CASE STUDY FOR CASCADE DEVELOPMENT OF GANGA VALLEY PROJECTS

EXECUTIVE SUMMARY

Ganga River Basin ranks among the largest in the world in drainage basin area and length. Flowing across the great alluvial Indo-Gangetic plains, the Ganga is bordered by the Himalayas to the north and the Vindhya-Satpura ranges to the south. The river has two main headwaters in the Himalayas--the Bhagirathi and the Alaknanda. The Bhagirathi flows from the Gangotri glacier at Gomukh and Alaknanda rises at the confluence and feet of the Satopanth and Bhagirath Kharak glaciers in Uttarakhand. Farther downstream, the river is joined by a number of other Himalayan rivers, the Yamuna, Ghaghara, Gomti, Gandak and Kosi. However, the Ganga and its major tributaries, the Yamuna, Ram Ganga, and Ghaghara are the only Himalayan rivers that have significant base and flood flows.

The challenges are very much on the Himalayan states, like Uttarakhand in development of hydropower over the next decade. The optimum hydro power development can be made by undertaking the Cascade Development of the Ganga basin up to Haridwar, which has catchment area of about 22600 sq. km.

During the Collection of information for the case study of the Ganga basin projects, it has been observed that -

1. Substantial geological risks are associated with hydropower development in the Himalayan region.

2. Hydrological risk is high, as the period of observations is relatively short and many times the flows are extrapolated from a gauge & discharge measuring station located downstream of the project site.

3. Different Methodologies are adopted for determining design floods for different projects. This inconsistency may lead to under or over designing of spillway capacities for the various projects in a cascade. A dam with adequate spillway capacity could be vulnerable to the cascade dam break potential from the failure of an upstream dam with inadequate spillway capacity.

4. Silt is a major problem to hydropower development in the Himalayan region, and it threatens to undermine the viability of the hydropower investments and necessitates development of more effective measures for silt management.

5. The present design of projects and operational plans, are mostly on individual basis. However, simple modeling calculations show that optimization of a cascade of hydropower projects result in greater energy generation.

6. An upstream storage project shall benefit to existing and planned downstream projects through regulated flow releases. It shall also control the flood by moderation of flood and shall trap sediment.

7. There are a number of developers working in the basin which causes lack of co-ordination. Proper coordination is necessary for efficient implementation of projects.

8. Some private developers are new to hydropower sector, and have insufficient understanding of the fundamental commercial risks. They are also unaware of market environment.

9. The road network faces severe challenges & problems, especially with uncoordinated hydropower construction schedules of the projects.

10. Compensatory afforestation is some time done away from the affected basin area.

11. Environmental flow is not determined on the basis of down stream need & ecosystem of the basin. In some cases no environmental flow has been defined.

12. Lack of proper communication and public awareness leads to opposition of the projects by local people.

13. Environmental Plan & Social Development Plan are not properly implemented.

14. Analysis of the available feasibility studies and related reports for the hydropower projects, consultations with the various stakeholders in hydropower development in the basin and reference to various International practices being adopted in this field, suggest the advantages of developing a framework for efficient hydropower development at the level of the river basin, as contrary to present practice of individual project level development.

River basin development involves optimization of planning, design, construction and operation of projects cascade in basin. This can be effectively done by considering the following factors at the river basin level:

1. Hydrological yield estimation can be vastly improved by the coordinated collection, storage, and dissemination of hydrological and meteorological data to developers. The effects of climate change can be estimated by centralized studies. The various developers thus ignore this important aspect or undertake yield estimation for individual project.

2. The mathematical models of basins can be developed so that the effects of one project on another in the cascade can be fully understood, and optimization of design and operation of the cascade of projects can be achieved for maximum benefits.

3. At least one Storage Project at the upstream end of a cascade can be investigated to get the benefit in terms of flow regulation, flood control, sediment trapping and against any negative aspects related to the environment or affected local population.

4. There can be consistency in determining of design floods, and prediction of floods and warning systems can be installed on a basin wise basis.

5. Development and sharing of infrastructure can be coordinated so as to minimize strain on infrastructure such as main roads, access roads, and construction power and transmission lines for evacuation of power.

6. Benefit sharing amongst all stakeholders can be more reasonably managed.

7. Environmental flow of river for various stretches in the basin can be determined on the basis of social & economic requirements of down stream inhabitant and water requirement of down stream flora & funa.

