

Chapter – 10

Power

10.1 General

As explained earlier, the Godavari (Polavaram) – Krishna (Vijayawada) link canal follows the same alignment as that of the Right Main Canal of the Polavaram Project proposed by Government of Andhra Pradesh across the river Godavari. There are no drops along the link canal and, therefore, no power generation is contemplated on the link canal. However, the power generation proposed by the State Government at Polavaram project is briefly discussed in this Chapter along with the status of power generation in the State of Andhra Pradesh. The effect of inter-basin water transfers on the power generation at Polavaram is also discussed at the end of the Chapter.

10.2 Present Status of Power Development in the State

The total installed capacity in the State of Andhra Pradesh as on 31.3.1998 is 6380 MW and the share of the State from Central Sector is 897 MW. The category wise break-up of installed capacity is given in Table 10.1.

Table 10.1
Category-wise break-up of installed capacity in Andhra Pradesh

Category	State sector (MW)	Joint sector (MW)	Private sector (MW)	Central share (MW)	Total (MW)
Thermal	2953	--	--	857	3810.00
Hydel	2650	--	--	--	2650.00
Mini hydel	7	--	15.75	--	22.75
Gas	--	272.5	423.90	--	696.40
Wind	2	--	52.74	--	54.74
Co-generation	--	--	2.75	--	2.75
Atomic	--	--	--	40	40.00
Total	5612	272.5	495.14	897	7276.64

Source: APSEB, 'Power Development in AP(Statistics) 1997-98'

10.2.1 Available Generating Capacity in the State from Different Sources -Category-wise as on 31.3.1998

Available generating capacity and energy available in Andhra Pradesh from different sources is given in Table 10.2.

Table 10.2
Source-wise generating capacity and energy available

Name of the Power House	No. of Units x capacity (MW)	Installed capacity(MW)	Generation during1997-98 (MU)
A. Thermal			
Kothagudem A	4 x 60	240.0	1222.220
Kothagudem B	2 x 110	220.0	1220.281
Kothagudem C	2 x 110	220.0	1194.564
Kothagudem D	2 x 250	500.0	1526.307
Vijayawada I	2 x 210	420.0	3301.910
Vijayawada II	2 x 210	420.0	3482.580
Vijayawada III	2 x 210	420.0	3572.640
RTPP	2 x 210	420.0	2982.574
RTS-B	1 x 62.5	62.5	400.190
NTS	1 x 30	30.0	116.224
Sub-total		2952.5	19019.490
B. Hydel			
Machkund	3 x 17 } 3 x 23 }	80 *	299.507
TBHES (TB Dam & Hampi)	4 x 9 } 4 x 9 }	58 *	112.341
Nizamsagar	2 x 5	10	5.093
Upper Sileru	4 x 60	240	354.122
Donkarayi	1 x 25	25	56.354
Lower Sileru	4 x 115	460	862.633
Srisaillam	7 x 110	770	2954.999
Nagarjunasagar RCPH	3 x 30	90	197.784
Nagarjunasagar	1 x 110 } 7 x 100 }	810	2277.625
Nagarjunasagar LCPH	2 x 30	60	90.315
Pochampad	3 x 9	27	14.894
Penna Ahobilam	2 x 10	20	7.468
Mini Hydro	7	7	11.557
Wind farm (Ramagiri)	10 x 0.2	2	0.440
Sub-total		2659	7245.132
C. Gas (Joint Sector)			
VGTS - I	(2 x 33 +1 x 34)	100	671.286
VGTS - II	(1 x 112.5 +1 x 60)	172.5	577.693

D. Central Projects			
NTPC	--	580*	4340.112
MAPP	--	40*	457.014
NLC – 2 MC	--	277*	2526.595
E. Private Sector	--	495.14	2054.983

* Share of Andhra Pradesh State.

Source: APSEB, 'Power Development in AP(Statistics)1997-98'.

10.2.2 Present Status of Utilisation of Power Produced

The present share of various uses as percentage of total consumption for 1997-98 is furnished in Table 10.3.

Table 10.3
Present share of various uses of power

Use	Percent
Domestic	19.20
Non-domestic	3.93
Agriculture	39.54
Industrial including cottage industries	5.85
H.T. industries	29.56
Others	1.92
Total	100.00

Source: APSEB, 'Power Development in AP(Statistics)1997-98'.

10.2.3 Schemes Under Construction as on 31.3.1998

Various generating schemes under execution as on 31.3.1998 in the State are given in Table 10.4:

Table 10.4
Schemes under construction as on 31.3.1998

Scheme	Capacity (MW)	Date/Expected date of commissioning
A. Thermal		
KTPS stage-V	2 x 250	2/98
B. Hydel		
Srisaillam left bank	6 x 150	10/99
Singur HES	2 x 7.5	5/99
AP Power House at Balimela	2 x 30	--
Mini Hydel schemes	5.15	3/99
C. Gas Based (Private sector)		
Jegurupadu CCPP	216	6/97
Godavari CCPP	208	3/98
APGPCL CCPP	172.5	12/97

Source: APSEB, ' Power Development in AP(Statistics)1997-98'.

