, villages and livelihoods.

The ministries and nodal bodies involved in building dams are focused on the optimum utilisation of water for power generation, irrigation and drinking. State governments are eager to sanction projects without considering the detrimental future consequences. The centre's approach towards environmental and social concerns is often lackadaisical. The growing demands for power and irrigation, as well as the pressure from state governments and project proponents, result in fast-track clearances. It is the project-affected families who bear the brunt of these developments, losing their land and livelihood in the process.

Investigations and conversations with dam builders, proponents and researchers revealed several loopholes, ambiguities and shortcomings in the dam-sanctioning and building processes, which are summarised below.

A Poor and Inadequate Policy Regime

Building a dam is a complex process with several adverse consequences, and needs to be governed by comprehensive policies sensitive to the needs of the project-affected and the environment. However, dam sanctioning is plagued by a poor and inadequate policy regime. Specific concerns regarding dam policies are described below.

Rehabilitation and Resettlement

The uprooting of families and communities by a dam brings loss, poverty and adversity. Many dam-affected people survive below the poverty line. Their agricultural land is their lifeline. Displacement and rehabilitation entails a loss of their land, livelihood, culture and way of life. However, those affected by a project are faced with an unjust policy regime and an insensitive and often corrupt bureaucracy.

Large dams submerge hilly tracts inhabited by tribal populations. These communities are among the poorest in the country. According to an independent estimate, 8.5 million tribals have been displaced till 1990. Of these, about 64% are yet to be rehabilitated.

The National Policy on Resettlement and Rehabilitation for Project-Affected Families, 2003 of the Ministry of Rural Development is not comprehensive enough to deal with this complex issue.

According to a fact-finding committee constituted to evaluate the Srisailam project, till date, there are no effective mechanisms for dealing with concerns related to resettlement and rehabilitation, such asthe undervaluation of compensation, traumatic forced and delayed relocation, the failure to acquire alternate cultivable lands, and the inability to handle cash compensation.

In many tribal societies in Northeast India, the system of allotting land under a particular person's name is still not prevalent. These lands are owned by a clan. Hence most oustees fail to get rehabilitation grants or compensation for their land. They ultimately settle in small places, as in the case of the Dumburdam in Tripura, which is said to have displaced a total of 35,000 to 40,000 people, many of whom were tribals. They had to resort to jhum (slash and burn shifting subsistence) cultivation. Many oustees face tremendous problems adjusting to resettlement sites. There are no clear policies or mechanisms to redress such issues.

Many rehabilitation policies do not address critical issues related to land holdings. The policy for oustees in Maharashtra state clearly states that an adult woman will not be entitled to receive any land. The Uttar Pradesh state policy is even more gender-biased. According to the U.P. policy, if a couple holds property separately, they will be considered one unit and will receive one package. In this situation, a woman will have to forego her right to the package as it will be given to the head of the family – the man.

The greatest concern is the implementation of the rehabilitation and resettlement plan, including physical relocation and ensuring continued sustainable livelihood options in consonance with the knowledge and skills of the project-affected people. The uprooted have rudimentary skills and minimal or no education, and often face hardships or are unable to eke out a living in their new circumstances. The experience of oustees of the Bhakra, Hirakud and Nagarjunasagar dams demonstrate how the project-affected are victimised by official apathy.

People affected by the OmkareshwarDam on the Narmada River continuously stand in the reservoir of the dam on the seventh day of their Jal Satyagraha to demand rehabilitation. Photo courtesy: Press Trust of India

Policies for Different Types of Dams Unclear

It is surprising that the CWC, a premier technical organisation in the country dealing with water resources since 1945, has repeatedly failed to provide a proper classification of dams based on their structure and purpose. This is a big lacuna, since a proper classification would help in devising separate policies for different types of dams in a systematic manner. When the CWC was asked for a concrete definition of large dams and also the existing types of dams, it referred the author to the Central Board of Irrigation and Power, which then pointed to the ICOLD definition of large dams. The classification of dams was not made available by either of these bodies.

Further, there are no comprehensive model Terms of Reference for a river valley project dealing with the social, environmental, economic or cultural services that a river provides. On the MoEF website, a link for a "Model ToR for River Valley and Hydroelectric Projects" is available, but clicking on it opens a document titled "Model ToR for Hydropower Projects". A Model ToR for river valley projects other than hydropower projects is not available. This is indeed a serious loophole, as 96% of India's existing large dams are irrigation projects and not hydropower projects. It is also an indication that there is a shift from building irrigation dams to hydropower dams in India.

Shoddy and Inadequate Studies

Though comprehensive studies assessing the impacts of dam projects should be carried out responsibly in advance of project sanctioning, this requirement is routinely flouted.

River Basin Studies

Until recently, the cumulative impacts of dams on forests, environment, wildlife and environmental flows were not considered important. Hence, several dams were sanctioned without any cumulative impact assessment. No importance was given to a comprehensive study of river basins. At present, there is no complete basin study that focuses on geo-tectonic problems, biodiversity, environment, public health, as well as the socio-economic and hydrological impacts of hydropower projects in India.

