Additional Documents (Volume#2) of TSGENCO in respect of Mid-Term Review (MTR) on Generation Tariff Order, Dt. 22.03.2022, the application was submitted on 30.11.2022 for the 4th Control period (2019-24) before Hon'ble TSERC at Hyderabad.

INDEX
(Volume #2)

KTPS-VII STAGE (1x800MW), PALONCHA.

Capital Expenditure incurred/to be incurred for civil works for the control Period (FY 2019-24)

S.No	WBS element No	2019-20	2020-21	2021-22	2022-23	2023-24
1	T-0010.04.01	6,65,02,350.53	14,79,00,503.37	2,42,42,400.72	31,28,84,342.20	41,89,00,000.00
2	T-0010.04.02	51,08,77,883.34	14,22,03,283.77	4,78,49,608.83	10,39,72,993.91	5,67,42,902.50
3	T-0010.04.03	-	-	-	10,00,00,000.00	11,00,00,000.00
4	T-0010.04.04	-	-	-	-	-
5	T-0010.04.05	-	-	-	78,00,000.00	5,00,00,000.00
6	T-0010.04.06	34,14,145.58	-	-	-	-
7	T-0010.04.07	-	-	-	2,10,00,000.00	3,53,00,000.00
8	T-0010.04.08	56,63,451.39	-	-	-	-
9	T-0010.04.09	5,07,72,758.48	2,35,70,314.62	1,92,07,053.30	1,24,05,61,162.00	4,00,00,00,000.00
10	T-0010.04.10	-	-	-	1,20,00,000.00	8,00,00,000.00
11	T-0010.04.11	-	-	-	4,00,00,000.00	11,00,00,000.00
12	T-0010.04.13	-	-	1,99,51,501.26	-	-
13	T-0010.05	-	-	-	2,46,89,658.74	-
14	T-0010.06	3,02,38,498.24	1,60,14,695.71	3,67,65,761.19	5,66,38,000.00	2,73,82,000.00
15	T-0010.07	3,91,299.65	38,52,556.54	2,71,46,160.01	8,79,38,000.00	-
	Total amount in Rs.	**66,78,60,387.21**	**33,35,41,354.01**	**17,51,62,485.31**	**2,00,74,84,156.85**	**4,88,83,24,902.50**
16	T-0010.02.01	-	35,40,000.00	-	11,80,000.00	-
	Total amount in Rs.	**66,78,60,387.21**	**33,70,81,354.01**	**17,51,62,485.31**	**2,00,86,64,156.85**	**4,88,83,24,902.50**
	Total amount in Crores	**830.70**				

Chief Engineer/Civil/Thermal

Annexure - II

Capital Expenditure incurred/To be incurred for civil works for the control Period (FY 2019-24)

S. No	WBS Element No.	Purchase order No.	Description	Amount Rs.	Present Status
F.Y-2019-20					
1	T-0010.04.01	4900027404	KTPS – Stage VII - Civil - Providing of 1 No. Jeep/Bolero (1+4) seating capacity including fuel charges , driver salary , driver batta, maintenance charges , road taxes , insurance, all statutory payments , etc., on hire basis @ 12 hours per day, for the official utilization of Executive Engineer/ Civil / CD-I / Stage-VII / KTPS, for the period w.e.f. 01-04-2018 or from the actual date of commencement to 31/03/2019	75,659.00	completed
2	T-0010.04.01	5300000908, 5300000911, 5300000912.	KTPS-VII Stage (1X800MW)-Supply and fixing of furniture , equipment, utensils, crockery items required for the Canteen of (1x800MW) KTPS VII Stage , Paloncha, Bhadradri-Kothagudem Dist	4,29,672.00	completed
3	T-0010-04.01	4900018408	Taking over of land Ac 15-00Gts on rent basis required for the purpose of fabrication yard and material stock yard for M /s BHEL for KTPS VII stage works.	6,63,750.00	completed
4	T-0010-04.01	4900011356	Taking over of land Ac 5-01 Gts in sy no463/1,463/2 on rent basis required for the purpose of fabrication yard and material stock yard for M/s BHEL for KTPS VII stage works.	2,89,063.00	completed
5	T-0010-04.01	4900011320	Taking over of land Ac 3-29 Gts in sy no 531 on rent basis required for the purpose of fabrication yard and material stock yard for M/s BHEL for KTPS VII stage woprks.	2,14,280.00	completed
6	T-0010-04.01	4900011361	Taking over of land Ac 5.07 Gts in sy no 532 on rent basis required for the purpose of fabrication yard and material stock yard for M/s BHEL for KTPS VII stage works.	2,97,692.00	completed
7	T-0010-04.01	4900011335	Taking over of land Ac 3-00 Gts in sy no 531 on rent basis required for the purpose of fabrication yard and material stock yard for M/s BHEL for KTPS VII stage works.	1,72,575.00	completed
8	T-0010-04.01	4900011333	Taking over of land Ac 3-20&1-6 Gts in sy no 531&528 on rent basis required for the purpose of fabrication yard and material stock yard for M/s BHEL for KTPS VII stage works.	2,67,492.00	completed
9	T-0010-04.01	4900029684	KTPS-Stage VII (1X800MW)- Civil-Running and maintenance of canteen at KTPS-VII Stage for the period from 01.05.2019 to 31.03.2020(i.e 11 months)	1,09,83,054.08	completed

S. No	WBS Element No.	Purchase order No.	Description	Amount Rs.	Present Status
10	T-0010-04.01	4900026102	Providing consultancy services for preparation of detailed project report (DPR) for installation of belt conveyor for transportation of raw coal / crushed coal from existing transfer point (TP-D) of ICHP of KTPS O &M to 4A/B conveyor of (1x800MW) KTPS Stage-VII	4,27,500.00	completed
11	T-0010.04.01	4900028418	KTPS-Civil-Stage VII - CD-I- Providing aluminium composite panel cladding for internal & external elevation , automatic sensor doors , glass doors , gypsum board false ceiling , interior works in UCB control room including conference room and C &I maintenance room and Sanitary fixtures to	1,35,58,628.00	completed
12	T-0010-04.01	4900027942	KTPS-Stage VII (1x800MW)-Civil-Laying RCC Pavement in stacker cum Reclaimer I &II areas (i.e stockpile area) of (1x800mw) coal fired supercritical thermal unit at Paloncha.	3,66,25,964.00	completed
			Sub total in Rs	**6,40,05,329.08**	
1	T-0010.04.02	4900028059	KTPS-Civil-Stage VII - CD-I- Supply of P - way material,PSC Sleepers,Ballast & Linking of Tracks for Railway siding and marshalling yard for (1X800MW) KTPS VII - Stage,Paloncha.	18,66,26,798.96	completed
2	T-0010.04.02	P.O.No.5300000963	Supply of 1950MT of 60 Kg rails required for Railway siding and marshalling yard for (1x800MW) KTPS, VII Stage , Paloncha, Bhadradri-Kothagudem District	9,87,52,217.60	Completed
3	T-0010.04.02	4900027456	KTPS-Civil-Stage VII - CD-I-KTPS-Stage VII (1x800MW)- Providing Project management consultancy service for Railway siding marshalling yard of KTPS VII - Stage(1X800MW) Paloncha.	2,35,15,783.58	Work is in Progress
4	T-0010.04.02	4900028058	KTPS-Civil-Stage VII - CD-I-Earth work embankment(cutting & banking) construction of bridges and RUB for railway siding and marshalling yard for (1X800MW) KTPS VII-Stage,Paloncha.	19,93,54,633.20	completed
			Sub total in Rs	**50,82,49,433.34**	
1	T-0010.04.06	4900028960& 4900028958	Laying of approach roads at Raw water pump house and Bhurgampahad pump house	34,14,145.58	completed
1	T-0010.04.08	4900028955	KTPS-Civil-Stage VII- CD-I-Demolishing the existing BF,BG&BE type quarters (multi storied buildings)in security colony area to facilicate construction of FGD (Fuel gas desulphrisation) unit for KTPS Stage-VII,Paloncha.	56,63,451.39	completed

S. No	WBS Element No.	Purchase order No.	Description	Amount Rs.	Present Status
1	T-0010.04.09	P.O.No. 4900028342	KTPS-O&M-Design, Supply, construction, erection, testing and commissioning of two (2) Nos Sewage Treatment plants of capacity 2000 KLD & 160 KLD with Moving Bed Biofilm Reactor (MBBR) Technology in residential colonies of KTPS -I to IV Stages i.e., 2000 KLD capacity STP in A , B & Intermediate colonies and other of 160 KLD capacity in C-colony at Paloncha	5,07,72,758.48	completed
1	T-0010.06	LOI No.CC-0063 Dt.20.02.2019; 4900029950	KTPS-V & VI stages- Renovation of deaf, blind and mentally handicapped school building at contractor's colony, Paloncha, Bhadradri-Kothagudem Dist	24,22,646.24	completed
2	T-0010.06	Proc. No. ED/C/Thermal/ SE.TCD-I/EE3/F.CSR-565 Lakh/D. No.149/2018-19, Dt.10.08.2018	TSGENCO-CSR-KTPS- Sanction of funds under CSR policy for construction of CC roads & drains in different wards of Paloncha Municipality	1,46,15,811.00	completed
		Proc No.ED/C/Thermal/ KTPSD/E3/F.LED lights/ D.No.320/2017-18, Dt.27.01.2018	TSGENCO-CSR-KTPS VII Stage - Sanction of funds for supply and fixing of 20W & 30W LED Street lights in Grampanchayats of Paloncha and Laxmidevipalli Mandals , of Kothagudem Assembly constituency under CSR funds during the year 2017-18	1,27,60,398.00	completed
3	T-0010.06	Proc No.CE/C/Thermal/SETCD-I/EE3/F.CSR/D.No. 289/2016-17, Dt.07.03.2017	KTPS VII Stage (1x800 MW) - CSR works - Allocation of funds under CSR –TSGENCO Contribution towards Construction of Dining Hall in Govt . English Medium School at Marvadi camp , PathaKothagudem, Kothagudem, BhadradriKothadugem Dist.	4,39,643.00	completed
			Sub total in Rs	**3,02,38,498.24**	
			FY 2019-20 Total amount in Rs	**66,23,43,616.11**	
F.Y-2020-21					
1	T-0010.04.01	4900031200	KTPS-Stage VII (1X800MW)- Civil-Running and maintenance of canteen at KTPS-VII Stage for the period from 01.04.2020 to 31.03.2021	1,40,19,478.90	completed
2	T-0010.04.01	4900029684	KTPS-Stage VII (1X800MW)- Civil-Running and maintenance of canteen at KTPS-VII Stage for the period from 01.07.2019 to 31.03.2020	1,06,376.92	completed
3	T-0010.04.01	4900028418	KTPS-Stage VII (1X800MW)-Providing aluminium composite panel cladding for internal & external elevation , automatic sensor doors , glass doors , Gypsum board	14,31,949.00	completed