10.2.4 Exports / Imports of Power

The total exports and imports of energy in the State during 1997-98 are as under:

Import including purchases	=	11881 MU
Export to other States	=	27.61 MU

10.2.5. Future Plans for Power Development in the State

Various schemes likely to be taken up in future for power development in the State are listed in Table 10.5.

Table 10.5
Proposed schemes and installed capacity

Name of the Scheme	No.of units x Capacity(MW)	Capacity (MW)
A. Thermal		
Kothagudem TPS, Stage-VI	(2 x 250)	500
Viskhapatnam TPS, Stage-I	(2 x 520)	1040
Simhadri TPS	(2 x 500)	1000
Rayalaseema TPS, Stage-II	(2 x 210)	420
Ramagundam TPS Extension	(2 x 260)	520
Krishnapatnam TPS Station 'A'	(2 x 260)	520
Krishnapatnam TPS Station 'B'	(2 x 260)	520
Vijayawada TPS, Stage-IV	(1 x .50)	0.50
Machilipatnam – TPS	(2 x .50)	1.00
Krishnapatnam, Stage-II	(4 x .50)	2.00
Bhoopalapally	(1 x .25)	0.25
Chennur	(2 x .06)	0.12
Anantapuram	(2 x .25)	0.50
Panyam TPS	(2 x .25)	0.50
Srikakulam TPS	(2 x .50)	1.00
B. Hydel		
Priyadarsini Jurala HES	(6 x 36.9)	221
Pulichintala HES	(2 x 30)	60
Nelakota irrigation cum power project	(2 x 30)	60
Tail pond dam PH at km 21.065 below Nagarjunasagar dam	(2 x 25)	50
Polavaram HES	(9 x 80)	720
Jalaput dam	(3 x 6)	18
Pochampad Unit – IV	(1 x 9)	9
Lower Machkund	(3 x 9)	27
Lower Sileru, Stage-III	(2 x 115)	230
Inchampalli HES	(13 x 75)	975
Mini-Hydel		
Pedduru Reservoir	(1 x 0.15)	0.15
Mini Hydel Projects allotted to private sector		81
C. Gas Based		
Hyderabad Metro Combined Cycle Power Project		650
Visakhapatnam (HPCL & APSEB)	(2 x 250)	500
Gas/Naptha/Furnace Oil/Diesel/LSHS based mini power plans allotted to private sector		2781
D. Wind Based		
Projects allotted to private sector		370

Source: APSEB, 'Power Development in AP (Statistics) 1997-98'.

10.3 Polavaram Project Power Scheme

The power scheme of the Polavaram project envisages generation of hydel power at the toe of the Polavaram project with an installation of 720 MW reversible pump turbine units. The power component in head works consists of 560 m long non-over flow dam situated in the left flank to accommodate the river sluices and twelve turbines, each with an installed capacity of 60 MW. The FRL of the Polavaram reservoir is 45.72 m and, the minimum pond level on downstream is 13.64 m. Therefore, there is a theoretical head of 32.00 m available, which can be utilised for power generation.

From the reservoir operation table prepared by the Government of Andhra Pradesh for 90% dependable year, the releases from the reservoir which can be utilised for power generation and the possible power generation have been worked out and the details are given in Table 10.6.

Table 10.6
Monthly releases and power generation at Polavaram

Month	Releases for Delta requirement (cumec)	Surplus flow (cumec)	Available Net head (m)	Power generation in MW		
				Firm power Utilizing delta requirement	Seasonal power utilizing surplus monsoon flows	Total
Jun	197	--	27.28	44.47	--	44.47
Jul	366	1346	22.13	67.00	246.48	313.48
Aug	365	2928	21.79	65.78	528.16	593.94
Sep	339	2663	21.88	61.39	482.2	543.64
Oct	320	585	24.32	64.48	117.84	182.32
Nov	252	101	26.21	54.58	21.97	76.55
Dec	211	--	30.25	52.94	--	52.94
Jan	232	--	29.62	56.76	--	56.76
Feb	218	--	28.79	51.87	--	51.87
Mar	170	--	28.07	39.53	--	39.53
Apr	147	--	27.37	33.40	--	33.40
May	49	--	27.02	--	--	--
Total				592.20	1396.	1988.90

From the power studies made in a 90% dependable year it could be seen that the releases intended for Godavari delta vary from 147 to 366 cumec, except during May. The firm power generation varies from 33 to 67 MW. And this firm power would be available for 11 months in a year.

The reservoir surpluses, mainly during the period from July to October (4 months), during a 90% dependable year vary from 585 to 2928 cumec. With the utilisation of these surplus monsoon flows, seasonal power could be generated which varies from 118 to 528 MW. In all other good years of water availability, surplus monsoon flows would be more and there is every possibility of generating seasonal power to the extent of even more than 1000 MW.