The responsibility for conducting cumulative impact assessments for dam projects is shunned by both the centre and the states. Under the Indian Constitution, water is a state subject (See Appendix 3"Water in the Indian Constitution"). Hence, it is the state governments that have legislative and functional jurisdiction over water. Since water is a state subject, the centre is of the opinion that individual states must conduct a river basin study, if at all necessary. The states in turn are of the opinion that any developmental project would help the entire country, therefore the centre should be responsible for river basin studies.

According to project proponents, it would be entirely uneconomical and illogical to conduct an entire river basin study for a project that would occupy only a portion of the river. However, the EIA Notification requires them to do so. In practice, it is neither asked for by the EAC or MoEF, nor carried out.

The existing norms of the MoEF require the EIA study to cover a radius of only 10 kilometres from the dam site. However, many state governments like that of Assam have already accepted the need to conduct a study over a wider area.

After a series of public protests against many projects, cumulative impact studies are now being prescribed by the MoEF. A comprehensive EIA study of the Subansiri and Siang sub-basins has been assigned to the CWC on the recommendation of an Inter-Ministerial Group in Assam based on Terms of Reference finalised by the MoEF. However, whether the recommendations of the studies are implemented remains to be seen. Projects are being sanctioned by all regulatory bodies involved while the studies are pending, thereby negating their purpose.

To date, there is no policy on what needs to be done regarding cumulative studies for existing power projects. The CWC, CEA and EAC have given no thought to what needs to be done about projects that have been commissioned or are under various stages of appraisal and clearances.

Impacts of Earthquakes and Climate Change on Dams

There are no proper studies on the impacts of earthquakes on dams.

The Himalayan belt is a highly seismic zone. The entire Northeast region is a highly earthquake-prone belt (seismic zone V) experiencing small to medium earthquakes every month. Uttarakhand state is categorised as seismic zone IV and V. The Ganga Valley is already affected by earthquakes.

Experts have time and again warned of the possible risk of earthquakes with the increase in large dams. Sadly, no government body or dams proponent has comprehensively studied the impact of earthquakes on these large dams.

In 2011, India's Planning Commission constituted a Technical Experts Committee[25] to ascertain the safety and stability of the 2,000 MW Lower Subansiri Hydroelectric Project. The committee revealed numerous findings that the large dam project could turn out to be an impending disaster unless its structure, design and other aspects were reviewed. It even reached an agreement on the uncertain seismo-tectonic environment of the project. The committee's report mentions that since earthquake science is an emerging field, a lot needs

to be studied. After observing the geology of the foundation rock and its engineering properties, the committee reported that the construction of the project is based on "weak science", and more innovative techniques are required to enable it to support a 123-meter-high concrete dam, especially in view of the seismic environment. The dam is scheduled to be commissioned in 2014.

So far, no steps have been taken by the EAC, MoEF, CWC and CEA to scrap projects which face risks associated with climate change and earthquakes.[26] Even the MoEF does not have a written position on these issues. On many occasions, the CWC has even argued that there are no concrete risks to mega dams from earthquakes.

In hilly regions with unpredictable weather as in Northeast India, the changing pattern of rainfall is already affecting agriculture and livelihoods. The changing climate has also raised concerns among geologists about the possibility of cloud bursts. Geologist Sushil Goswami of Guwahati University, Assam has expressed anxiety about sudden unexpected situations like cloudbursts. These could lead to unexpected flooding, resulting in dam bursts due to inadequate spillways. Dam spillway capacities are currently designed to withstand the maximum possible precipitation based on roughly 100 years of data. In case of the Banqiao Dam on the Ru River in the Henan province of China, a sudden cloudburst in 1975 led to abnormal precipitation which caused a series of about 60 dams to burst. Thousands died due to submergence. The dam's failure caused more casualties than any other dam failure in history. At present, India does not have any tools to predict cloudbursts.

These vital factors are yet to be taken seriously by the government and dam proponents. Although the EAC has rhetorically stated that issues of climate change need to be taken into account, it has done nothing to push for proper climate change assessments of dams.

The under construction Teesta III Dam in Sikkim was affected by the earthquake in 2011. Photo credit: Samir Mehta

Lack of Information Sharing and Public Consultation

It is indeed ironic that the project-affected often learn of dam projects in their vicinity only when officials arrive to conduct a survey. The absence of meaningful consultation with people thus contradicts the World Commission on Dams' keystone strategic priority that dams should be built with the demonstrable acceptance of the affected people, and with their free, prior and informed consent.

Shoddy Public Hearings

Under the EIA Notification, 2006, there are provisions for a public hearing at project-affected sites. However, the implementation of such provisions has mostly proven to be a farce. Worse still, there is no active monitoring of such hearings by any neutral authorities.[27] Even when the video recordings of the public hearings demonstrate their inadequacy, the EAC and MoEF grant environmental clearances to projects.

Downstream Communities Left Out of Public Hearings

It is widely known today that the people living in downstream areas also face submergence along with adverse impacts on the flora and fauna. Degraded catchments, excessive rainfall or over-filling of reservoirs may necessitate sudden releases of large quantities of water from the reservoir in order to protect the dam structure. Such sudden releases can prove disastrous for people living downstream, their crops and entire ecosystems.[28] Yet, the CWC maintains that public hearings are required only in the upstream areas of dams. There is no requirement for any separate public hearing or consultation in downstream areas.