S. No	WBS Element No.	Purchase order No.	Description	Amount Rs.	Present Status
4	T-0010.04.01	4900031385	KTPS-Stage VII (1X800MW)-Civil-Installation of Belt conveyor for transportation of Raw crushed coal from existing Raw coal storage yard existing in KTPS Old plant to 4-AB conveyor of (1x800MW) KTPS Stage-VII,Paloncha.	12,15,72,729.41	completed
5	T-0010-04.01	4900027942	KTPS-Stage VII (1x800MW)-Civil-Laying RCC Pavement in stacker cum Reclaimer I &II areas (i.e stockpile area) of (1x800mw) coal fired supercritical thermal unit at Paloncha.	1,62,83,679.66	completed
			Sub total in Rs	**15,34,14,213.89**	
1	T-0010.04.02	4900030753	KTPS-Civil-Stage VII - CD-I-Design and Supply,Erection,Testing& Commissioning of Railway Electrification including modification to the existing 25KV AC, 50Hz, Single phase , Overhead Equipment (OHE), Switching Post (SSP) and General Electrical works for the Proposed marshalling yard of KTPS (Stage VII) of TSGENCO at Paloncha, taking off from the existing Gajulagudem in Secunderabad Division of South Central Railway.	3,52,01,677.39	Work in progress
2	T-0010.04.02	4900028059	KTPS-Civil-Stage VII - CD-I- Supply of P - way material,PSC Sleepers,Ballast & Linking of Tracks for Railway siding and marshalling yard for (1X800MW) KTPS VII - Stage,Paloncha.	6,89,87,742.58	Work is completed
3	T-0010.04.02	4900028058	KTPS-Civil-Stage VII - CD-I-Earth work embankment (cutting & banking) construction of bridges and RUB for railway siding and marshalling yard for (1X800MW) KTPS VII-Stage,Paloncha.	2,47,77,524.80	Work is completed
4	T-0010.04.02	4900027456	KTPS-VII Stage (1x800MW–Providing Project Management Consultancy for railway siding and Marshalling yard for (1x800MW) KTPS VII Stage , Paloncha, Bhadradri-Kothagudem Dist	1,32,36,339.00	Work in progress
			Sub total in Rs	**14,22,03,283.77**	
1	T-0010.04.09	4900028342	KTPS-O&M-Design, Supply, construction, erection, testing and commissioning of two (2) Nos Sewage Treatment plants of capacity 2000 KLD & 160 KLD with Moving Bed Biofilm Reactor (MBBR) Technology in residential colonies of KTPS -I to IV Stages i.e., 2000 KLD capacity STP in A , B & Intermediate colonies and other of 160 KLD capacity in C-colony at Paloncha, Bhadradri-Kothagudem Dist.	2,35,70,314.62	Completed
			Sub total in Rs	**2,35,70,314.62**	

S. No	WBS Element No.	Purchase order No.	Description	Amount Rs.	Present Status
1	T-0010.02.01	4900021154	KTPS-Civil-Stage VII - CD-I-Consultancy Services for preparation of detailed project report for feasability of Railway siding and marshalling yard for (1X800MW), Paloncha	35,40,000.00	work in progress
1	T-0010.06	LOI No.CC-0008, Dt.22.05.2019; 4900030010	KTPS-V & VI Stages-Laying of RCC road by making earthen embankment from Pandurangapuram bridge near Gangamma thalli temple to Kothapet village, Pandurangapuram, Bhadradri-Kothagudem Dist	30,22,963.95	Completed
1	T-0010.06		Other works under CSR Policy	1,29,91,731.76	completed
			Sub total in Rs	**1,60,14,695.71**	
			FY 2020-21 Total amount in Rs	**33,87,42,507.99**	
F.Y-2021-22					
1	T-0010-04.01	4900026102	KTPS-VII Stage (1x800MW)-Providing consultancy services for preparation of detailed project report (DPR) for installation of belt conveyor for transportation of raw coal/crushed coal from existing transfer point (TP-D) of ICHP of KTPS O &M to 4A/B conveyor of (1x800MW) KTPS-VII stage , Paloncha, Bhadradri-Kothagudem Dist	6,17,500.00	Work in progress
2	T-0010-04.01	4900011320	Taking over of land Ac 3-29 Gts in sy no 531 on rent basis required for the purpose of fabrication yard and material stock yard for M/s BHEL for KTPS VII stage woprks.	2,42,125.00	Work is in progress
3	T-0010-04.01	4900011361	Taking over of land Ac 5.07 Gts in sy no 532 on rent basis required for the purpose of fabrication yard and material stock yard for M/s BHEL for KTPS VII stage works.	3,36,375.00	Work is in progress
4	T-0010-04.01	4900011335	Taking over of land Ac 3-00 Gts in sy no 531 on rent basis required for the purpose of fabrication yard and material stock yard for M/s BHEL for KTPS VII stage works.	1,95,000.00	Work is in progress
5	T-0010-04.01	4900011333	Taking over of land Ac 3-20&1-6 Gts in sy no 531&528 on rent basis required for the purpose of fabrication yard and material stock yard for M/s BHEL for KTPS VII stage works.	3,02,250.00	Work is in progress
6	T-0010-04.01	4900018408	Taking over of land Ac 15-00Gts on rent basis required for the purpose of fabrication yard and material stock yard for M /s BHEL for KTPS VII stage works.	6,63,750.00	completed
7	T-0010-04.01	4900011356	Taking over of land Ac 5-01 Gts in sy no463/1,463/2 on rent basis required for the purpose of fabrication yard and material stock yard for M/s BHEL for KTPS VII stage works.	3,26,625.00	Work is in progress

S. No	WBS Element No.	Purchase order No.	Description	Amount Rs.	Present Status
8	T-0010.04.01	4900031385	KTPS-Stage VII (1X800MW)-Civil-Installation of Belt conveyor for transportation of Raw crushed coal from existing Raw coal storage yard existing in KTPS Old plant to 4-AB conveyor of (1x800MW) KTPS Stage-VII,Paloncha.	1,58,07,089.00	completed
9	T-0010.04.01		BHEL Civil Works taken up by TSGENCO	57,51,686.72	completed
			Sub total in Rs	**2,42,42,400.72**	
1	T-0010.04.02	4900030753	KTPS-Civil-Stage VII - CD-I-Design and Supply, Erection,Testing & Commissioning of Railway Electrification including modification to the existing 25KV AC,50Hz,Single phase ,Overhead Equipment(OHE), Switching Post (SSP) and General Electrical works for the Proposed marshalling yard of KTPS (Stage-VII) of TSGENCO at Paloncha , taking off from the existing Gajulagudem in Secunderabad Division of South Central Railway.	3,08,05,830.76	Work in progress
2	T-0010.04.02	4900028059	KTPS-Civil-Stage VII - CD-I- Supply of P - way material,PSC Sleepers,Ballast & Linking of Tracks for Railway siding and marshalling yard for (1X800MW) KTPS VII - Stage,Paloncha.	14,91,346.00	Work is completed
3	T-0010.04.02	4900028058	KTPS-Civil-Stage VII - CD-I-Earth work embankment (cutting & banking) construction of bridges and RUB for railway siding and marshalling yard for (1X800MW) KTPS VII-Stage,Paloncha.	26,60,720.00	Work is completed
4	T-0010.04.02	4900027456	KTPS-VII Stage (1x800MW–Providing Project Management Consultancy for railway siding and Marshalling yard for (1x800MW) KTPS VII Stage , Paloncha, Bhadradri-Kothagudem Dist	1,15,96,083.07	Work in progress
5	T-0010.04.02		Interfacing of additional equipment at SSP/GLE with the existing Remote Control Master Station at Secunderabad – Deposition of amount to M/s South Central Railway, Secunderabad	12,95,629.00	Work is completed
			Sub total in Rs	**4,78,49,608.83**	
1	T-0010.04.09	4900028342	KTPS-O&M-Design, Supply, construction, erection, testing and commissioning of two (2) Nos Sewage Treatment plants of capacity 2000 KLD & 160 KLD with Moving Bed Biofilm Reactor (MBBR) Technology in residential colonies of KTPS -I to IV Stages i.e., 2000 KLD capacity STP in A , B & Intermediate colonies and other of 160 KLD capacity in C -colony at Paloncha , Bhadradri-Kothagudem Dist.	1,88,41,767.30	completed

S. No	WBS Element No.	Purchase order No.	Description	Amount Rs.	Present Status
1	T-0010.04.09	4900016838	KTPS-O&M-Providing Consultancy Services for conducting detailed study design,engineering,drawing and providing drawings and cost estimates and specifications for electrical mechanical C&I civil works pertaining to construction of STP with MBBR technology at KTPS	3,65,286.00	Completed
			Sub total in Rs	**1,92,07,053.30**	
1	T-0010.04.13	4900032445	KTPS- Civil- Stage-VII- CD-I-Construction of second and third floor on Simulator building at Centre of Excellence for training and development in KTPS, Paloncha.	1,18,86,647.26	Work in progress
	T-0010.04.13	4900034686	TSGENCO-CETD-Execution of electrical works for the second and third floors of Simulator building which is under construction at CETD Campus	2,16,160.00	Work in progress
	T-0010.04.13	5300001287	TSGENCO-KTPS-VII Stage-Supply of 400 MT of PP cement in bags required for construction of Second and Third Floor on simulator building at Centre of Excellecnce for training and devolopment in KTPS, Paloncha, Bhadradri Kothagudem Distric	21,66,140.00	completed
	T-0010.04.13	5300001263	KTPS-VII Stage - Procurement of 87 MT of reinforcement steel materials	56,82,554.00	completed
			Sub total in Rs	**1,99,51,501.26**	
1	T-0010.06	4900033540	KTPS-Stage VII (1x800MW) - Attending repairs to the ZPS School in old security colony of KTPS Stage-VII, Paloncha, Bhadradri-Kothagudem	13,98,695.00	completed
			Other CSR expenditure	3,53,67,066.19	completed
			Sub total in Rs	**3,67,65,761.19**	
1	T-0010.07	4900030233	TSGENCO-CETD-Construction of Hostel Building in CETD Campus, Paloncha	27951070.64	Work is in progress
			Sub total in Rs	**2,79,51,070.64**	
			FY 2021-22 Total amount in Rs	**17,59,67,395.94**	
F.Y-2022-23					
1	T-0010.04.01	4900033847	KTPS-VII Stage-(1x800MW)–O&M-I-SD-II - Construction of control room of size 3mX3m, providing of barbed wire fencing and grade slab to the proposed high speed	14,65,784.74	Work is completed
2	T-0010.04.01	4900034890	KTPS-Stage-VII (1X800MW) - Civil - O&M-I - SD-II - Construction of rest room in Coal Plant area back side of MCC -1 of KTPS Stage-VII	4,01,750.00	Work is completed
3	T-0010.04.01	4900035836	KTPS-Stage-VII (1X800MW) - Civil - Cutting of trees, dismantling of existing shed and fencing in the proposed FGD area of (1X800MW) KTPS VII Stage , Paloncha,	2,82,407.70	Work is completed
4	T-0010.04.01	4900034905	KTPS-VII Stage (1X800MW) - Civil - O&M-I - SD-II - Providing concrete pavement around the Hi -masts, Ventilation fans and flooring work in EM material store shed in	4,77,428.00	Work is completed

