Chapter 10
Power

10.1 General

Krishna (Almatti) – Pennar link canal proposes to divert a part of the water that becomes available by way of successive replacement principle for the benefit of drought prone area of Anantapur district of Andhra Pradesh in Upper Pennar sub-basin and Raichur and Bellary districts of Karnataka State in Krishna basin. The proposal for power generation by the Govt. of Karnataka at Almatti dam and by NWDA at the off take of link canal is briefly discussed in this chapter.

10.2 Power Generation at Almatti Dam

There will be regulated release of water from Almatti dam to be picked up downstream at Narayanpur dam for diversion into the left bank canal. It has been found feasible to generate hydroelectric power at the foot of Almatti dam by making use of the regulated releases. The Karnataka Power Corporation Limited (KPCL) has proposed to install five generating units of 55 MW each and one unit of 15 MW. The total installed capacity of the Almatti dam powerhouse will be 290 MW. Penstocks have been embedded in the body of the dam and the powerhouse is proposed to be located on the right flank of the dam. To facilitate power generation during monsoon months it has been proposed to maintain the water level at 519.6 m (FRL).

10.3 Effect of Inter-Basin Water Transfer on the Power Generation at Almatti Dam

The Krishna (Almatti) – Pennar link canal is a component of Mahanadi – Godavari – Krishna – Pennar – Cauvery – Vaigai interlinking proposals. The Almatti project as planned by the Government of Karnataka is an independent scheme envisaging power generation as detailed above. However the interlinking of the river basins as proposed by NWDA envisages transfer of water from Manibhadra on Mahanadi to Dowlaiswaram on Godavari, thereby releasing water upstream of Dowlaiswaram for possible diversion to Krishna and beyond. Major links from Godavari to Krishna are the Inchampalli – Nagarjunasagar, Inchampalli – Pulichintala and Polavaram – Vijayawada (Prakasam

Barrage) links. The Nagarjunasagar, Pulichintala and Prakasam Barrage are situated downstream of Almatti dam. The diversion from Almatti dam is considered as in exchange of Godavari waters received down streams from the above links. With the introduction of link canal the reduction in power generation is about 85.5 MU only. This reduction in power generation can be eliminated by further raising the FRL of Almatti reservoir as envisaged in the Upper Krishna Project.

10.4 Power Generation from the Link Canal

It is proposed to generate power from the link canal at the exit of tunnel no.1, just downstream of the off take point at Almatti reservoir.

10.4.1 Installed Capacity

The link canal is proposed to be operated for 6 months i.e., from June to November. The withdrawal pattern of link canal varies from peak demand of 230 cumec during August to lean demand of 30 cumec during June. The Almatti reservoir simulation study reveals that the reservoir level fluctuates from 519.60 m to 514.49 m during June to November.

An approach channel of length 700 m and a tunnel of 1.125 km long is proposed to off-take from foreshore of the Almatti reservoir to facilitate crossing the ridge on the rim of reservoir. At the exit of the tunnel a fore bay is proposed with intake arrangement for penstocks for powerhouse and bypass provision for canal operation during emergency periods. The gross head available at the exit of tunnel varies from 11.23 m to 5.61 m.

For design of the tunnel, the economical diameter of tunnel has been worked out based on equivalent discharge and revenue loss in power generation. The equivalent discharge of tunnel was found to be 170 cumec with 9.0 m dia in size.

The average monthly power potential for the period from 1955 to 1983 considering the head losses at tunnel and penstocks with overall plant efficiency of 88% has been worked out and found to be 15.9 MW in August and 2.0 MW in June. The optimum installed capacity of the powerhouse was fixed based on various installed capacities and their power generation. The optimum installed capacity was chosen as the installed capacity at which maximum power is generated and beyond which there is no appreciable increase in power generation due to additional increase in capacity. It was found that 14.0 MW installed

capacity as the optimal one and based on this, 3 units of 4.50 MW each have been proposed. Since the powerhouse will operate for 6 months, no standby units are proposed. The power generation with the 13.5 MW installed capacity including 10% overloads due to excess water available is estimated as 42.5 MU.

10.4.2 Selection of Turbine

The power plant falls under low head category hence, the radial flow turbine is preferred. The types of radial flow turbines are:
i) Tubular type in which the generator is located outside passage (i.e.,) horizontal type (S-Type), vertical.
ii) Bulb type with generator and runner enclosed.
iii) Rim generator in which the generator is on the periphery of the turbine runner.