Take the case of Arunachal Pradesh. More than 165 MoUs have been signed by the Arunachal Pradesh government for the development of hydropower. For dams seeking Environmental Clearance, the public hearings have been held in Arunachal Pradesh, but no public hearings have been held in Assam where serious downstream impacts are apprehended. Even in Arunachal Pradesh, locals say that the hearings are just eyewashes. For instance, in case of the North Eastern Electric Power Corporation's Ranganadi Hydropower Project, and the National Hydroelectric Power Corporation's Lower Subansiri Project, there was no proper advertisement for the public hearing. Very few people could attend the hearing which lasted for a very short period of time.

The concerns of people in downstream areas whose life and livelihood depend on proper river flow remain largely neglected.

Refusal to Share Project Information

The ministries involved in the dam sanctioning process have not been proactive in sharing information with the public. For example, on July 24, 2012, the National Green Tribunal criticised the MoEF because it had not placed forest clearance letters for the 1,750 MW Demwe Lower Hydroelectric Project in Arunachal Pradesh in the public domain in a timely manner. Such delays can prevent people from raising objections at the appropriate time. The National Green Tribunal directed the MoEF and the state forest departments to display the forest clearances on their respective websites within seven days of granting the clearance.

In February 2012, the Central Information Commission directed the MoEF under the RTI Act, 2005 to upload on its website all the documents submitted by the project developers for clearance at least 10 days before the projects were considered by the EAC. When the MoEF did not follow this directive, the South Asia Network on Dams, Rivers and People (SANDRP[29]), a network of organisations and individuals working on water sector issues, wrote to the Central Information Commission, and the body issued a notice to the MoEF. The MoEF still does not follow this notice fully. Now it publishes some of the documents on its website before the EAC meetings. The EAC has not taken steps to ensure that the directions of the Central Information Commission are fully complied with for projects, even though it was repeatedly informed of the violation.

The CWC and CEA have refused to release information about dams sought under various RTI applications. Both have repeatedly passed the buck in case of specific questions on hydropower dams. Information regarding the names and credibility of the MoEF accredited consultants who are involved in geological, hydrological and other studies involved in the dam building process is also not available.

Even the National Register of Large Dams (NRLD) maintained by the CWC has insufficient details about the dams it lists. Many dams, although they should be considered large dams according to the NRLD's definition, are not included in this register.[30] For 2,687 or about 52% of large dams in India, the NRLD does not mention the name of the river on which they are located. This makes conducting a proper river basin study very difficult.

The state governments too have anomalous records on the number of large dams in each state. For instance, while preparing this report, replies received from the Arunachal Pradesh government to queries filed under the RTI Act, 2005 in a span of two months provided different data about the total number of MoUs signed for proposed dams.

A Biased and Fast-tracked Clearance Process

The EAC approves dam projects with a bias towards project proponents, instead of appraising them neutrally. Undeniably, several appraisals reflect anti-environment and anti-people leanings. Also, the clearance process is often hastened due to pressure from the project developers.

False Appraisals Favouring Project Developers

The EAC has considered a total of 262 hydropower and irrigation projects in close to six years of its existence, from April 2007 to December 2012. It has not rejected any project in this period. Even in case of the two projects for which it declined to recommend clearing the Terms of Reference of the EIAs, the rejection was worded such that the developers could resubmit reformulated proposals.

Findings by SANDRP reveal that the EAC has never rejected final Environment Clearance for any project even when other committees recommended that the clearance be denied. The EAC has also never asked for a fresh public hearing even when serious deficiencies in the public hearing process have been pointed out to them.

The MoEF can overrule the EAC but it has never done so.

Upfront Money and Fast-track Clearances

The system of upfront payments from dam developers even before they start a project enables the state government to gain extra revenue. These premiums are charged before any clearance is accorded to the project. Rules specify that the money is non-refundable. These upfront premiums are largely arbitrary with no defined rules governing them. The amount of money charged is also random. Payments have been as low as around half a million rupees in Uttarakhand, and run into tens of millions in Arunachal Pradesh.

Once a state government receives an upfront premium, it comes under repeated pressure from dam developers to hasten the process of clearance. Any delay in receiving clearances causes huge losses to the project proponents. The centre, which is already in a haste to appraise projects, further faces pressure from the state governments. Numerous reports on the situation in Arunachal Pradesh state describe how projects were awarded at throwaway prices with neither performance guarantee nor adherence to the Environment Clearance. Besides, projects were often cleared without even scrutinising the project proposal. Many activists who are working with project-affected families have alleged that projects are being accorded clearances randomly.

Documents received from the Department of Hydro Power Development of Arunachal Pradesh under the RTI Act, 2005 reveal that in 2007-08, the state government received a whopping Rs. 930 million from Athena Energy Ventures Pvt. Ltd. as a one-time non-refundable upfront premium and commitment fee for the proposed 1,750 MW Demwe Lower Hydroelectric Project near the holy site of Parshuram Kund on the Lohit River. This happened long before the techno-economic and environment clearances were granted. The project received its Techno-Economic Clearance on November 20, 2009 and its Environment Clearance on February 12, 2010. Thus the premium and fee was received by the Arunachal Pradesh government nearly a year ahead of the first formal clearance.

Similar discrepancies have been observed in many small projects. In the case of the 85 MW Mawphu Hydroelectric Project II on the Umiew River in the East Khasi Hills of Meghalaya, the Union Power Minister M Veerappa Moily was ready to lay the foundation in July 2012, even though the project had not received any of the statutory clearances, including the Environment Clearance, Forest Clearance and CEA Clearance.