S. No	WBS Element No.	Purchase order No.	Description	Amount Rs.	Present Sta tus
5	T-0010.04.01	4900034923	KTPS-Stage-VII-Civil-O&M-I-SD-I-Construction of staff rooms for E&M maintenance staff in Boiler and ESP areas	5,45,890.84	Work is completed
6	T-0010.04.01	4900035193	KTPS-Stage-VII-Civil-O&M-I-SD-I-Providing the aluminium partition in DE/Electrical and DE /I&C rooms in the 3rd floor of service building	5,67,231.82	Work is completed
7	T-0010.04.01	4900036517	KTPS – VII Stage – Civil – O&M-I – SD-I – Construction of parking shed at Stage-VII main gate	4,91,365.00	Work is completed
8	T-0010.04.01		KTPS-VII Stage (1x800MW)- Construction of office building with (G+2) floors in Coal Handling Plant (CHP) area of (1x800MW) KTPS-VII Stage , Paloncha, Bhadradri-Kothagudem Dist.–	2,62,00,000.00	to be taken up
9	T-0010.04.01		KTPS-VII Stage (1x800MW) - Construction of New Accounts Office Building with (G+1) floors in 'A' Colony of (1x800MW) KTPS-VII Stage , Paloncha , Bhadradri Kothagudem Dist.	7,45,00,000.00	to be taken up
10	T-0010.04.01		KTPS-VII Stage (1x800MW) – Raising of Ash Slurry Sump to a further height of 1.50M from existing EL (+) 3.80M in Ash Slurry pump house of (1x800MW) KTPS-VII Stage, Paloncha, Bhadradri Kothagudem Dist	48,00,000.00	to be taken up
11	T-0010-04.01	4900011320	Taking over of land Ac 3-29 Gts in sy no 531 on rent basis required for the purpose of fabrication yard and material stock yard for M/s BHEL for KTPS VII stage woprks.	5,44,781.25	Work is in progress
12	T-0010-04.01	4900011361	Taking over of land Ac 5.07 Gts in sy no 532 on rent basis required for the purpose of fabrication yard and material stock yard for M/s BHEL for KTPS VII stage works.	7,56,843.75	Work is in progress
13	T-0010-04.01	4900011335	Taking over of land Ac 3-00 Gts in sy no 531 on rent basis required for the purpose of fabrication yard and material stock yard for M/s BHEL for KTPS VII stage works.	4,38,750.00	Work is in progress
14	T-0010-04.01	4900011333	Taking over of land Ac 3-20&1-6 Gts in sy no 531&528 on rent basis required for the purpose of fabrication yard and material stock yard for M/s BHEL for KTPS VII stage works.	6,80,062.50	Work is in progress
15	T-0010-04.01	4900011356	Taking over of land Ac 5-01 Gts in sy no463/1,463/2 on rent basis required for the purpose of fabrication yard and material stock yard for M/s BHEL for KTPS VII stage works.	4,35,046.60	Work is in progress
	T-0010.04.01		KTPS VII Stage-Repairs to pedestals of Ash disposal pipelines of KTPS VII Stage, Paloncha.	37,00,000.00	To be Taken up

S. No	WBS Element No.	Purchase order No.	Description	Amount Rs.	Present Status
16	T-0010.04.01		KTPS-VII Stage (1X800MW)– Lettering and Archiving of the structures in the BOP , CHP & AHP area of KTPS Stage -VII, Paloncha.	6,35,000.00	To be Taken up
17	T-0010.04.01		KTPS-VII Stage-Civil-O&M-I-SD-II - Laying of CC pathway around the fencing of Switchyard, Stage-VII, KTPS.	8,15,000.00	To be Taken up
18	T-0010.04.01		KTPS-VII Stage -Civil-O&M-I-SD-I - Modification of the aluminium partition for the Chief Engineer Office and SE /Adm Office in the 4th floor of Service Building in Stage-VII	6,60,000.00	To be Taken up
19	T-0010.04.01		KTPS-VII Stage - Civil - O&M-I - Construction of kerb wall and providing lawn near Gate Complex of Stage-VII main gate.	17.20.000.00	To be Taken up
20	T-0010.04.01		KTPS-Stage-VII- Civil-O&M-I-SD-II-Providing of MS Grills above the brickwork in Gas Cylinder shed.	5,25,000.00	To be Taken up
21	T-0010.04.01		KTPS-Stage-VII- Civil-O&M-I-SD-II-Grounting in the under ground tunnels of Track Hopper and TP 1,2,3 in coal plant area of KTPS Stage-VII, Paloncha	6,52,000.00	To be Taken up
22	T-0010.04.01		KTPS-Stage-VII- Civil-O&M-I-SD-II-Removal of scrap at various locations of the CHP and AHP areas, Stage-VII, Paloncha	5,90,000.00	To be Taken up
23	T-0010.04.01		KTPS-Stage-VII- Civil-O&M-I-SD-I-Rectification of the roof leakages between columns A 4-A12 in AB bay in TG building (to be taken up)	8,35,000.00	To be Taken up
24	T-0010.04.01		KTPS-Stage-VII-Civil-O&M-I-SD-II-Rectification of Acid Resistant tiles at dosing tanks in Ash Water pump house and laying of concrete on Ash clarifier walk way slab Ktps Stage-VII, Paloncha	3,50,000.00	To be Taken up
25	T-0010.04.01		KTPS-Stage-VII (1X800MW)- Civil-O&M-I-SD-I-Providing the kerb wall to the Approach road around the Adminstrative building.	5,55,000.00	To be Taken up
26	T-0010.04.01		KTPS-Stage-VII- Civil-O&M-I-SD-I-Lettering and Archiving of the Building in the Main Power house area.	5,15,000.00	To be Taken up
27	T-0010.04.01		KTPS-Stage-VII (1X800MW)- Civil-O&M-I-SD-I-Providing over slabs over cable trenches metal filling and attending other miscellaneous works in switch yard area.	7,50,000.00	To be Taken up
28	T-0010.04.01		KTPS-Stage-VII- Civil-O&M-I-SD-I-Attending Grounting works in condenser pit of TG Building, Cable Trenches of the building in BTG area at KTPS-Stage-VII	6,50,000.00	To be Taken up
29	T-0010.04.01		KTPS-Stage-VII- Civil-O&M-I-SD-III-Laying of wet mix macadam road along peripheral patrol road near material gate, Stage-VII,KTPS	6,10,000.00	To be Taken up

S. No	WBS Element No.	Purchase order No.	Description	Amount Rs.	Present Status
30	T-0010.04.01		KTPS-Stage-VII- Civil-O&M-I-SD-III-Lettering and Archiving of the buildings/structures in the BOP area, Stage-VII,KTPS	6,45,000.00	To be Taken up
31	T-0010.04.01		KTPS-Stage-VII- Civil-O&M-I-SD-III-Laying of peripheral patrol bitumen road at watch tower -4 and miscellaneous BT road's repairs, Stage-VII,KTPS	13,70,000.00	To be Taken up
32	T-0010.04.01		Miscellaneous civil works	18,47,20,000.00	
			Sub total in Rs	**31,28,84,342.20**	
1	T-0010.04.02		KTPS-VII stage (1x800MW)–Providing Project Management Consultancy for railway siding and Marshalling yard for (1x800MW) KTPS VII Stage , Paloncha, Bhadradri-Kothagudem Dist.	1,03,20,000.00	Work in progress
2	T-0010.04.02	4900030753	KTPS-Civil-Stage VII - CD-I-Design and Supply, Erection,Testing & Commissioning of Railway Electrification including modification to the existing 25KV AC,50Hz,Single phase ,Overhead Equipment(OHE), Switching Post (SSP) and General Electrical works for the Proposed marshalling yard of KTPS (Stage-VII) of TSGENCO at Paloncha , taking off from the existing Gajulagudem in Secunderabad Division of South Central Railway.	5,14,26,000.00	Work in progress (including balance bill amount as on 12.09.2022)
3	T-0010.04.02	4900034690	KTPS Stage - VII (1x800MW) - Construction of Retaining wall for protection of 400KV Tower (No-KTPS-112) and Ash disposal Pipe Line Pedestals in Marshalling Yard of KTPS Stage -VII, Paloncha, Bhadradri-Kothagudem Dist	54,67,321.41	Work is completed
4	T-0010.04.02		KTPS-VII Stage (1x800MW) - Construction of 2Nos Pit less In motion Weigh bridges i .e 1No on existing line of KTPS -V & VI Stage & 1No. for (1x800MW) KTPS VII Stage along with control room , Longitudinal drains , Cross drains , Bitumen Road, CC road , Pipe Culverts and other miscellaneous works in Railway siding & Marshalling Yard of (1x800MW) KTPS-VII Stage, Paloncha	1,85,32,672.50	Work to be taken up
5	T-0010.04.02		KTPS-VII Stage (1x800MW)-Providing cross over line in lead line including overshoot line along with earth work in Marshalling yard of KTPS VII Stage , Paloncha, Bhadradri-Kothagudem Dist.	31,50,000.00	Work to be taken up
6	T-0010.04.02		KTPS-VII Stage (1x800MW)-Removing of temporary lines and Realignment of line Nos.5, 6 & 7 including points & crossings in Marshalling yard of KTPS VII Stage , Paloncha, Bhadradri-Kothagudem Dist	13,50,000.00	Work to be taken up

S. No	WBS Element No.	Purchase order No.	Description	Amount Rs.	Present Status
7	T-0010.04.02		KTPS-VII Stage (1x800MW)-Supply, Erection, Testing & Commissioning of (7) Nos High Mast Lighting system of 30Mtrs height in Marshalling Yard of (1x800MW) KTPS VII Stage , Paloncha, Bhadradri-Kothagudem Dist	90,00,000.00	Work to be taken up
8	T-0010.04.02		Payment of Codal Charges to M/s. South central Railway for Railway siding and marshalling yard works of KTPS VII Stage, Paloncha	1,50,47,000.00	Work to be taken up
			Sub total in Rs	**10,39,72,993.91**	
1	T-0010.04.03		KTPS-VII Stage (1x800MW)-Design, Engineering, Supply, Civil & Structural works, erection, testing & commissioning of ash water recovery Pump House , ash water recovery pipe from ash dyke area to AHP clarifier of 1x800MW coal fired supercritical Thermal unit ,ash pond ,land acquisition (CIVIL WORKS)	10,00,00,000.00	to be taken up
1	T-0010.04.05		Formation of Wet mix, BT and RCC roads in BOP,CHP & AHP areas	65,10,000.00	to be taken up
2	T 0010.04.05		KTPS - Stage-VII -Rectification of peripheral bituminous road near material gate, Stage-VII, KTPS.	7,30,000.00	to be taken up
3	T-0010.04.05		KTPS - Stage-VII - Civil - O&M-I - SD-III - Laying PCC pavement in PTP area, Stage-VII, KTPS.	5,60,000.00	to be taken up
			Sub total in Rs	**78,00,000.00**	
1	T-0010-04.07		KTPS - Stage-VII - Civil - O&M-I - SD-III Development of green belt around cooling tower	1000000.00	To be Taken up
2	T-0010-04.07		Development of Green belt in CHP & AHP of KTPS stage VII, Paloncha	500000.00	To be Taken up
2	T-0010-04.07		Development of Green belt in KTPS stage VII, Paloncha	19500000.00	To be Taken up
			Sub total in Rs	**2,10,00,000.00**	
1	T-0010.04.09	4900028342	KTPS-O&M-Design, Supply, construction, erection, testing and commissioning of two (2) Nos Sewage Treatment plants of capacity 2000 KLD & 160 KLD with Moving Bed Biofilm Reactor (MBBR) Technology in residential colonies of KTPS -I to IV Stages i.e., 2000 KLD capacity STP in A , B & Intermediate colonies and other of 160 KLD capacity in C -colony at Paloncha , Bhadradri-Kothagudem Dist.	5,61,162.00	completed

S. No	WBS Element No.	Purchase order No.	Description	Amount Rs.	Present Status
2	T-0010.04.09		KTPS-VII Stage (1x800MW) –Soil investigation, Engineering, Design, Construction of 1 block (1 unit) of A-Type, 6 blocks (1 unit each) of B-Type, 1 block (24 units) of C-Type with stilt + 4 floors, 1 block (72 units) of D-Type with stilt + 8 floors, 2 blocks (1 block of 90 units with Stilt + 10 floors & 1 block of 81 units with Stilt + 9 floors, totaling to 171 units) of E-Type, 5 blocks (90 units each with stilt +10 floors, totaling to 450 units) of F-Type Multi storied residential quarters and Office building with (G+1) floors including electrical & Fire fighting system works in full shape at Kothagudem Thermal Power Station Complex, Paloncha, Bhadradri-Kothagudem Dist	1,24,00,00,000.00	to be taken up
			Sub total in Rs	**1,24,05,61,162.00**	
1	T-0010.04.10		KTPS-V Stage-Construction of vocational training institute near TSGENCO Housing colony of KTPS V&VI stages, Paloncha	1,20,00,000.00	To be Taken up
1	T-0010.04.11		Establishing Training institute under KTPS-VII stage (Civil Works)	4,00,00,000.00	To be Taken up
1	T-0010.04.13	4900032445	KTPS- Civil- Stage-VII- CD-I-Construction of second and third floor on Simulator building at Centre of Excellence for training and development in KTPS, Paloncha.	2,30,64,658.74	Work in progress
2	T-0010.04.13		TSGENCO-CETD-Execution of electrical works for the second and third floors of Simulator building which is under construction at CETD Campus	3,65,000.00	Work in progress
3	T-0010.04.13		KTPS-VII Stage (1x800MW)-Construction of compound wall adjacent to new CETD Gate in C -colony of KTPS -VII Stage , Paloncha, Bhadradri-Kothagudem Dist	12,60,000.00	To be Taken up
			Sub total in Rs	**2,46,89,658.74**	
1	T-0010.06		Sanction of funds under CSR policy during the year 2016-17 for construction of CC roads & drains in Payakariyanambile, Kodipunjula vagu, Punukula, Pullaigudem, Somulagudem, Suraram and Pandurangapuram habitations of Paloncha mandal through Panchayat Raj Department and in different wards of Paloncha town through Paloncha Municipality-	1,70,50,000.00	Work in progress