Considering the advantages and disadvantages in respect of specific cost of equipment, civil works, efficiency of turbine and operation and maintenance costs, the horizontal tube turbine (S-Type) is adopted.
The information of various turbines, their capacities and standardization is furnished in CBIP Publication 175. The turbine capacity for a designed head of 8.5 m does not fall in any of the above standardization and hence the turbine has been hydraulically designed. The design parameters of turbine are as given below.

Number and capacity	3 x 4.5 MW
Design discharge	61.3 cumec
Design head	8.5 m
Specific speed	800 rpm
Rotational speed	149 rpm
Runner dia	3.6 m
Turbine centre line	506.65 m

10.4.3 Power House

Brief description of the intake structure, machine hall and draft tube is given below:

10.4.3.1 Intake Structure

A reinforced concrete intake structure consisting of 6 vents of 2.0 m width and 5.0 m height is provided at the end of the intake fore bay to feed 3 turbines with 2 vents for each turbine. The flow level of intake structure is kept at 504.0 m. A bell mouth is provided at the entry of the intake barrel to obtain a smooth flow into the turbine. Each vent is fitted with gates to control the flow. Three trash racks of 24 m width and 7.85 m height are provided upstream of the bell mouth for each intake barrel to prevent debris entering the turbine. A transition is provided from the downstream face of the intake gate groove from a rectangular section to a circular section to act as penstock. A RCC slab is provided over the intake structure to serve as a platform.

10.4.3.2 Machine Hall

The Machine hall of powerhouse is a reinforced concrete framed structure of 61.20 m long and 20.50 m width and is designed to house 3 units of 4.5 MW each. On the right side, an unloading bay and service bay are provided to receive the mechanical and electrical equipment for installation in the powerhouse. An overhead EOT crane with facility of its movement in both directions to unload and erect equipment is provided.

Control room is provided adjoining the unloading and service bay to install the control panels required for operation of the generating units. The individual transformer for each turbine is proposed to be kept outside the powerhouse over the draft tube. The gearboxes and generator are erected on floor at 505.0 m elevation.

10.4.3.3 Draft Tube Structure and Tail Race Pool

Single pier draft tube structure with individual gate is provided immediately downstream of powerhouse building for each turbine unit. The width and height of the draft tube vent is 5.66 m x 3.78 m. The platform with hoist supporting structure is also provided over the draft tube vents to facilitate operation of draft tube gates. A tail race is provided immediately downstream side of draft tube which consist of a RCC floor with reverse slope of 4 H : 1 V and warped wing walls built in concrete.

10.4.4 Water Conductor System

It consists of : (i) Approach channel from Almatti reservoir; (ii) Tunnel; and (iii) Fore bay with by pass arrangement.

10.4.4.1 Approach Channel

The approach channel off-takes from the fore shore of Almatti dam is 700 m long and 32.0 m wide in bed and trapezoidal in cross sections. The bed level of approach channel is fixed at 505.5 m against the MDDL of reservoir of 506.8 m to facilitate drawl of water up to MDDL level. A transition of 1:3 at the end of approach channel is provided to connect the tunnel. The approach channel is proposed to be lined in cement concrete.

10.4.4.2 Tunnel

The tunnel is 1.125 km long and 9.0 m in dia and proposed to be concrete lined. A rectangular passage of 60 m in width and 7.0 m in height with bell mouth at tunnel entry is also proposed. Gate grooves at rectangular passage with erection platform also provided to facilitate the operation of gates at the entry of tunnel. A transition from the downstream face of the groove is provided from rectangular section to circular section. The tunnel is proposed to have a slope of 1: 4400.

10.4.4.3 Fore bay

The fore bay is 12.0 m long and 63.0 m wide. A bypass arrangement is provided on left flank to facilitate the release of water in emergency cases and during non-operation of powerhouses. The floor and top of level of the fore bay is fixed at 504.0 m and 521.0 m respectively with provision to raise the height up to 524.256 m level. A transition wing wall of 1:3 is provided to connect the tunnel exit and fore bay.

It is proposed to have on orifice opening, with slide gates and operation platform in bypass, 4 vents with vent size of 2.75 m horizontal and 2.10 m vertical is provided. The elevation of crest at opening is kept at 505.0 m to enable to pass peak discharge. The energy dissipater with chute blocks, basin blocks and dented sill blocks are also provided at the downstream of the by pass channel. The energy dissipater consists of depressed floor up to 500.30 m level for a length of 41.4 m and thereafter at 504.75 m, rose by vertical transition of 3 H and 1 V from

the downstream of dented sill. The energy dissipater is connected with main canal just downstream of tailrace pool with smooth transitions. The top of the sidewalls is staggered from 521.0 m to 512.0 m level.