Not Much Benefit to Dam-bearing States

The benefits of dam projects often accrue to other states, not to the state where the dam is built. Also, project-affected communities who lose their lands, suffer rehabilitation woes and deal with the consequences of environmental degradation stand to gain nothing from dam construction.

Take the case of the proposed 163-metre-high Tipaimukh Dam, which is expected to permanently submerge more than 275 square kilometres of land, most of which is forest land, in Manipur state. The project is expected to have firm power generation of 412 MW. Almost none of its power will be reserved for Manipur.

In a small hilly place like Tawang in Arunachal Pradesh bordering China, at least 15 mega dams are being planned, when the small population in Tawang needs less than 5 MW of electricity. The 760 MW Nyamjungchu project of Bhilawara Pvt. Ltd. in Tawang is actually designed to supply power to Bhilwara Textiles in Rajasthan, which is over 2,000 kilometres away.

Environmental Concerns

Dams are known to destroy the environment and bring on environmental catastrophes. Dam projects result in significant losses of arable land, flora and fauna. The flow of the river changes irreparable, among several other complex changes. However, the process of appraising and sanctioning dams turns a blind eye to the environmental disasters in the making.

No Clarity on Environmental Flows

Dams affect the continuity of the river flow and cause total or partial change in the natural river hydrograph. Changes in the river flow and flow pattern are crucial concerns when a dam comes up.

As a justification for dams, dam proponents and sources at the CWC say that "dams have no effect as far as river drying is concerned. In fact it is the other way round, where there is no dam there is a risk of the river drying up."

The EAC and CWC have a lackadaisical attitude towards maintaining proper environmental flows or eflows in rivers. Nevertheless, the Chairman of the EAC, Rakesh Nath, admitted that proper eflows in rivers must be ensured, since "a river should look like a river" aesthetically as well. While he said that eflows would be considered important criteria for future projects, he was not very clear about what needed to be done in cases where dams have irreversibly altered the river flow. In a conversation with the author, Nath argued that it was not possible to change what had already been done, but that the EAC could surely be more cautious in the future. This has left the concerns regarding eflows from existing dams in limbo.

Mr. Nath also said that there should be more regulation at the central level. He said that the EAC follows a thumb rule for a cascade of dams. According to this rule, the river should flow freely for one to two kilometres between the tail race of the upstream dam and the tail end of the reservoir of the downstream dam. Experts explain that there is no scientific basis for this conclusion. In any case, the EAC is not following its own thumb rule, as is evident from a number of cases. For example, in the case of the 240 MW Kuther and 180 MW Bajoli hydropower projects on the Ravi River, this minimum distance was not ensured.

Proponents and government nodal bodies for dams claim that they try to ensure minimum alterations of the water flow by taking care of the design and choosing the best site location for a dam. However, it is not clear how dam developers and nodal bodies like the CWC and CEA ensure minimum water flow prescribed in the environmental clearance. There are no clear guidelines about the monitoring of minimum water flow.

Idukki Dam in Kerala does not have any flows below it, leave alone environmental flows. Photo credit: Latha Anantha

The EAC presently recommends the release of 20% of the average lean season flow for lean months, 30% of the average monsoon flow for monsoon months, and between 20 to 30% of the average flow for non-lean, non-monsoon months.[31] Worse still, when dam developers claim that they cannot release these flows which are inadequate in any case, the EAC readily negotiates with the project proponents. This standard prescribed by the EAC is entirely arbitrary, without any scientific, ecological or sociological basis. Although various groups and bodies like the Wildlife Institute of India have recommended higher environment flows in select rivers, the EAC remains heedless.

While making these decisions, the EAC has never recommended the development of a more holistic and participatory method for assessing eflows. It has also never recommended that certain rivers should not be dammed. In some cases, the EAC has recommended the calculation of eflows using the holistic Building Block Methodology (BBM).[32] According to SANDRP, EIA consultants do not use this methodology while falsely claiming that they use it. For example, SANDRP has written to the EAC pointing out that WAPCOS Ltd. has used the Tenant Method to determine eflows in the Lohit River Basin, while claiming that they have used BBM. However, the EAC accepts what the EIA consultants claim and do not question them.

The maximum number of dams to be permitted on one river is still not clear. After talking to officials in the CEA, CWC and EAC, it became apparent that there is no fixed rule about or limitation to the maximum number of dams that can possibly be built on one river. The Terms of Reference of basin studies also do not include such a rule. Environmentalists have suggested that basin studies should include:

- environmental flows assessment using the Building Block Methodology (including cultural and religious needs and requirements)
- number of dams that can be permitted
- location of dams
- installed capacity of the dams
- type of dam (storage or run-of-the-river)
- type of operation (base load, peaking power or a combination of the two)
- impacts of operation on downstream communities and ecology, especially the impact of peaking power operations

Alteration of significant river flow is a major concern amongst environmental activists. Members of the EAC also accept that the river flow is altered to an extent. The challenge for the government is to keep the alterations to a minimum. Since rivers are lifelines of communities, changes in their flow impact people's livelihoods dramatically.