S. No	WBS Element No.	Purchase order No.	Description	Amount Rs.	Present Status
2	T-0010.06		TSGENCO-CSR-KTPS-Sanction of funds under CSR policy during the year 2016-17 for construction of CC roads & drains in Payakariyanambile, Kodipunjula vagu, Punukula, Pullaigudem, Somulagudem, Suraram and Pandurangapuram habitations of Paloncha mandal through Panchayat Raj Department and in different wards of Paloncha town through Paloncha Municipality	40,00,000.00	Work in progress
3	T-0010.06		TSGENCO - KTPS –VII Stage (1x800MW) - Sanction of funds for laying of roads & drains in Paloncha Municipality under C.S.R policy	80,00,000.00	Work in progress
4	T-0010.06		KTPS-VII Stage (1x800MW) - Sanction of funds towards Renewal of Bitumen roads in Patha Suraram, Kotha Suraram, Pandurangapuram, Punukula, Pullaigudem, Veeru naik Thanda, Bheekya Thanda, Kammarigudem, Somulagudem, Jaganadhapuram & Nagaram villages of Paloncha mandal under CSR policy	1,80,00,000.00	To be Taken up
5	T-0010.06		TSGENCO – KTPS–VII Stage (1x800MW) - Sanction of funds to provide Central Lighting from Indira Nagar of Palvancha town to Jagannadhapuram (Tribal Area), Laying of CC roads and Drains in various Grampanchayats of Palvancha Mandal and Lakshmidevipally Mandal in Kothagudem Constituency under C.S.R policy	95,88,000.00	To be Taken up
			Sub total in Rs	**5,66,38,000.00**	
1	T-0010.07	4900030111	KTPS-Stage VII -(1X800 MW)-Civil-Construction of Vehicles parking shed in CETD Campus,Paloncha.	439000.00	Work Completed.
2	T-0010.07	4900030233	TSGENCO-CETD-Construction of Hostel Building in CETD Campus, Paloncha	60874000.00	Work is in progress
3	T-0010.07		TSGENCO-CETD-Construction of compound wall from CETD New Hostel building to C Colony Main Compound wall along Quarter No .s BDE-13 & BDE-14.	1165000.00	To be Taken up
4	T-0010.07		TSGENCO-CETD-Supply,Fabrication and Fixing of Wardrobes,Kitchen Storage Cabins,Cupboard Shutters with HDHMR sheet including box racks,Lock system etc for CETD New Hostel building Rooms.	4085000.00	To be Taken up
5	T-0010.07		TSGENCO-CETD-Providing Plantation and Landscaping at Newly constructed Hostel building,CETD Campus.	1250000.00	To be Taken up

S. No	WBS Element No.	Purchase order No.	Description	Amount Rs.	Present Status
6	T-0010.07		TSGENCO-CETD-Providing Plantation and Landscaping at Simulator building,CETD Campus.	1250000.00	To be Taken up
7	T-0010.07		TSGENCO-CETD-Providing Fountain at Newly constructed Hostel building ,CETD Campus.	2000000.00	To be Taken up
8	T-0010.07		TSGENCO-CETD-Providing Fountain at Simulator building,CETD Campus.	2000000.00	To be Taken up
9	T-0010.07		TSGENCO-CETD-Construction of Model room, welding workshop room and 4 wheeler and 2 wheeler parking sheds,Turbine model rooms at CETD Campus.	8140000.00	To be Taken up
10	T-0010.07		Misc works as per Cji5	6735000.00	
			Sub total in Rs	**8,79,38,000.00**	
1	T-0010.02.01	4900021154	KTPS-Civil-Stage VII - CD-I-Consultancy Services for preparation of detailed project report for feasability of Railway siding and marshalling yard for (1X800MW), Paloncha	11,80,000.00	Work in progress
			FY 2022-23 Total amount in Rs	**2,00,86,64,156.85**	
F.Y-2023-24					
1	T-0010.04.01		KTPS-Stage-VII- Civil-O&M-I-SD-II-Grounting in the under ground tunnels of Track Hopper and TP 1,2,3 in coal plant area of KTPS Stage-VII, Paloncha	7,00,000.00	To be Taken up
2	T-0010.04.01		KTPS-Stage-VII- Civil-O&M-I-SD-I-Providing roof treatment in TG building at EL (+)38M	1,00,00,000.00	To be Taken up
3	T-0010.04.01		Extension of BT Road from Durga temple to KTPS Stage-VII main gate and extension of culvert at main gate.	45,00,000.00	To be Taken up
4	T-0010.04.01		Construction of RCC drains on either side of road from Durga temple to main gate	40,00,000.00	To be Taken up
5	T-0010.04.01		Construction of arch and main gate at Durga Temple.	15,00,000.00	To be Taken up
6	T-0010.04.01		Construction of Sedimentation tank at Main gate of KTPS Stage-VII.	45,00,000.00	To be Taken up
7	T-0010.04.01		Construction of Compound wall with main gate to the FGD Plant area	50,00,000.00	To be Taken up
8	T-0010.04.01		KTPS-Stage VII(1x800MW)-Grouting in the underground tunnel of 14UG and ERH in coal plant area of KTPS stage-VII(1X800 MW), Paloncha.	7,00,000.00	To be Taken up
9	T-0010.04.01		KTPS-Stage VII- Providing approaches, plinth protection and rectification of damaged DV sheds in CHP & AHP area of KTPS Stage-VII,Paloncha.	20,00,000.00	To be Taken up
10	T-0010.04.01		Construction of tool rooms of size 14x12mx4m (H) at Track Hopper complex and Wagon Tippler complex in CHP area of KTPS Stage VII, paloncha.	36,00,000.00	To be Taken up

S. No	WBS Element No.	Purchase order No.	Description	Amount Rs.	Present Status
11	T-0010.04.01		KTPS-Stage-VII(1x800MW)-Civil-SD-II-O&M-I-Rectification of sprinkler pedastals at wagon tippler in CHP area of KTPS Stage-VII.	3,00,000.00	To be Taken up
12	T-0010.04.01		Grouting in the underground tunnels of Wagon Tippler, 1AB,2AB,3AB and 4AB in coal plant area of KTPS stage-VII Paloncha.	7,00,000.00	To be Taken up
13	T-0010.04.01		Rectification of beams at 2 AB tail end in Track Hopper in coal handling area of KTPS Stage-VII, Paloncha.	5,00,000.00	To be Taken up
14	T-0010.04.01		Grade slab and Ironite flooring work in TP9 and TP10 in CHP area of KTPS stage VII, Paloncha.	20,00,000.00	To be Taken up
15	T-0010.04.01		KTPS-VII Stage-Civil-O&M-I-SD-I - Construction of Drain from main gate to Stage-V	20,00,000.00	To be Taken up
16	T-0010.04.01		Providing roof treatment to the switch yard control room and attending miscellaneous worksinswitch yard.	12,00,000.00	To be Taken up
17	T-0010.04.01		Providing 6 inch toe gaurds at staircases and platforms in all TPs, Crusher house and Track hopper in coal handling plant area of KTPS Stage VII Paloncha.	7,00,000.00	To be Taken up
18	T-0010.04.01		Drains invert levels finishings in all CHP drains of KTPS stage VII, Paloncha	5,00,000.00	To be Taken up
19	T-0010.04.01		Finishing works around ventilation ducts in TPs and under ground tunnels	5,00,000.00	To be Taken up
20	T-0010.04.01		Generation of Solar power on Roof top areas of all buildings of KTPS-VII Stage	25,00,00,000.00	To be Taken up
21	T-0010.04.01		Miscellaneous civil works	12,40,00,000.00	To be Taken up
			Sub total in Rs	**41,89,00,000.00**	
1	T-0010.04.02		KTPS-VII Stage (1x800MW) - Construction of 2Nos Pit less In motion Weigh bridges i .e 1No on existing line of KTPS -V & VI Stage & 1No. for (1x800MW) KTPS VII Stage along with control room , Longitudinal drains , Cross drains , Bitumen Road, CC road , Pipe Culverts and other miscellaneous works in Railway siding & Marshalling Yard of (1x800MW) KTPS-VII Stage, Paloncha	4,32,42,902.50	To be Taken up
2	T-0010.04.02		KTPS-VII Stage (1x800MW)-Supply, Erection, Testing & Commissioning of (7) Nos High Mast Lighting system of 30Mtrs height in Marshalling Yard of (1x800MW) KTPS VII Stage , Paloncha, Bhadradri-Kothagudem Dist	1,35,00,000.00	Work to be taken up
			Sub total in Rs	**5,67,42,902.50**	

S. No	WBS Element No.	Purchase order No.	Description	Amount Rs.	Present Status
1	T-0010.04.03		KTPS-VII Stage (1x800MW)-Design, Engineering, Supply, Civil & Structural works, erection, testing & commissioning of ash water recovery Pump House , ash water recovery pipe from ash dyke area to AHP clarifier of 1x800MW coal fired supercritical Thermal unit ,ash pond ,land acquisition (CIVIL WORKS)	11,00,00,000.00	to be taken up
1	T-0010.04.05		Formation of Wet mix, BT and RCC roads in BOP,CHP & AHP areas	4,75,00,000.00	to be taken up
2	T-0010.04.05		KTPS - Stage-VII - Civil - O&M-I - SD-III - Laying PCC pavement in PTP area, Stage-VII, KTPS.	25,00,000.00	to be taken up
			Sub total in Rs	**5,00,00,000.00**	
1	T-0010-04.07		KTPS - Stage-VII - Civil - O&M-I - SD-III Development of green belt around cooling tower	2000000.00	To be Taken up
1	T-0010-04.07		Development of Green belt in CHP & AHP of KTPS stage VII, Paloncha	2500000.00	To be Taken up
2	T-0010-04.07		Development of Green belt in KTPS stage VII, Paloncha	30800000.00	To be Taken up
			Sub total in Rs	**3,53,00,000.00**	
1	T-0010.04.09		KTPS-VII Stage (1x800MW) –Soil investigation, Engineering, Design, Construction of 1 block (1 unit) of A-Type, 6 blocks (1 unit each) of B-Type, 1 block (24 units) of C-Type with stilt + 4 floors, 1 block (72 units) of D-Type with stilt + 8 floors, 2 blocks (1 block of 90 units with Stilt + 10 floors & 1 block of 81 units with Stilt + 9 floors, totaling to 171 units) of E-Type, 5 blocks (90 units each with stilt +10 floors, totaling to 450 units) of F-Type Multi storied residential quarters and Office building with (G+1) floors including electrical & Fire fighting system works in full shape at Kothagudem Thermal Power Station Complex, Paloncha, Bhadradri-Kothagudem Dist	4,00,00,00,000.00	To be taken up
1	T-0010.04.10		KTPS-V Stage-Construction of vocational training institute near TSGENCO Housing colony of KTPS V&VI stages, Paloncha	8,00,00,000.00	To be Taken up
1	T-0010.04.11		Establishing Training institute under KTPS-VII stage (Civil Works)	11,00,00,000.00	To be Taken up