The minimum standing water level in Godavari river on the downstream of the project is 13.64 m (44.75 ft) i.e., Godavari barrage pond level. It is seen that the minimum level to be maintained at Godavari barrage, 42 km downstream of the proposed Polavaram project, to maintain the canal system during non-monsoon season, is 12.73 m (41.75 ft). The capacity between the above two elevations is 68 Mm³. And this storage between the two projects can be utilised in a tail pool. During off peak hours of non-monsoon season the water available in the pond will be pumped back to the reservoir using surplus off peak thermal energy, and during the peak hours of the day, peaking power can be generated drawing water from the reservoir.

The pondage of 68 Mm³ available in the pool would provide a regulated discharge of 3146 cumec for 6 hours a day, with which peaking power during non-monsoon period could be generated for 6 hours a day as shown in Table 10.7.

Table 10.7
Non-monsoon monthly releases and generation of peaking power at Polavaram

Month	Days	Available net head (m)	Discharge (cumec)	Peaking power generation (MW)
Nov	30	26.21	3146	682.53
Dec	31	30.25	3146	787.69
Jan	31	29.62	3146	771.26
Feb	28	28.79	3146	749.60
Mar	31	28.07	3146	730.79
Apr	30	27.37	3146	712.61
May	31	27.02	--	--
Jun	30	27.28	3146	710.31

It can be seen that with the available pondage, peaking power can be generated to the extent of 720 MW. Therefore, the present power scheme envisages generation of hydropower at the toe of the Polavaram project with an installation of 720 MW (12 units of 60 MW each) reversible pump turbine units. The main consideration for proposing installation of 12 generating pump turbine units is to utilise, the head created by construction of Polavaram project, huge surplus monsoon flows of river Godavari in all good years of water availability, available pondage between the Polavaram project and the downstream Godavari barrage and generate conventional power during monsoon season and peaking power utilising off peak thermal energy to the maximum possibility.

Out of the 12 generating units of 60 MW each, it is proposed to operate one set continuously for firm power generation drawing the requirements of Godavari delta releases, and 2 to 9 sets could be operated as conventional units during monsoon season of 4 months in a year of 90% dependability. (11 sets of 60 MW each could be operated in all other good years of water availability during monsoon of 4 months in a year). Leaving the month of May for maintenance, during non-monsoon season of 7 months (211 days) in a year, all the rest of 11 units of 60 MW each can be operated as reversible pump turbine units and generate power for 6 hours a day

To generate firm, seasonal and peaking power as indicated above at the toe of the dam, the following civil works and electrical works are proposed.

A. Civil Works

- i. 12 numbers of independent trash rack structures at the head of the NOF dam
- ii. Embankment of 12 numbers of 64 m long, 7.50 m dia penstocks in the NOF dam with necessary bell mouth entry
- iii. Power house to accommodate 12 numbers generating units of 60 MW each with necessary equipment and tail pool structure (size 330 m x 30 m)
- iv. Tail race channel 880 m long to join the tail waters to the river course
- v. Switch yard

B. Electrical Works

- (i) Power station, generating plant and control equipment
- (ii) Power station auxiliaries
- (iii) Power transformers and outdoor yard equipment

With the operation of the units explained in the above sections, the energy generation that could be achieved from the power station at Polavaram is detailed in Table 10.8.

Table 10.8

Total energy generation from the power station at Polavaram

Month	Days	No .of peaking hrs.	Firm power generation (MW)	Seasonal power generation (MW)	Peaking power generation (MW)	Total energy generation (MU)		
						Firm	Seasonal	Peaking
Jun	30	6 x 30	44.47	--	660	32.02	--	118.80
Jul	31	--	67.00	246.48	--	49.85	183.38	--
Aug	31	--	65.78	528.16	--	48.94	392.95	--
Sep	30	--	61.39	482.25	--	44.20	347.22	--
Oct	31	--	64.48	117.84	--	47.97	87.67	--
Nov	30	6 x 30	54.58	21.97	660	39.30	15.82	118.80
Dec	31	6 x 31	52.94	--	660	39.38	--	122.76
Jan	31	6 x 31	56.76	--	660	42.23	--	122.76
Feb	28	6 x 28	51.87	--	660	34.86	--	110.88
Mar	31	6 x 31	39.53	--	660	29.41	--	122.76
Apr	30	6 x 30	33.40	--	660	24.04	--	118.80
May	31	--	--	--	--	--	--	--
Total						432.20	1027.04	835.56
Grand total						2294.80 M. units		

In view of the energy crisis, it is proposed to utilise the available resources at the proposed multipurpose Polavaram project to the maximum extent.

10.4 Effect of Inter-Basin Water Transfers on the Power Generation at Polavaram

The Polavaram – Vijayawada link canal is a component of Mahanadi – Godavari – Krishna – Pennar – Cauvery – Vaigai interlinking proposals. The Polavaram project as planned by Andhra Pradesh 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 and Inchampalli – Pulichintala links. Since Inchampalli is situated upstream of Polavaram, inflows into Polavaram will get affected due to the diversions at Inchampalli. Hence the power generation at Polavaram Project proposed by Andhra Pradesh cannot be fully achieved. Since the firm power generation envisaged at Polavaram is only 60 MW, the loss in power generation owing to the interlinking could be made good by other means of power generation.