Impacts on Wildlife

The endangered Black neck crane in Zimithang valley, the barrage site of Nymjangchhu Project. Photo credit: Urmi Bhattacharjee

At present, no emphasis is placed on the Biodiversity Impact Assessment of projects. This has resulted in a veritable threat to endangered flora and fauna. The 780 MW Nyamjungchu Hydroelectric Project impacts the Black Necked Crane and Red Panda, the 200 MW Gundia Hydroelectric Project impacts the Gundia Indian Frog, projects in the Upper Ganga Basin including the 300 MW Alaknanda Hydroelectric Project threaten the Snow Leopard, projects on the Upper Ganga and Brahmaputra threaten the Gangetic Dolphin, while the 1,750 MW Lower Demwe Project threatens the Bengal Florican.

There is also a propensity among many project proponents to consider only large mammals as wildlife. CWC officials on numerous occasions have opined that dams cannot be avoided in a country like India. They say that birds can still fly and find other habitats, but there is a crucial need for irrigation and power generation which makes the presence of large dams necessary.

Even if the EAC rejects a proposal for the imminent threat to wildlife, such rejections lack consistency. For instance, in 2012, the EAC rejected a proposal for the 420 MW Kameng Dam on the Kameng River, since the submergence area was only 350 metres from the Pakke Tiger Reserve. However, in 2007, the EAC cleared the 1,120 MW Kameng-I Dam on the same river despite being cognisant of the fact that the area is located within a critical wildlife habitat. The minutes of the EAC meeting mentioned that "a part of the submergence area falls under the Pakke Tiger Reserve".

Similarly, the 76 MW Rambara Project on the Mandakini River in Rudraprayag district in Uttarakhand, just 6 kilometres from Kedarnath, was given Terms of Reference approval in the 19th EAC meeting in October 2008, although the minutes noted that "the whole project is located within the Kedarnath Musk Deer Sanctuary". The 200 MW Bara Bangahal Hydroelectric Project in the Kangra district in Himachal Pradesh state was also approved in similar circumstances.

Efforts of Environmental Groups Belittled

Many government officials and developers are of the view that environmental groups and activists are trying to sabotage the dam building process for their own vested interests. This leads to a failure on the part of the government and developers to take into consideration the concerns of such groups. In many cases, vital concerns raised by environmental groups were ignored at first, but accepted subsequently. For instance, government bodies did not initially understand the crucial need to carry out cumulative impact assessments of projects and maintain environmental flows. Later on, they accepted these measures as necessary.

Based on many years of experience, SANDRP concluded that "the EAC has shown its strong bias against people, the environment and all those who represent the interests of the local communities and the environment." In February 2012, three organisations working on issues related to water and dams, i.e. SANDRP, the River Research Centre, Kerala and International Rivers, were invited for a discussion with the EAC. There has been little impact of this discussion on the functioning of the EAC. Similar approaches by many other NGOs have been neglected by the EAC which avoids a concrete dialogue with these groups.

The MoEF seldom invites NGOs for discussions even after repeated strong representations from environment groups. The representations have also shown derelictions in following orders of the courts and the Central Information Commission. The MoEF has not met NGOs to discuss their suggestions on amendments required to the EIA notification, even though officials in the MoEF admit that there are problems with the EIA notification.

Concerns related to the UN Convention on Biological Diversity

The UN Convention on Biological Diversity (CBD) agreed to at Rio in 1992, with the main objectives of conservation, sustainable use, and access and sharing of benefits for local communities could have been a boon for riverine biodiversity. About 10.8 million people depend on riverine fisheries in India.[33]

However, in the case of mega dams, many environment groups feel that the Convention on Biological Diversity was of little help in protecting Indian rivers, riverine biodiversity and dependent communities. On the contrary, the United Nations Framework Convention on Climate Change encourages and certifies hydropower projects of all sizes as climate friendly projects under the Clean Development Mechanism. Many environment groups are concerned with the projection of mega dams in Northeast India as climate friendly, particularly as dam developers seek carbon credits and profits from the Clean Development Mechanism.

In order to push for an urgent review of plans for big dams, many groups are recommending the inclusion of rivers in the definition of wetlands in the Wetlands Rules, 2010. However, rivers have not been included.

Concerns about Changes in Detailed Project Reports

Dam proponents often alter the DPR to meet their needs. Deviations from the DPR are also commonplace. However, such changes are not dealt with responsibly by the bureaucracy.

Lack of Guidelines for Changes in Dam Functions

In some cases, the purpose of dams was changed when the initial purpose was found to be unfeasible. At such times, a new DPR was prepared. In some cases, the old and new DPRs had strikingly different findings. This happened in the case of the 2,000 MW Lower Subansiri Project. The Brahmaputra Board finalised the first DPR in April 1983 when it was slated to be a multipurpose project. Later, when the National Hydroelectric Power Corporation prepared a new DPR, it had remarkable inconsistencies. The proponents had conveniently ignored all recommendations and findings of the Brahmaputra Board in preparing their new DPR.

The strikingly opposite findings in the two separate DPRs for the same hydropower project have raised numerous questions among renowned engineers in the state who feel that the new DPR could have been conveniently altered by dam proponents to suit their requirements. In these cases, there is no clearly defined methodology to monitor the dubious DPR.