S. No	WBS Element No.	Purchase order No.	Description	Amount Rs.	Present Status
1	T-0010.06		TSGENCO-CSR-KTPS-Sanction of funds under CSR policy during the year 2016-17 for construction of CC roads & drains in Payakariyanambile, Kodipunjula vagu, Punukula, Pullaigudem, Somulagudem, Suraram and Pandurangapuram habitations of Paloncha mandal through Panchayat Raj Department and in different wards of Paloncha town through Paloncha Municipality	1,00,00,000.00	Work in progress
2	T-0010.06		KTPS-VII Stage (1x800MW) - Sanction of funds towards Renewal of Bitumen roads in Patha Suraram, Kotha Suraram, Pandurangapuram, Punukula, Pullaigudem, Veeru naik Thanda, Bheekya Thanda, Kammarigudem, Somulagudem, Jaganadhapuram & Nagaram villages of Paloncha mandal under CSR policy	30,00,000.00	To be Taken up
3	T-0010.06		TSGENCO – KTPS–VII Stage (1x800MW) - Sanction of funds to provide Central Lighting from Indira Nagar of Palvancha town to Jagannadhapuram (Tribal Area), Laying of CC roads and Drains in various Grampanchayats of Palvancha Mandal and Lakshmidevipally Mandal in Kothagudem Constituency under C.S.R policy	1,43,82,000.00	To be Taken up
			Sub total in Rs	**2,73,82,000.00**	
			FY 2023-24 Total amount in Rs	**4,88,83,24,902.50**	

Chief Engineer/Civil/Thermal

TELANGANA STATE POWER GENERATION CORPORATION LIMITED
VIDYUT SOUDHA :: HYDERABAD-500082
CIN:U40102TG2014SGC094070, Phone No:040-23499407
Website: www.tsgenco.co.in Email ID:ce.cth@tsgenco.co.in

O/o the
Chief Engineer/Civil/Thermal,
TSGENCO, Vidyut Soudha
Hyderabad-500082.

U.O to the Chief Engineer/ Coal & Commercial:

Sub: KTPS Complex – Filing of Mid-Term Review (MTR) Petition for the 4th control period (FY-2019-24) before Hon'ble TSERC- Certain Information – Furnished - Reg.

Ref: U.O. No. CE (Coal & Comml)/ SE (C&C)/F.MTR-(2019-24) /D.No.88/22, Dt.27.08.2022

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With reference to the U.O cited, certain details like Status of work, actual capitalization, Purchase Order, Justification and period of work, regarding execution of the following civil works proposed under the Capital investment Plan for the FY.2019-20 to FY 2023-24 are herewith enclosed as annexure for taking further action.

Sl.No	Station	Name of Work
1	KTPS-O&M, Paloncha	KTPS-Ash pond-Raising of Northern Ash pond-II upto EL (+) 99M at Paloncha, Bhadradri-Kothagudem (Dist).
2	KTPS-V&VI Stages, Paloncha	KTPS-V & VI Stage-Raising of AB pond bunds from Ch:0M to 2900M, Intermediate bund (1200M) and Cross bund (900M) from EL(+) 115.50M to EL(+) 120.50M at Paloncha, Bhadradri-Kothagudem Dist
3	KTPS-VII Stage (1x800MW), Paloncha	KTPS-Ash pond-Raising of Northern Ash pond-II from EL (+) 104M to EL (+)109M at Paloncha, Bhadradri-Kothagudem (Dist).

05/09/22
CHIEF ENGINEER/CIVIL/THERMAL

To
The Chief Engineer/ Coal & Commercial,
TSGENCO, Vidyut Soudha,
Hyderabad–5000 082

U.O. No.CE/Civil/Thermal/SE.TCD-I/EE3/F.MYT/D.No.170/2022-23, Dt.05.09.2022.

Chief Engineer
Coal & Commercial
TSGENCO, VS, Hyd-82.
Inward No. 760
05 SEP 2022
SE/Coal & Commercial
SE/Planning
SE/Tadicherla Coal & Project
Chief Engineer
Coal & Commercial

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ANNEXURE

KTPS - Filing of Mid-term Review (FY 2019-24) before Hon'ble TSERC.

I) KTPS (O&M) (2019-20):

S.No.	Name of work	LOI No.	Period of work	Staus of work	Expenditure incurred/ to be incurred (Rs.)					Justification
					2019-20	2020-21	2021-22	2022-23	2023-24	
1	KTPS-Ash pond-Raising of Northern Ash pond-II upto EL (+) 99M at Paloncha, Bhadradri-Kothagudem (Dist).	LOI.NO.CC-0014 /CE/C/thermal/SE/ TCD-I/KTPSD/F.NAP2/ D.No.317/ 2014, Dt:12.12.2014	12 months	Completed on 11.12.2015	1,95,52,000.00 (Bill paid during the year 2019-20)	—	—	—	—	The serving Northern ash pond-I up to EL (+) 94M was exhausted by January-2015. Hence, Northern ash pond-II was raised up to height of (+) 99M for discharge of ash generated from KTPS I to IV stages /Paloncha for uninterrupted power generation. Further, the bunds of ashpond were raised for 3M i.e., up to EL(+)102M, to increase the life of pond.
II) KTPS (V&VI) (2021-22&2022-23):										
1	KTPS-V & VI Stage-Raising of AB pond bunds from Ch:0M to 2900M, Intermediate bund (1200M) and Cross bund (900M) from EL(+) 115.50M to EL(+) 120.50M at Paloncha, Bhadradri-Kothagudem Dist	LOI No. CC- 0020 / CE / Civil / Thermal / SE.TCD-I / EE3 / F.AB Pond / D.No.513/2020-21, Dt.23.05.2020	15 months	Completed on 04.01.2022	—	7,89,48,062.00	23,01,76,675.61	1,19,04,316.39 (Bill to be paid)	—	The balance capacity of serving additional ash pond of KTPS V & VI Stages/Paloncha was exhausted by September-2020. To deposit ash generated from KTPS-V&VI Stages/Paloncha from October, 2020, raising of AB ashpond was required for uninterrupted power generation of 1000MW.
I) KTPS VII Stage (2022-23&2023-24):										
1	KTPS-Ash pond-Raising of Northern Ash pond-II from EL (+) 104M to EL (+)109M at Paloncha, Bhadradri-Kothagudem (Dist).	To be taken up			—	—	—	15,00,00,000.00	25,00,00,000.00	The work is proposed to take up in the FY 2020-21 for an amount of Rs.40.00 Crore, considering the existing Northern Ash Pond-I would serve up to June'2021. Due to phasingout of KTPS I to IV Stages, generation of ash has been decreased and life of existing ash pond increased. The same will serve up to October-2023. Hence, raising of NAP-II is proposed to take up during the years 2022-23 & 2023-24, to deposit the Ash generated from (1x800MW) KTPS-VII Stage, Paloncha.

CHIEF ENGINEER/CIVIL/THERMAL 05/09/22

TELANGANA STATE POWER GENERATION CORPORATION LIMITED
MHS & Solar :: POCHAMPAD
3980 1393

From:
The Chief Engineer, O&M,
MHS & Solar/TSGENCO,
Pochampad – 503 219
Nizamabad Dist.
Email: mhs.ce@tsgenco.co.in

To: 2
The Chief Engineer, HPC & HP,
3rd floor, Vidyuth Soudha,
TSGENCO, Hyderabad-500 082

Lr. No. CE/MHS&Solar/PPD/ADE/T/F- Dkt /D. No. 525 /22, DT: 27.10.2022.

Sir,

Sub: - TSGENCO-MHS Circle PPD –Filing of Mid – Term Review (MTR) Petition for the 4th control period (FY 2019-24) before Hon'ble TSERC – Information Furnished.

Ref: - Lr.No. CE/HPC&HP/SE/HD-II/EME-3/F.Dkt/D.No. 24/2022, dt. 08.09.2022.

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It is to inform that, in the capital investment plan for the FY 2020-21 to FY 2021-23 the following were included.

(1). Replacement & modification of the outdated equipment of Pochampad Hydro Power Station was approved in the 40th TSGENCO board meeting for an amount of Rs. 17, 09, 03, 846.00 (Rupees Seventeen Crores Nine Lakh Three Thousand Eight Hundred and Forty Six Only).

(2). Renovation & Modernization of Nizamsagar Power House (2X5 MW) at Nizamsagar approved in the 39th TSGENCO board meeting for an amount of Rs. 15, 10, 52, 000.00 (Rupees Fifteen Crores Ten lakh and Fifty Two Thousand Only).

Further, the Energy forecast (Gross Generation in MU) of stations on month wise and year wise along with overhaul works schedules, Net Generation (MU), Auxiliary Energy consumption in (MU) for FY: 2022-23 to FY: 2023-24 pertaining to MHS Circle, Pochampad are herewith enclosed in the separate sheets.

And Non – Tariff income from the rental from quarters & Income from investment of consumer security deposit (Actual for the FY: 2019-20 to FY: 2021-22 and projections for FY: 2022-23 to FY: 2023-24) and estimate value pertaining to De capitalization of the assets pertaining MHS Circle, Pochampad are enclosed in separate sheets.

The status of the work, actual capitalization details, P.O details, justification and period of work etc., are enclosed in Annexure.

It is to inform that, it is proposed to include the following works which are to be taken up on the Units 1, 2 & 3 of Pochampad Hydro Power Station in view of the frequent problems on the equipment.

1. Replacement of Cooling water Pipeline as the existing pipeline also erected during the Stage-I Erection i.e., 35 years ago.
1. Erection and commissioning of Fire frightening system.
2. Replacement of PIG Control Panels Unit I & II.
3. Replacement of 24V Battery Charger and 220V battery charger along with replacement of battery banks.
4. Replacement of Shaft Sleeves and Bushes of all units.
5. Replacement of LT breakers in the power house.
6. Rectification of penstock intake gates of Unit I & III (Unit -II is already completed)

Yours Faithfully

Chief Engineer (O&M)
MI IS & Solar/TSGENCO
Pochampad.

