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HYDRO ELECTRIC POWER PROJECTS CONSTRUCTION PLANNING AND IMPLEMENTATION IN INACCESSABLE NORTHERN AREAS OF PAKISTAN

BY

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INTRODUCTION

1. Power Development Work in Pakistan has been generally taken up by WAPDA in areas which are located in plains and in vicinity of communication centres. This has helped in the movement of manpower, material, equipment and allied resources needed for completion of the project without much hindrance or problems of transportation.

2. There has been great power shortage in the northern areas of the country, construction of power transmission lines from down country is costly and also open to seasonal damages by avalanches and rock-slides along their routes. Adequate hydro power potential is available on large and small streams in these areas. WAPDA has therefore planned to utilise these power resources by construction of small and medium Hydro Electric Power Plants at these far flung areas with difficult approaches to provide electric power to the many towns and villages. This paper out lines the efforts required to launch such projects.

PLANNING

3. Before any such potential is developed a thorough survey, planning and design work is required. Accurate topographical maps, hydrological and geological data of these areas have not been recorded. Accordingly after identification of a project, through reconnaisance surveys following preliminary exploration is required:

a. Strip map showing contour lines upto one or two meter interval keeping in view the type of mountains and terrain to firm up the available potential and consider various alternatives and possible types of the project.

b. Geological data for the purpose of designing different structures like diversion weir, power channel, forebay, spillway, acquaducts, power house etc.

c. Hydrological data to identify the head during different seasons and its effect on design and type of turbines etc. Also required is the collection of rainfall data in the catchment area and estimation of flood cycles to forestall its damage potentials to the project.

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d. Availability and location of construction materials
The availability of construction materials in the vicinity of project area is of crucial importance and requires thorough and detailed investigation. In addition practical routes for transportation of cement, steel and other imported materials from down country have to be considered.

e. Accessability of the site
Preliminary identification of a project must also generally establish its constructibility without which any detailed investigation would not serve any purpose. The most important factor from the point of view of costing is the availability of workable approaches to the planned project site. Improvement of old routes or construction of new tracks including launching of temporary or permanent bridges as necessary, will have an important effect on the project costs. It is to be kept in view that suitable approach will also be required for operation and maintenance purposes after completion of the project.

CONTRACTING

4. Once the project designs, financial allocations and sanctions are approved by competent authority the contracting action can be taken in hand. The selection of contractors, in these far flung areas to work on such sophisticated but small projects generally over and above their technical and/or financial ability is another very important matter requiring careful consideration. It will also depend on the following factors which can play crucial role in the successful and scheduled completion of the project.

a. Knowledge of the area and its social and geographic restraints.

b. Influence on the local population and tribes.

c. Availability of or means to procure light equipment and skilled manpower.

It is very likely that the main constractors will have to associate some influential local contractor or elder to overcome tribal problems and retarding influences.

IMPLEMENTATION

5. Following are the most important activities for the execution of the project. The agency who has contracted must plan the following and the client must ensure through contract clauses that the following fields are covered:

a. Materials supply at site and its plan of movement.

b. Manpower resources local and non local

c. Organisation to control the project

d. Adoption of below freezing construction techniques.

These activities are discussed in detail in the following paras:-

a. Construction Materials and Equipment

There are two types of materials i.e. locally available e.g. sand, aggregates, stone water etc. and those which have to be imported e.g. steel, cement, construction equipment and other special materials etc. Work in the areas of these projects is generally restricted to summer months only. Since work is to be performed well away from population centres this aspect can have crucial effect on cost and execution and is further explained as follows:

I. Locally available material

i. Location of sand source, its suitability and transportation to site by animal or if possible by mechanical means.

ii. Availability of stones and gravel : Their suitability by laboratory tests about their soundness and their capability of easy processing to the desired grade. The problem of transportation to site will have to be stored out if the quarries are away from the project site.

iii. Since the projects are in difficult areas where extreme cold climate is normally encountered during winter season, it is always desirable to have ample space for stock piling of materials at site during summer month. A plan must also exist to build up stocks of sand, gravel/crush during months of inactivity provided the tracks are not blocked due to snow fall or heavy rains. Lot of project time can be saved if this aspect of storage is well planned and executed. It is also likely that during slack period of winter lot of local transport like jeeps and tractors are available and can be advantageously utilised by the contractor.

II. Imported materials.

This aspect will be discussed under the following two heads i.e. cement, steel etc. and construction equipment.

i. Cement and steel etc.