There is also no concrete policy when it comes to transferring a project from one proponent to another. Often, at the discretion of the state government, an existing project is randomly transferred to another developer. There are no existing rules or guidelines for such cases. This concern has been raised by many engineers in Guwahati, Assam.

Deviations from the DPR

During implementation, many projects deviate from the DPRs based on which they have been approved. In such cases, new or revised DPRs should be required to be submitted for approval. Yet, there is no proper monitoring of whether developers have sought a fresh appraisal. For example, in December 2008, the CEA observed that Teesta Urja Limited had deviated from the approved DPR for the Teesta III Hydropower Project. Civil society groups brought this to the notice of the EAC on January 1, 2009. The issue was discussed by the EAC in a meeting on April 21, 2009, and the minutes note that changes adopted by Teesta Urja Limited contravene the Environmental Clearance accorded on August 3, 2006. Further, the EAC

confirmed that changing the scope of the project under any circumstances would require a fresh appraisal. However, the dam developer has not sought a fresh appraisal, and the CEA also did not require it. In the meanwhile, the construction of the dam continues.

No System to Assess Existing Projects

Many dams, whether for irrigation or hydropower, have failed to live up to their promise. So far, there is no system to monitor and assess the performance of existing hydropower projects at the central and state levels. Many have already been reported to have underperformed. A recent finding by SANDRP shows that in Northeast India, 67% of projects with 87% of the total installed capacity generate at less than the promised level. Arunachal Pradesh tops the list of underperformance at 49%, followed by Nagaland at 38%.

Himanshu Thakkar of SANDRP says that "underperformance has nothing to do with the age of the project. Not-so-old projects like the 405 MW Ranganadi and the 75 MW Doyang hydroelectric projects are hugely underperforming."

Ageing Dams Not Being Decommissioned

Ageing dams are a serious concern. Both the CWC and EAC are of the opinion that a dam is a permanent structure that does not need to be decommissioned, even though many old dams have developed leaks and fissures. According to CWC officials, it is always better to repair existing dams, since decommissioning involves huge financial and other losses. They believe that dams must continue to exist in order to meet the food and water needs of the country. At present, there is not much progress in terms of the technical know-how and social and environmental issues associated with dam decommissioning in the country.

Many dams like the Mullaperiyar Dam in Kerala and the Dumbur Dam in Tripura have either exceeded their life span or led to huge social impacts including the alienation of tribals from their lands. Almost all existing large dams are embroiled in environmental and social fiascos. Yet, the government's nodal bodies have not made any decisions to decommission such dams. There is a very clear unwillingness when it comes to considering the decommissioning of large dams in the interest of the environment.

Currently, the CWC has the following programmes that aim to improve and develop existing projects in the event of damages:

The Command Area Development Programme: With its focus on the development of geographical areas under the command of river valley projects through a centrally sponsored sector scheme, this programme is implemented by the state or central government for constructing field channels and drainage system, and levelling undulating lands of farmers.

Modernization and Improvement of Projects: This programme envisages the lining of existing canals, branches, distributaries, water courses and field channels, and renewal of existing structures for the reduction of conveyance and operational losses.

Unlike the US, where many dams that are proving to be uneconomical, environmentally destructive or otherwise obsolete are being decommissioned, in India dams are still believed to be hugely economical. Experts believe that this opinion rests on the erroneous cost-benefit analyses carried out in India, which ignore many costs and overestimate benefits in terms of economic progress and power generation.

Parambikulam Dam. Photo credit: Latha Anantha

Appendix 1

List of CWC guidelines for river valley projects

Guidelines for Less Water Consuming Cropping Pattern for Irrigation Systems in Drought Prone Areas

Guidelines for Preparation of River Basin Master Plan

Guidelines for the Provision of Drinking Water Supply System in Multipurpose and Irrigation Projects

Guidelines for Submission, Appraisal and Clearance of Irrigation and Multipurpose Projects

Guidelines for Preparation of Revised Estimates of the Project and Appraisal Procedure

Guidelines for Monitoring of Irrigation Projects

Guidelines for Planning Conjunctive Use of Surface and Ground Waters in Irrigation Projects (CWC and Indian National Commission on Irrigation and Drainage)

Guidelines for Standard Equipment Specifications

Guidelines/Norms for Detailed Calculations for the Requirement of Each Category and Size of the Earth Moving and Production Equipment– Working Group Report

Report of the Committee to Review Existing Criteria for Working out Benefit Cost Ratio for Irrigation Projects (CWC/Planning Commission)

Evolution of Project Preparation and Appraisal in the Irrigation Sector

Guidelines for Preparation of Status Report of Monitored Projects

Guidelines for Accelerated Irrigation Benefits Programme (MoWR)

Water Management Manual (MoWR)

Guidelines for Environment Impact Assessment of River Valley Projects (MoEF)

A Guide for Estimating Irrigation Water Requirements (Ministry of Agriculture)

Manual on Irrigation Water Management (Ministry of Agriculture)

Indian Standard Guidelines for Allocation of Cost Among Different Purposes of River Valley Projects (BIS)