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S.No	Indent/PO details	Actual Capitalization details	Status of the work	Justification and period of the work
R-0013				
(a)	SCADA System Design, Engineering, Manufacture, Supply, Erection, testing and commissioning of Distributed Control System and Governing System for units I, II & III (3x9MW each) and Distributed Control System for Unit-IV of Pochampad Hydro Power station, Pochampad. The vibration monitoring system and instruments like Turbine discharge flow meters, oil level indicators, RTDs, DTTs, Gauge panel instruments etc., were also included		Indent was submitted to Head Quarters, but certain remarks were raised, after attending the remarks indent was prepared and submitted vide l.r. No. CE/MHS&Solar/PPD/ADE/P&IT/F.No. Up gradation/D.No. 175/22, dt. 21.10.2022	
(b)	Design, manufacture inspection and shop testing at Manufacturer's works before dispatch, delivery on F.O.R. project site basis and supervision on erection, testing and commissioning of 3 sets of Digital Automatic Voltage Regulator (DAVR) based static excitation equipment (SEE) for Generating Units# 1,2&3.		LOI was Placed vide ref: LOI No. CE/HPC &HP /SE/HD-I/EME -2/F.DAVR/D.No.493 /2021,Dtd:15.12.2021. and supply of mandate spares list was submitted recently. PO to be placed.	
(c)	Design, manufacturing, inspection and testing at Manufacturer's works before dispatch, delivery on F.O.R. project site basis and supervision on erection, testing and commissioning of advanced numerical protection relay panels with time		PO was placed Vide ref .No: 4500027072 /CE (HPC&HP)/SE(HD-I)/121/F07/2022-23/Dt:21.04.2022.and Drawings were approved	

	synchronizing feature along with DR Evaluation Unit with required hardware and software along with recommended spares for protection of generator , generator transformer and UAT/Excitation transformer.		vide ref Lr.No.CE(HPC&HP) /121/F.PJHES& Pochampad GRP/ D.No.372/22,Dt:13.10.2022 for an amount of Rs. 1, 95, 85, 993.10 (Incl of taxes)	
(d)	Procurement of 145KV SF6 circuit breakers for Unit 1, 2 & 3, Main feeder of HPS, Pochampad.		Indent was submitted vide Lr.No. CE/MHS&Solar/PPD/ADE/ P&IT/F.No. Up gradation/D.No. 76/22, dt. 05.07.2022	Requested for allocation of the budget from R&M budget sanctioned for replacement & modification of outdated equipment of Units I, II & III of Pochampad Hydro Power Station in 40th board meeting. The same is under process at Head quarters.
(e)(i)	Procurement of numerical relay test kit.	Rs. 33, 63, 000.00	PO placed vide ref 5300001227 for an amount of Rs. 33, 63, 000.00 and material received at site on dt. 21.09.2021	
(ii)	Procurement of TAN delta test Kit	Rs. 27, 29, 694.00	PO placed vide ref 5300001224 for an amount of Rs. 27, 29, 694.00 and material received at site on dt. 22.06.2021	

R-0012				
(i)	Renovation and modernization of Nizamsagar Power House (2X5 MW), Nizamabad Dist, Telangana State - Purchase order as per BBU			PO placed vide ref No. 5300001156 for ana amount of Rs. 11, 96, 18, 100.00 Some of the materials were received at site.
(ii)	Renovation and modernization works (Fire Fightening system and miscellaneous work etc.,) of Nizamsagar Power House (2X5MW), NZSR			An amount of Rs. 1, 99, 33, 900.00 was approved for fire fightening system, Indent /Estimate to be prepared.
(iii)	Providing of RCC slab at generator floor level for placing of Transformer and Electrical panels of units 1& 2 at HPS, Nizamsagar.	Rs. 20, 39, 611.57 (Excluding floor finishing)	PO placed vide ref 4900036707 for an amount of Rs. 20, 39, 611.57 (Excluding floor finishing) The work is not yet started.	Vide Lr. No. CE/HPC&HP/SE/HD -II/EME-VII/F.NZSR R&M/D. No. 35/22, dt. 28.09.2022, as the civil works R&M budget is exhausted, the FA&CCA (Accounts), VS has reappropriate the budget for an amount of Rs. 30, 00, 000.00 from the WBS element R-0012.01. (Including provision towards floor finishing)

C-0030.02 (Civil works)				
(iv)	Design, fabrication supply, erection, testing and commissioning of New Escape Gates, Screw hoist structure for Twin regulators and Repairs of existing Escape and Cross regulator gates, gate embedments over Nizamsagar power house Canal junction-Nizamsagar.	Rs. 88, 60, 535.18	PO placed vide ref 4900024662. The Work was completed	Work was commenced on 17.05.2018 and completed on 10.09.2020.

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Monthly wise and Year wise Energy Forecast, Net Generation, Auxiliary Energy Consumption for FY : 2022-23 to FY : 2023-24 of HPS, Pochampad

	Gross Generation Forecast in MU												
S.No		April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Total
1	2022-23	6.9225	0	0	12.8756	23.0413	23.936	25	2	5	10	10	10	128.7754
2	2023-24	2	0	0	2	10	12	12	2	5	10	10	10	75

	Auxiliary Consumption Projections in MU												
S.No		April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Total
1	2022-23	0.058	0.020	0.020	0.076	0.113	0.1079	0.108	0.020	0.050	0.075	0.075	0.075	0.798
2	2023-24	0.020	0.018	0.018	0.020	0.080	0.095	0.095	0.020	0.050	0.075	0.075	0.075	0.641

	Net Generation Projection in MU												
S.No		April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Total
1	2022-23	6.864	-0.020	-0.020	12.799	22.929	23.828	24.892	1.980	4.950	9.925	9.925	9.925	127.978
2	2023-24	1.980	-0.018	-0.018	1.980	9.920	11.905	11.905	1.980	4.950	9.925	9.925	9.925	74.359

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Maintenance Schedules for the FY: 2022 - 23 to FY: 2023-24 of HPS/Pochampad							
S.No	FY	Name of the Station	Capacity	From	To	Total No of Days	Type of Planned Maintenance (Annual/Capital/R&M)
1	2022-23	HPS, Pochampad	36 MW (4 X 9)	25.04.2022	09.07.2022	76	Annual
2	2023-24	HPS, Pochampad	36 MW (4 X 9)	01.05.2023	30.06.2023	61	Annual

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Month-wise Generation Projections and Auxiliary Energy Consumption details of SHES, Singur

Gross Energy Forecast in MU

S.No.	FY	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Total
1	2022-23	0.5229	0	0.4461	3.1887	6.3393	7.2075	7	1	0	1	1	1	28.7045
2	2024-25	1	0	0.3	0.2	0.5	4	4	1	0	1	1	1	14

Auxiliary Energy Consumption Projections in MU

S.No.	FY	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Total
1	2022-23	0.02642	0.02786	0.02378	0.07806	0.0555	0.05818	0.07178	0.03	0.02	0.03	0.03	0.03	0.48158
2	2024-25	0.03	0.02	0.025	0.023	0.03	0.06	0.06	0.03	0.02	0.03	0.03	0.03	0.388

Net Energy Forecast in MU

S.No.	FY	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Total
1	2022-23	0.49648	-0.02786	0.42232	3.11064	6.28380	7.14932	6.92822	0.97	-0.020	0.97	0.970	0.97	28.22292
2	2024-25	0.97	-0.02	0.275	0.177	0.47	3.94	3.94	0.97	-0.02	0.97	0.97	0.97	13.612

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Maintenance Schedules for the FY: 2022-23 to FY: 2023-24 of SHES, Singur							
S.No	**FY**	**Name of the Station**	**Capacity**	**From**	**To**	**Total No of Days**	**Type of Planned Maintenance (Annual/Capital/R&M)**
1	2022-23	SHES, Singur	15 MW (7.5 X 2)	15-04-22	15-06-22	62	Annual
2	2023-24	SHES, Singur	15 MW (7.5 X 2)	15-04-23	15-06-23	62	Annual

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Energy forecast details for Mid term Review of HPS,Nizamsagar

Monthly Generation for FY: 2022-23 (MU)		Auxillary Cosumption (MU)	Year wise Generation for FY:2022-23 (MU)	Net Generation (MU)	Overhaul Schedule Date		Total No of Days
April	0.6578	0.00666	10.5349	10.42217	10.05.2022	20.06.2022	42
May	0	0.00998					
June	0.3914	0.00512					
July	1.1012	0.00999					
August	3.0892	0.01013					
September	2.7238	0.01085					
October	2.5715	0.01					
November	0	0.01	Both the Units will be under R&M works				
December	0	0.01					
January	0	0.01					
February	0	0.01					
March	0	0.01					
Total	10.5349	0.11273					

Monthly Generation for FY: 2023-24 (MU)		Auxillary Cosumption (MU)	Year wise Generation for FY:2023-24 (MU)	Net Generation (MU)	Overhaul Schedule Date		Total No of Days
April	0	0.01	Both the Units will be under R&M works				
May	0	0.01					
June	0	0.01					
July	0	0.01					
August	0	0.01					
September	0	0.01					
October	3	0.01	9.00	8.88	-	-	-
November	0	0.01					
December	1.5	0.01					
January	1.5	0.01					
February	1.5	0.01					
March	1.5	0.01					
Total	9.00	0.12					

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POCHAMPAD - 503 219.

Monthly wise and Year wise Energy Forecast, Net Generation, Auxiliary Energy Consumption for FY : 2022-23 to FY : 2023-24 of MHS, Peddapalli

FY:2022-23 — Gross Generation Forecast in MU

S.No	Name of the station	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Total
	MHS/Peddapalli	0.405213	0	0	0.031038	1.139653	0.400000	0.410000	0.200000	0.000000	0.100000	0.260000	0.650000	3.595904

FY:2023-24

S.No	Name of the station	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Total
	MHS/Peddapalli	0.420000	0	0	0.050000	0.300000	0.310000	0.420000	0.150000	0.000000	0.200000	0.300000	0.700000	2.850000

FY:2022-23 — Auxiliary Consumption Projections in MU

S.No	Name of the station	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Total
	MHS/Peddapalli	0.009554	0.002758	0.002230	0.002822	0.016753	0.008000	0.009000	0.003000	0.002000	0.004000	0.006000	0.010000	0.076117

FY:2023-24

S.No	Name of the station	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Total
	MHS/Peddapalli	0.009000	0.002000	0.001000	0.001000	0.005100	0.006000	0.009000	0.003000	0.002000	0.004500	0.006000	0.011000	0.059600

FY: 2022-23 — Net Generation Projection in MU

S.No	Name of the station	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Total
	MHS/Peddapalli	0.395659	-0.002758	-0.002230	0.028216	1.122900	0.392000	0.401000	0.197000	-0.002000	0.096000	0.254000	0.640000	3.519787

FY: 2023-24

S.No	Name of the station	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Total
	MHS/Peddapalli	0.411000	-0.002000	-0.001000	0.049000	0.294900	0.304000	0.411000	0.147000	-0.002000	0.195500	0.294000	0.689000	2.790400

Addl. Asst. Engineer
O&M-M.H.S-TS GENCO
PEDDAPALLI-505 172

Asst. Divisional Engineer
O & M-M.H.S-TSGENCO
PEDDAPALLY-505 172

//Counter Signed//
20.09.2022
Divisional Engineer
O&M:MHS: TSGENCO
PEDDAPALLI-505 172

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POCHAMPAD - 503 219.

Maintenance Schedules for the FY: 2022 - 23 to FY: 2023-24 of MHS/Peddapalli.

FY 2022-23

S.No	Name of the Station	Capacity	From	To	Total No. of Days	Type of Planned Maintenance (Annual/Capital/R&M)
1	6th mile power house.	2X500 KW	10.05.2022	19.05.2022	10	Annual
2	7th mile power house.	2X500 KW	20.05.2022	27.05.2022	8	Annual
3	9th mile power house.	2X500 KW	13.07.2022	19.07.2022	7	Annual
4	10th mile power house.	3X220KW	07.07.2022	12.07.2022	6	Annual
5	12th mile power house.	2X325KW	28.05.2022	05.06.2022	8	Annual
6	14th mile power house.	2X500 KW	07.06.2022	14.06.2022	8	Annual
7	16th mile power house.	2X500 KW	15.06.2022	21.06.2022	7	Annual
8	18th New mile power house.	2X750 KW	22.06.2022	28.06.2022	7	Annual
9	18th Old mile power house.	3X220 KW	29.06.2022	05.07.2022	7	Annual
10	19th mile power house.	3X230 KW	29.04.2022	07.05.2022	9	Annual

FY 2023-24

S.No	Name of the Station	Capacity	From	To	Total No of Days	Type of Planned Maintenance (Annual/Capital/R&M)
1	6th mile power house.	2X500 KW	10.05.2023	19.05.2023	10	Annual
2	7th mile power house.	2X500 KW	20.05.2023	27.05.2023	8	Annual
3	9th mile power house.	2X500 KW	13.07.2023	19.07.2023	7	Annual
4	10th mile power house.	3X220KW	07.07.2023	12.07.2023	6	Annual
5	12th mile power house.	2X325KW	28.05.2023	05.06.2023	8	Annual
6	14th mile power house.	2X500 KW	07.06.2023	14.06.2023	8	Annual
7	16th mile power house.	2X500 KW	15.06.2023	21.06.2023	7	Annual
8	18th New mile power house.	2X750 KW	22.06.2023	28.06.2023	7	Annual
9	18th Old mile power house.	3X220 KW	29.06.2023	05.07.2023	7	Annual
10	19th mile power house.	3X230 KW	29.04.2023	07.05.2023	9	Annual

Asst. Divisional Engineer
O & M-M.H.S-TSGENCO
PEDDAPALLY-505 172

CHIEF ENGINEER, O&M
MHS & SOLAR, TSGENCO
POCHAMPAD - 503 219.