These materials may have to be transported in two or three stages to the site. Initially from suppliers or from factories to a conveniently located base camp upto which place movement by heavy cargo vehicles is possible. Suitable storage space will have to be built or acquired by the contractor to serve as main store. From here the material is transported in smaller loads by jeeps or tractors on hazardous tracks to another storage area in the vicinity of the project. It is then further carried by labour (or by animal transport) to the site of actual construction. All these aspects require careful planning and funding because many projects are known to have floundered as execution agencies did not give them due importance. All opportunities of serviceable communication must be availed in good time to avoid frustration when roads and paths are closed due to heavy rain and snow falls causing slides and snow avalanches.

ii. Water

Although it seems odd yet some construction sites of a hydro project for topographical reasons are away from the available source of water. Accordingly in some areas water is very scarce for construction or even for drinking purposes. In such cases its availability and carriage to site by animals or by a pipe line must be planned well before starting execution.

iii. Equipment

Since the projects are in far flung areas equipment like concrete mixers, compressors, crushers etc. Should be of light weight type capable or carriage by tractors, jeeps or donkies. In many cases these machines may have to be dismantled to be transported by men or by animal transport and then assembled at site. This opration will require expert technical hands.

- The most important but generally neglected part regarding equipment is its maintenance and repair. It is always impossible to move a defective machine to hundreds of miles for repairs in city workshops. The importance of an adequate workshop staffed with competent skilled labour at project site with necessary tools can not be over emphasised. A stock of fast moving spares must also be available at site so that equipment is not kept idle due to minor spare parts. Idle equipment means loss of production time and serious delays in construction schedule.

b. Manpower Resources

So far we have discussed materials and equipment etc. which are purchased and plannned to reach project site through complex despatch system. But the most important aspect is the skilled and unskilled manpower who are going to put all things together and complete a complicated project successfully.

I. Unskilled manpower

In many cases unskilled manpower may be available in project vicinity but two things must be kept in view that:

These workers are likely to be seasonal i.e. they may not be available during summers as they move to mountain pastures with their livestock and also during harvest season when either they are sowing or cutting their food crops. This labour is available in winter because there is no activity on the fields and snow fall on mountsins forces the people to villages which are at lower altitude. But unfortunately this is the period when construction activity comes to stand still due to extreme low temperature. This labour can then be only used for dumping of materials from road head to the project site. The above factor implies that unskilled labour will also have to be brought from down country which can only be made available by offering them higher rates of pay and provision of boarding and lodging

at site.

II. Skilled labour

Carpenters, steel cutters and benders masons etc. are all to be brought to the site from down country. The principle of making their job attractive by payment of higher wages and provision of food stuff and other site facilities also applies to them.

III. Deployment of labour

It must be understood while calculating working days in a year, that this labour will be absent from the project for upto 14 days at a time when they go to their homes during Eids or Moharram. The security of area from local tribal interference and other disturbance also affect their will to work because nobody is ready to risk his life even if the working conditions are otherwise excellent.

IV. Medical and first aid care is very essential and must be provided as labour will be working in remote areas where no alternative aid is available.

c. PROJECT ORGANIZATION

I. What has been said in the preceeding paras imply that a very sound Project Control Organization will need to be set up to provide administrative support to the project. This can more conveniently be functional in the following three stages.

i. Stage - I

A dependable and knowledgable organization is required in a connected major city to procure and despatch materials to road head.

ii. Stage - II

Road head will require staff and storage space to receive and stock construction materials and then despatch to project site in smaller loads as per project plan being implemented by Project Manager.

iii. Stage - III

Receive, store and despatch to the actual site of work by manpower or animal transport etc. as necessary.

II. A Project Control Office will also be required at stage II where Project Manager and his technical staff can be located to monitor the project and keep vigilance on the performance of stage I & III including the construction activities and quality control.

d. If the project is of great importance and require quick completion then special winter below freezing construction techniques will be required. Thus keeping in view minimum temperature which will be relevant during this period, addition of special chemicals, their mix

ratio and water heating arrangements will have to be specified. This will effect the overall cost of the project.

6.WEATHER AND GEOLOGICAL RESTRAINTS

As discussed earlier weather conditions have a lot of influence on construction work in Northern Areas. This implies that a project which can be implemented in one year or two years under normal circumstances in accessable areas. It may require double or triple the period. Weather and seismic restraints can be classified in the following manner:

a. Heavy rains bring down rock slides causing closure of approaches to project areas.

b. Avalanches can affect the communication system or damage the construction work which is in progress.

c. Heavy snow falls will make approaches to project impossible for days and months also hampering the construction work.

d. Northern Areas fall in the seismic belt and earth-quakes of minor and major intensity are quite common. This has a dual effect. Firstly special provisions in the design of structures are to be made and secondly allowances in possible damage to communication net work and danger to manpower at work should be made.

CONCLUSION

7. It has been tried to out-line the considerations and highlight various handicaps involved when hydro power projects are taken up in far flung and difficult Northern areas of Pakistan. These are summarised below and should not be overlooked or neglected by planners.

a. Accessability of site for initial surveys and detailed technical and collection of design data.

b. Availability of roads and tracks to the site for the purpose of project implementation.

c. Materials and manpower resources available locally or to be imported.

d. Weather restraints.

e. An efficient Project Control Organisation to implement the plan and follow construction schedule.

f. Effective medical and first aid facilities with arrangement of evacuation of injured workers.