Guidelines of Dams & Research Wing, CWC

Manual on Design Fabrication, Erection and Maintenance of Steel Penstocks

Manual on Hydraulic Design of Gates

Manual on Design of Radial Gate

Manual on Design of High Head Gates and Rope Drum Hoist

Manual on Design of Weirs and Barrages on Permeable Foundations

Manual on Canal falls

Manual on Irrigation and Power Channels

Manual on Lining of Canal in Expansive Soils

Design Flood Manual

Manual on Hydraulic Design of Overflow Spillway Crest

Guidelines for Planning of Parallel Canals

Guidelines for Safety Inspection of Dams

Compendium on Silting of Reservoir

Sub-Zonal Flood Estimation Reports

Model Study Report used for Design and Drawings for River Valley Projects

Technical Specifications

Design / Technical Memorandum

National Register of Large Dams

Report on Dam Safety Procedures

Estimation of PMF using PMP Atlas (Southern Peninsular Rivers except Krishna Basin)

PMP Atlas for Ganga Basin

Manual for estimation of PMP (WMO No. 332)

Atlas for 1 day point PMP (IMD)

Atlas for 1 day point PMP (IITM)

Concrete Manual (USBR)

Earth Dam Manual (USBR)

Design of Small Dams (USBR)

Design of Gravity Dam (USBR)

Design Standards-Embankment dam (USBR no.13)

Concrete Dam (CBIP no. 266)

Manual on Tunnel (CBIP)

Life of Reservoirs (CBIP)

Guidelines of River Management Wing, CWC

Guidelines for Preparation, Submission, Appraisal and Clearance of Flood Management Schemes

Manual on Flood Forecasting

Manual on Hydrological Observation

Embankment Manual

Enhancement of Powers of the State Governments for the Sanction of Flood Control, Drainage, Anti-Water Logging and Anti-Sea Erosion Scheme (Planning Commission, I & CAD Division)

Policies for Hydropower Dams

For hydropower dams, the following acts, plans, policies, and reports are also applicable:

The Electricity Act, 2003

Indian Companies Act, 1956

Forest Conservation Act, 1980

Environment (Protection) Act, 1986

National Electricity Plan (CEA)

Indian Electricity Sector – Widening Scope for Private Participation (MoP)

Policy on Hydro Power Development (MoP)

Technical Report No.19 “Life of Reservoir (1977)” (CBIP)

Bureau of Indian Standards (BIS) Codes

Building and designing dams and their safety parameters are based on the following Bureau of Indian Standards (BIS) codes:

IS 5497 : Guide for topographical surveys for river valley projects

IS 4890 : Method for measurement of suspended sediment in open rivers

IS 13216 : Code of practice for geological explorations for reservoir sites

IS 4186 : Guide for preparation of project report for river valley projects

IS 4877 : Guide for preparation of estimate for river valley projects

IS 5477 : Methods for fixing the capacities of reservoirs

IS 7323 : Method for determining evaporation from reservoirs

IS 7323 : Guidelines for operation of reservoirs

IS 13028 : Guidelines for overall planning of river basin

IS 7560 : Guidelines for allocation of cost among different purposes of river valley projects

IS 4247 : Code of practice for structural design of surface hydel power stations

IS 12837 : Guidelines for selection of hydraulic turbines for medium and large hydroelectric powerhouses

IS 12800 : Guidelines for selection of turbines preliminary dimensioning and layout of surface hydroelectric powerhouses

Appendix 2

Water in the Indian Constitution

The Constitution of India lays down the legislative and functional jurisdictions of the union, state and local governments regarding water. Under the Constitution water is a state subject and the union's jurisdiction is limited to inter-state river waters.

List II of the Seventh Schedule contains subjects on which the states have jurisdiction. Entry 17 of this list is:

"Water, that is to say, water supplies, irrigation and canals, drainage and embankments, water storage and water power subject to the provisions of Entry 56 of List I". [Entry 56 of List I (Union list) is: "Regulation and development of inter-State rivers and river valleys to the extent to which such regulation and development under the control of the Union, is declared by Parliament by law to be expedient in the public interest."]

Article 262 of the Constitution about adjudication of disputes relating to water of inter-state rivers or river valleys is:

"(1) Parliament may by law provide for the adjudication on any dispute or complaint with respect to the use, distribution or control of the waters of, or in, any inter-state river or river valley.

(2) Notwithstanding anything in this Constitution, Parliament may by law provide that neither the Supreme Court nor any other Court shall exercise jurisdiction in respect of any such dispute or complaint as is referred to in clause (1)."

The 1992 amendments to the Constitution regarding panchayats and municipalities introduced the following entries in the schedules, listing the subject-areas in which the state governments and legislatures may devolve functions to such bodies, so as to make them evolve as local self-governing institutions:

In the Eighth Schedule (Part IX) dealing with panchayats, the subjects, "minor irrigation, water management and watershed development", "drinking water" and "maintenance of community assets" are listed. In the Twelfth Schedule (Part IX A) dealing with municipalities, the subject "water supply of domestic, industrial and commercial purposes" is listed. Functional responsibilities are thus visualised for local governments with respect to several aspects of water use.

The two laws enacted by the union under Article 262 and Entry 56 of List I are the Inter-State Water Disputes Act, 1956 and the River Boards Act, 1956.