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20.09.2022

Divisional Engineer
O&M:MHS: TSGENCO
PEDDAPALLI-505 172

II Non- Tariff Incomefor the Fy 2019-20, to Fy 21-22 & Projected for fy 2022-23 to 2023-2024

C. Rental Charges from Staff Quarters

1. Actual fy 2019- 2020 to fy 21-22

AH.301560- Rental from Letting out of shop & Quarters

Particulers	Amount for the Fy 2019-20
Rental charges for the fy 2019-20	40,920.00

AH.301110- Rental from Quartes

Particulers	Amount for the Fy 2019-20
Rental charges for the fy 2020-21	22,720.00

AH.301110- Rental from Quartes

Particulers	Amount for the Fy 2020-21
Rental charges for the fy 2020-21	255,540.00

AH.301110- Rental from Quartes

Particulers	Amount for the Fy 2021-22
Rental charges for the fy 2021-22	52,960.00

2. Projected Fy 2022-23 to 2023 to 2024

Fy 2022-23

AH.301110- Rental from Quartes

Particulers		Amount for the Fy 2022-23
	Actual charges for the period 01.04.2022 to 14.09.2022	61,140.00
	Projected charges for period Add : from 15.09.2022 to 31.03.2023	16,000.00
	Total	**77,140.00**

Fy 2023-2024

Particulers	Amount for the Fy 2023-24
Rental charges for the fy 2023-24	50,000.00

Accounts Officer
TGENCO-MHS-Pochampad

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II Non- Tariff Incomefor the Fy 2019-20, to Fy 21-22 & Projected for fy 2022-23 to 2023-2024

E. Income from invesment of consumer security deposit

1. Actual fy 2019- 2020 to fy 21-22

Particulers	Amount for the Fy 2019-20
Int on Securtity Deposits for the Fy 2019-20	12,446.00

Particulers	Amount for the Fy 2020-21
Int on Securtity Deposits for the Fy 2020-21	12,353.00

Particulers	Amount for the Fy 2021-22
Int on Securtity Deposits for the Fy 2021-22	8,958.00

2. Projected Fy 2022-23 to 2023 to 2024

Fy 2022-23

AH.116240. Other Deposits -

Particulers	Amount for the Fy 2022-23
Int on Securtity Deposits for the Fy 2022-23	10,500.00

Fy 2023-24

AH.116240. Other Deposits -

Particulers	Amount for the Fy 2023-24
Int on Securtity Deposits for the Fy 2023-24	10,500.00

Accounts Officer
TGENCO-MHS-Pochampad

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III The Estimated value of De- Capitazation of the Assets Pertaining to unit /station

Capital Investment for the Fy 2019-20 to Fy 202-24

1. Actual fy 2019- 2020 to 2021-22

Particulers	Amount for the Fy 2019-20
NIL	NIL

Particulers	Amount for the Fy 2020-21
NIL	NIL

Particulers	Amount for the Fy 2021-22
NIL	NIL

2. Projected Fy 2022-23 to 2023 to 2024

Fy 2022-23

Particulers	Amount for the Fy 2022-23
NIL	NIL

Fy 2023-24

Particulers	Amount for the Fy 2023-24
NIL	NIL

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POCHAMPAD - 503 219.

Format-A Contract Details

Details of Contracts for Major Contracts

Station: Pochampad Hydro Power Station, Pochampad .

Sr No	Name of Package /Works	Scope of work in Brief	Name of Contractor	Original Schedule as per Contract		Estimated Contract Price	Actual Schedule		Actual Completed Cost	Time Over Run	Cost Over Run	Variation in Scope of Work If any	Break up of Cost Over Run (Rs Crore)			Reason for Time Over Run	Liquidated Damage	
				Start	End	Rs Crore	Start	Completion Date	RS Crore	Days	Rs Crore		Variation in Scope	Price Variation	Any Other Reason		Max Car be Levy as per contract Conditions	Actual Levied/Likely to be levied
1	Design, Manufacture, Inspection, Shop testing, Packing & forwarding and insurance, transportation to site stores and training of the **Automatic Capacitance and Tan Delta Test Kit** for Pochampad Hydro Power Station.	Design, Manufacture, Inspection, Shop testing, Packing & forwarding and insurance, transportation to site stores and training of the Automatic Capacitance and Tan Delta Test Kit for Pochampad Hydro Power Station.	M/s. ELTEL INDUSTRIES, BANGALORE			0.23	22.06.2021	07.07.2021	0.23									Nil
2	Design, Manufacture, Inspection, Shop testing, Packing & forwarding, supply and transportation to site stores and training of the **Numarical relay test kit** for Pochampad Hydro Power Station.	Design, Manufacture, Inspection, Shop testing, Packing & forwarding, supply and transportation to site stores and training of the Numarical relay test kit for Pochampad Hydro Power Station.	M/s. Megger India Private Limited, Mumbai			0.28	22.09.2021	30.10.2021	0.28									Nil

Chief Engineer (O&M)
MHS & Solar/TSGENCO
Pochampad

Format-A Contract Details

Details of Contracts for Major Contracts

Station: Nizamsagar Hydro Power Station, Nizamsagar

Sr No	Name of Package /Works	Scope of work in Brief	Name of Contractor	Original Schedule as per Contract		Estimated Contract Price	Actual Schedule		Actual Completed Cost	Time Over Run	Cost Over Run	Variation In Scope of Work If any	Break up of Cost Over Run (Rs Crore)			Reason for Time Over Run	Liquidated Damage	
				Start	End	Rs Crore	Start	Completion Date	RS Crore	Days	Rs Crore		Variation in Scope	Price Variation	Any Other Reason		Max Can be Levy as per contract Conditions	Actual Levied/Likely to be levied
1	Design, fabrication supply, erection, testing and commissioning of New Escape Gates, Screw hoist structure for Twin regulators and Repairs of existing Escape and Cross regulator gates, gate embedments over Nizamsagar power house Canal junction-Nizamsagar.	Design, fabrication supply, erection, testing and commissioning of New Escape Gates, Screw hoist structure for Twin regulators and Repairs of existing Escape and Cross regulator gates, gate embedments over Nizamsagar power house Canal junction-Nizamsagar.	M/s. Saraswathi Consturctions, Secunderabad			0.88	17.05.2018	10.09.2020									5%	Rs. 18, 699.46

Chief Engineer (O&M)
MHS & Solar/TSGENCO
Pochampad

Format A:Contract Details

Station: Lower Jurala Hydro Electric Project

Details of Contracts for Major Contracts

S No	Name of package/works / Scope of work	Name of the contractor	Original schedule as per Contract		Estimated Contract Value	Actual Schedule		Actual Completed cost	Time over run	Cost over run	Variation in scope of work if any	Break up of cost over run (Rs Crore)			Reasons for time over run	Liquidated damages	
			Start Date	Completion Date	Rs.Crore	Start Date	Completion Date	Rs.Crore	Days	Rs.Crore		Variation in scope	Price variation	Any other reason		Max can be levy as per contract conditions	Actual levied/likely to be levied
																Penalty Recovered	Penalty to be recovered
1	Excavation For Approach Channel Intake Pool, Power house Pit, Tail Race Pool & Tail Race Channel Etc for Lower Jurala Hydro Electric Scheme (6x40 MW)	M/ RamaKrishna Reddy, Hyderabad-500082.	10.02.2008	09.02.2010	130.09	10.02.2008	07.08.2012	112.67	919	0.00	NA	NA	NA	NA	1. Due to change of ground levels due to shifting of power house. 2. Encountering rock strata on higher levels 3. Price escalation due to change of SSR.		Rs.52,86,000.00
2	Construction of Power House Civil works including switch yard, gates and hoists etc., at Lower Jurala Hydro Electric Project (6 x 40 MW)	M/S Patel-VArks Precision consortium,Hyd.	29.01.2010	19.01.2014	185.22	29.01.2010	31.12.2016	167.13	1077	0.00	NA	NA	NA	NA	1. Due to change of ground levels due to shifting of power house. 2. Encountering rock strata on higher levels 3. Price escalation due to change of SSR.	Rs.1,75,99,100	a. Rs 14,75,000 (To be recovered due to slow progress) b. Rs 46,380.24 (Additional tax liability to be recovered due to restructured rates due to implementation of GST) c. Rs 1,06,594.35 was propoced to be recovered due to implementation of GST on Price escalation in respect of Fuel. The same is pending at Head Quarters. d. Rs.12,161.38 was propoced to be recovered due to implementation of GST on Price escalation in respect of Labour. The same is pending at Head Quarters. e. Further, recovery for Rs.3,40,000.00 was proposed due to mismatch of 2nd lift near unit VI. The same is pending at Head Quarters. f. Penalty for an amount of Rs.76.75Lakhs was instructed to be witheld by the CE/Civil/Hydel vide Letter Dt.10.08.2022 as per AG Audit. Further, it was also instrcuted to witheld the Price escalation charges paid during the extended period as per AG Audit report.
3	LJHES- Construction of Weir consisting of left non over flow, over flow section, right non over flow section, earthen embankment of left and right banks including, de-silting sluices etc., at 7.9 KM down stream of Priyadarshini Jurala project across river Krishna near Atmakur (V), Mahabubnagar (Dist). A.P.	M/s Patel - VArks-JV	13.11.2008	13.05.2013	108.1726	13.11.2008	30.09.2015	101.59	1601	0.00	NA	NA	NA	NA	1.Due to land acquisition 2.Due to incessant rains 3.Due to local bandhs		a. Rs 48,30,409.19 (Additional tax liability to be recovered due to restructured rates due to implementation of GST) b. Rs 6,41,976.00 towards excess payment in price escalation to be recovered c. Rs.45,429 towards power consumption charges d. Rs.7,240 towards recovery of balance reinforcement steel e. Penalty for an amount of Rs.32.65Lakhs was instructed to be witheld by the CE/Civil/Hydel vide Letter Dt.10.08.2022 as per AG Audit. Further, it was also instrcuted to witheld the Price escalation charges paid during the extended period as per AG Audit report.
4	LJHES-Weir Den-Providing core drilling with NX Bit for geo optical investigation at construction stage on left portion of Weir across river Krishna at 7.9KM down stream of PJP Dam.	M/S Venugopal Tube Wells Pvt Ltd	08.05.2013	07.08.2013	0.2604	08.05.2013		0.26		0.00	NA	NA	NA	NA			