8. Catchment Area Treatment can be enhanced by proper monitoring by various stakeholders and standardization.

9. Environment Impact Assessment can be prepared for entire basin to establish baseline and objectives of Environmental Mitigation Plan of whole basin can be derived.

10. Water quality can be measured & standardized on the basis of down stream need and river carrying capacity.

There are some recent developments towards river basin planning, particularly in the area of project optimization. There have been some recent cases of optimization by developers and State Governments involving a small number of projects along limited stretches of river. These cases emphasize the need for a more systematic approach to basin optimization so that the benefits to all developers, affected communities and the Government, can be realized.

A number of issues are covered in this report, but it is not intended to be a complete analysis of issues in the hydropower industry in the Ganga basin. There are a number of issues and risks which are not dealt in this report. However, the study and the report are focused on the main issues where a river basin planning approach in cascade form can play a more important role in improving sustainable development.

This Report makes recommendations and suggestions to enable hydropower development to move towards river basin level planning, design and operation. The fundamental themes of these recommendations are:

1. Need for data sharing amongst the developers and government authorities, particularly related to meteorology, hydrology and sedimentation.

2. Need for improved methods of hydrological yield estimation, which has a fundamental impact on project economics.

3. Need for significant improvement in coordination between developers, in respect of shared infrastructure such as main roads access roads, construction power and power evacuation transmission lines etc.

4. Need of effective developer's forum in the basin.

5. Need for creation of 'Compensatory Afforestation Fund' and 'Catchment Area Treatment Fund'

6. Need for 'One basin One Developer' approach for the development and optimization of benefits.

7. Need of 'Platform Project' approach for environmental protection.

The key recommendations and suggestions of the case study are summarized hereunder:

1. A System to be established for uniform and easy availability of data sets for hydrology, topography, sedimentation, ecology and economic activity of the basin.

2. Methods can be standardized in the basin for calculation of energy generation (not based on only 90% dependable year) and design flood analysis using extreme rainfall methods.

3. Develop and implement a basin operation model for real-time scheduling and for flood forecasting.

4. To provide a co-ordinated approach for sedimentation at the basin level. This could include data sharing and consideration of alternative design assumptions such as cost-benefit of removing smaller than the current minimum 0.2 mm particles.

5. Develop Master Plans for infrastructure such as main roads, access roads, construction power, transmission lines for power evacuation so that benefits are maximized and costs are minimized.

6. To develop plans to collect relevant data for deciding sustainability flows.

7. Developers to consider collective benefit-sharing for large items and state governments to consider contributions from the 12% free power as suggested in new Hydro Power Policy.
8. Develop basin-wide plan, with sequenced priorities linked to water management issues for developers.

9. Benefit sharing and priorities paper incorporating requirements of Environmental Impact Assessment and Social Impact Assessment can be developed at the basin level.

Implementing a completely new system via River Basin Authorities would require considerable time, and it is important that positive actions are taken at the earliest and without delaying the hydropower development. A shift towards river basin planning from individual project approach may include:

1. Informal, cooperative development of databases and tools to facilitate river basin considerations in project planning and implementation, which could be formalized through a central agency or independent body for the ongoing maintenance of data.

2. Establishment of a developer's forum with stronger participatory requirements and mechanisms for data sharing and decision-making.

3. Establishment of a new institution, with legal mechanism to establish representative membership and to provide clear responsibility for river basin planning.

There is a essential need to establish an effective and mandated River Basin Development Authority. Such Authority could have representation from all stakeholders and be chaired by a person without vested interest and not belonging to the basin state. Membership of Authority could change as development progresses in the basin. Representatives of developers and relevant technical organizations and transmission utilities and people living in the basin could have membership in the Authority.

A river Basin development authority may be more effective than a single State Authority because it might not be possible for the local people with specific issues to be involved. Funds to operate these Authorities may come from the revenue emanating from the 12% free power royalty to the state.

River basin planning approaches once implemented in the Ganga basin shall enhance the power generation from the planned projects and will reduce the cost of development of hydro power projects by sharing of infrastructural cost, catchment area treatment and compensatory afforestation cost and shall boost the economic development of the region. The developer's forum could also be gainfully utilized in the coordinated development.

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