References

1. The guide has been prepared by consulting nodal bodies involved in dam building, project proponents, and those affected by dams in the states of Uttarakhand, Sikkim, Arunachal Pradesh and Himachal Pradesh.
2. The International Commission on Large Dams (ICOLD) defines a large dam as one exceeding 15 metres in height above the deepest river bed level, and a dam between 10 and 15 metres height provided that the volume of earthwork exceeds 0.75 million cubic metres and storage exceeds 1 million cubic metres or the maximum flood discharge exceeds 2000 cubic metres per second.
3. mowr.gov.in/micensus/mi3census/annexure-i.pdf
4. The culturable command area is the area which can be irrigated by a project and is fit for cultivation.
5. This includes surface irrigation and groundwater irrigation.
6. For details about the hydro-development plan for the 12th plan period, see www.cea.nic.in/reports/hydro/hydro_develop_12th_plan.pdf.
7. Large dams usually lead to escalated costs since they are not completed within the scheduled period or budget and spill over from one five-year plan to another. When the 10th Five-Year Plan began, there were 410 ongoing projects, some of which were started in the 5th Five-Year Plan. According to the Ministry of Rural Development, the spillover cost from previous projects to the 10th Five-Year Plan is Rs. 17,700 crore (1 crore = 10 million, and the current conversion rate is approximately US$1 = Indian Rs. 60), which is more than the allocated amount.
8. www.cea.nic.in/reports/hydro/hydro_develop_12th_plan.pdf
9. For a classification of dams, see blog.thecivilengg.com/types-of-dams/. For an introduction to water resources development projects, see web.iitd.ac.in/~chahar/Courses/CEL351/Dams-%20Introduction.pdf.
10. Dams are classified based on their structure and function. Government nodal bodies like the CWC and CEA currently do not have separate rules for different types of dams. Existing rules apply generally to all dams, and there are additional rules for hydropower schemes.
11. Reply from the Tehri Hydroelectric Development Corporation to an application under the RTI Act, 2005
12. 1 crore = 10 million, 1 lakh = 100,000
13. The current conversion rate is approximately US$1 = Indian Rs. 60.
14. If the buyer and seller are in the same state, the profit margin of the developer is determined by the state commission. If, however, they are in different states, or if the generating company is a government undertaking, the profit margin of the developer is determined by the central commission.
15. These details were obtained through RTI applications filed with government hydropower developers like the National Hydroelectric Power Corporation and the North Eastern Electric Power Corporation.
16. For irrigation and multipurpose projects, the details are available in the "Guidelines for submission, appraisal and clearance of irrigation and multipurpose projects":www.cwc.gov.in/main/downloads/Revised%20Guidelines%202010.doc
17. www.cea.nic.in/reports/hydro/guidlines_dpr_he.pdf
18. A drifter is either a hydraulic or pneumatic powered rock or ground drill placed on top of a feed. The feed is like a rail that the drill travels on. This type of drilling procedure is also called drifting. Drifters are also used in mining, construction, exploration and natural science.
19. The CWC and sources at the National Hydroelectric Power Corporation said that they consider a dam's life to be 50 years.
20. This varies from developer to developer, but is generally believed to be 25 to 30 years.
21. The BIS codes are listed in Appendix 1.
22. Reply from the MoP and the MoWR to applications filed under the RTI Act, 2005
23. This information was obtained by filing an RTI application with the CWC to enquire about the details of rehabilitation and resettlement and the procedure for the redressal of public grievances.
24. The Inter-Ministry Task Force on large reservoirs maintains that a third of their storage capacity has been affected by siltation, resulting in reduced area under irrigation and lowering the life of the dam.

According to the Planning Commission, in most cases, the rate of siltation is far in excess of the rate assumed during construction.

25. The committee's report was submitted on July 27, 2012, but was made available only after the Krishak Mukti Sangram Samiti (KMSS) Secretary Akhil Gogoi organised an official press meet about the report.

26. According to the MoWR, the responsibility for the safety of dams rests with the concerned owners i.e. the state governments, public sector undertaking or private bodies. Recommendations on safety, including seismic safety, are provided by the CWC for specific cases as and when they are referred to the CWC by the dam owners.

27. This observation is based on reactions of environmental NGOs and project-affected people.

28. Reportedly, such releases occurred twice from the famous Bhakra Dam, in the late 1970s and again in 1988. Another case was that of the Rihand Dam. In 1997, a huge amount of water was suddenly released and flooded 175 villages in the Rewa district of Madhya Pradesh state including the town of Rewa, killing 14 people and causing estimated damages of Rs. 200 crores. See theconstructor.org/structures/environmental-impacts-of-large-dams/236/ for details.

29. sandrp.in

30. sandrp.wordpress.com/2013/03/14/how-much-do-we-know-about-our-dams-and-rivers/

31. This was claimed by members of the EAC.

32. There are over 200 methodologies for determining eflows. See the website of the Global Environmental Flows Network: www.eflownet.org.

33. COP 11 Hyderabad, October 12, 2012 sandrp.in/rivers/PR_Impact_of_Dams_on_Rivers_CAN_CBD_HELP_Oct_12_2012.pdf

Jawaharlal Nehru famously called large dams the temples of modern India. These temples are being planned and sanctioned by a complex web of government bodies and expert committees. The policies that govern the process are weak, transparency is lacking, and the people impacted by projects take no role in the decisions that affect their lives.

The lack of transparency and consultation makes it difficult for civil society to hold decision-makers to account. This reports sheds light on the complicated dam planning and sanctioning process in India. It explains where avenues for bringing in the public interest exist, and how policies and processes need to be strengthened.

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