S.No.	Name of package works	Scope of work	Name of the contractor	Original schedule as per Contract		Estimated Contract Value	Actual Schedule		Actual Completed cost	Time over run	Cost over run	Variation in scope of work if any	Break up of cost over run (Rs Crore)			Reasons for time over run	Un-inflated damages	
				Start Date	Completion Date	Rs Crore	Start Date	Completion Date	Rs Crore	Days	Rs Crore		Variation in scope	Price variation	Any other reason		Max can be levy as per contract conditions	Actual levied/likely to be levied
5	Miscellaneous Civil works of Power House, Switch Yard and colony, miscellaneous civil works including furniture & equipments					32.11			32.11		0.00	NA	NA	NA	NA			
6	Construction of Coffer dam across the TRC @ chainage 900Mts & flood protection		M/s R.Vidya Sagar Rao, Hyderabad	13.05.2010	13.07.2010	1.01	13.05.2010	16.03.2011	1.01	245	0.00	NA	NA	NA	NA	1. Due to non availability of sand 2. Due to non availability of cement 3. Due to incessant rains	Rs.2,00,564.00	
7	Construction of flood dykes along the bank of River Krishna on U/s of Weir.					0.50			0.00		0.00	NA	NA	NA	NA			
8	Procurement of Reinforcement steel					80.69			77.47		0.00	NA	NA	NA	NA			
9	Procurement of Cement					66.00			54.68		0.00	NA	NA	NA	NA			
10	Development of infrastructure office sheds Civil Circle Office, Division Office & E&M office sheds including office furniture and computers					0.72			0.73		0.00	NA	NA	NA	NA			
11	Rock bolting & Shotcreting in Approach Channel					0.58			0.59		0.01	NA	NA	NA	NA			
12	Construction of RCC Guide wall		M/s K.V Constructions, Hyderabad	03.06.2014	02.12.2014	2.30	03.06.2014	30.06.2015	1.77	210	0.00	NA	NA	NA	NA	1. Due to Rains 2. Due to interruption of revamping works after Power House inundation 3. Due to non-availability of Sand	NA	
13	Dismantling of rock ledges at Ch 0.00 m of Approach channel and Ch 900.00 m of TRC.		M/s. Ramakrishna Re Jdy, Hyderabad-500082.	24.10.2013	23.12.2014	6.30	23.10.2013	31.05.2017	5.60	892	0.00	NA	NA	NA	NA	1.Due to floods into River Krishna and submergence of Power House. 2.Due to revamping works of Power House. 3.Due to power generation	Rs.5,87,268.00	Rs.5,29,636.42 to be recovered due to restructured rates due to implementation of GST Which is attributable to the agency.
14	Removal of necking in the River Krishna beyond confluence point					17.00			0.10		0.00	NA	NA	NA	NA			
15	Compensation towards land acquisition for submergence land on U/s side of Weir & crop compensation for 2016-17 and 2017-18 above EL+299.00					4.00			0.08		0.00	NA	NA	NA	NA	*An amount of Rs 42.17 lakhs was paid in the month of June'2019 towards crop compensation for the Kyots of Kekulapally villagres for the FY 2016-17 & 2017-18 and this amount was utilized from the non-planned expenditure. **An amount of Rs.313.60 lakhs towards land acquisition upto EL+301.00m of Mulamalla Village deposited under WBS H-0002.07.04.04 & GL Account 105310. *An amount 11.58 lakhs was paid towards publication charges for acquiring lands in mulamalla village		

	Name of package/Works / Scope of work	Name of the contractor	Original schedule as per Contract		Estimated Contract Value	Actual Schedule		Actual Completed cost	Time over run	Cost over run	Variation in scope of work if any	Break up of cost over run (Rs Crore)			Reasons for time over run	Liquidated damages	
			Start Date	Completion Date	Rs.Crore	Start Date	Completion Date	Rs.Crore	Days	Rs.Crore		Variation in scope	Price variation	Any other reason		Max can be levy as per contract conditions	Actual levied/likely to be levied
16	Consultancy Services Charges	Stup Consultant Pvt. Ltd, Hyd& M/S Design Scope Architects and Interiors,Hyd	23.07.2007	23.07.2010	1.72	23.07.2007	30.09.2015	1.01		0.00	NA	NA	NA	NA			
17	Construction of residential quarters at P.J.P Camp colony, Atmakur.	M/S CH Gowri Shankar,Hyd	10.02.2014	09.08.2015	13.25	10.02.2014	31.08.2016	13.25	388	0.00	NA	NA	NA	NA	1. Due to non availability of sand 2. Due to non availability of cement 3. Due to non availability of 20mm Dia Steel.	Rs 5,60,000.00	
18	Construction of Project Hostel	Sri.N Srinivas Reddy			0.97			0.73		0.00	NA	NA	NA	NA			
19	Formation of WBM road and black topping from Jurala Village to LJHES Stores.	M/s Nandha Constructions			5.12		20.12.2010	4.36		0.00			NA	NA			
20	Construction of Compound wall around LJHES site.	M/S V Arks Engineer Pvt Ltd	12.04.2013	11.10.2013	1.80	12.04.2013	20.01.2014	0.79	101	0.00	NA	NA	NA	NA	1.The land was under submergence 2.The farmers have requested to carryout the work after completion of crop period		
21	Providing black topping including repairs to the road from Kothapally Junction to right bank Earth dam site of Weir near Rekulapally village, Development works of Midamalla and Jurala Villages.				4.50			0.00		0.00	NA	NA	NA	NA			
22	Construction of storage sheds & Stores related works.				0.98			0.97		0.00	NA	NA	NA	NA			
23	Compensation towards land acquisition for construction LJHES on left & right flanks.				6.26			5.20		0.00	NA	NA	NA	NA			
24	Vehicles				3.00			1.67		0.00	NA	NA	NA	NA			
25	Plantation				4.00			0.69		0.00	NA	NA	NA	NA			
26	Procurement of Other Materials				2.64			2.59		0.00	NA	NA	NA	NA			
27	Development of green belt etc camps as per environmental norms				2.50			0.00		0.00	NA	NA	NA	NA			
28	Corporate social responsibility fund				6.00			3.16		0.00	NA	NA	NA	NA			
29	Other Miscellaneous works				40.87			38.63		0.00	NA	NA	NA	NA			
		TOTAL:-			697.91			617.46		0.00							

Superintending Engineer Civil O&M,
Jurala Hydro Electric Projects (LJHEP&PJHEP),
Atmakur 509131, Wanaparthy Dist

LJHEP(6 x 40 MW) -Civil works-Additional Capitalization - Works taken up/Proposed after cut-off year 2017-18

S.No	Asset	Capitalization (Cr)				*Expenditure Proposed for balance Amount		Total	Remarks including Justification
		2018-19	2019-20	2020-21	2021-22	2022-23	2023-24		
1	Hydraulic Works (including Weir Civil Works)	0	-0.02	0	0.0	5.00	0	5.00	The Hon'ble Labour Court III, Hyd had passed an order Dt.29.12.2016 in the M.P.No.05/2011 filed by Project Contract Workers and Employees Union (Reg.No.F/1907) duly directing M/s Patel Engineering Ltd, Hyd to pay escalation wages to workers whom the Company had engaged in Civil works of Srisailam left bank Hydro Electric Scheme Power House. The Hon'ble Labour court had also directed that APGENCO/now TSGENCO shall pay the wages as a principal employer by depositing the amount with labour commissioner in case the firm fails to pay it and recover from the company bills of the other works executed by the firm in any stations. M/s.Patel Engineering Ltd., Hyderabad, filed appeal against the above court order. The case was pending in high court. Hence the final bills were with held following the instructions communicated vide letter DS(O&M)/TGM(HR)/WP6504/2017-20, DT:29.05.2017. Further, the agency M/s Patel-VARKS-JV C/o.Patel Engineering Ltd. Hyd has informed that the Hon'ble High court has set aside the orders and requested to process the pending final bills. In this regard , the Chief Engineer/Civil/Hydel VS vide letter Dt:21.05.2022 has instructed to process the Final bill against the submission of Bank Guarantee for the equivalent amount and approval for restructured rates due to implementation of GST was also accorded. Accordingly, the Final bill was prepared in this office and the same is pending for want of Bank Guarantee submission by the Agency.
2	Power House concrete works	0	0.83	0	0.0	0.75	0	0.75	The Hon'ble Labour Court III, Hyd, had passed an order Dt.29.12.2016 in the M.P.No.05/2011 filed by Project Contract Workers and Employees Union (Reg.No.F/1907) duly directing M/s Patel Engineering Ltd, Hyd, to pay escalation wages to workers whom the Company had engaged in Civil works of Srisailam left bank Hydro Electric Scheme Power house. The Hon'ble Labour court had also directed that APGENCO/now TSGENCO shall pay the wages as a principal employer by depositing the amount with labour commissioner in case the firm fails to pay it and recover from the company bills of the other works executed by the firm in any stations. M/s.Patel Engineering Ltd., Hyderabad, filed appeal against the above court order. The case was pending in high court. Hence the final bills were with held following the instructions communicated vide letter DS(O&M)/DGM(HR)/WP6504/2017-20, DT:29.05.2017. Further, the agency M/s.Patel -VARKS -Precision Consortium, Hyd has informed that the Hon'ble High court has set aside the orders and requested to process the pending final bills. in this regard The Chief Engineer/Civil/Hydel VS vide letter Dt:15.02.2022 has instructed to process the Final bill against the submission of Bank guarantee for the equivalent amount and accordingly, the Agency has submitted the Bank Guarantee bearing No. 0505522BG0001511, dt.06.06.2022 for an amount of Rs.3,00,00,000/- (Rupees Three crore only), valid up to 15.11.2022 with a claim period up to 15.11.2023. Further, as per the approval accorded for restructured rates due to implementation of GST, the final bill is prepared in this office and the same is pending for approval of Price escalation in respect of labour and fuel and tentative amount to be recovered from the Agency due to mismatch of 2nd lift at Unit-VI
3	Power house excavation works			0	0.0	0.70	0	0.70	The work is completed in all respects. Further, the cutoff PO was also placed in SAP. The Final bill is prepared in Sub-Division level and the Agency did not sign the final bill and they are requesting the TSGENCO management to waive off the recovery of Interest on Bank Guarantees for an amount of Rs.52.86Lakhs towards non-renewal of Bank Guarantees. In view of the above, the Final bill is yet to be processed.
4	Other Civil works	5.29	3.03	0.70	1.21	0.40	0.060	0.46	The works which were essentially required for completion of COD of all Units were prioritized and were taken up first in respect of Civil and E&M works. After COD, all the balance works were taken up subsequently in coordination with E&M works such as Painting ,SS hand railing, Granite Flooring & Cladding, Grouting, Armstrong False ceiling and other works which were necessitated or essentially required for completion of the Project in full shape with the prior approval of competent Authority from time to time which are also capitalized.
5	Land Acquisition of Ac71-07 Guntas in Rekulapally and Ac31-02Guntas in Mulamalla villages (Submerged Lands)	0	0	0	3.11	7.00	3.3	10.30	TSGENCO has established Hydro Electric Project (LJHEP) on river Krishna at Atmakur (V) now in Wanaparthy (Dist.) at Ch.7.9Km downstream of PJP Dam on Krishna river with an installed capacity of 240 MW (6 x 40MW). The project (LJHEP) consists of major structures of Power House and Weir with crest level up to El+299.00m for diverting water through Power House and all the six units have been commissioned successfully during the period 10/2015 to 10/2016. During the monsoon seasons of 2016, 2017 and 2018 i.e., after the completion of construction of Weir, due to impounding of water in Weir for Power generation, it was observed that, the agriculture lands on right bank (Rekulapally village) and left bank (Mulamalla village) were getting submerged every year (during Flood Seasons) leading to damage of standing crop and the Ryots of respective villages have made representations several times and requested the TSGENCO management either to acquire their submerging agricultural lands due to back water of Weir from El+299.00m to El+305.00m or stop entry of Flood water into their lands. The erstwhile APGENCO did not acquire these additional lands which are submerging due to back water, for the reason that the submergence area is variable from year to year depending upon water flows at Weir, which is further dependent on water releases from Almatti and Narayanpur of Karnataka, which in turn based on rains in catchment area of Krishna River. As per the observations made in 2016, 2017 and 2018 monsoon seasons, the back water of Weir touched up to El+301.00m resulting in submergence of lands in Rekulapally and Mulamalla villages. Accordingly, TSGENCO management has accorded approval for acquiring the agricultural lands from El+299.00m up to El+301.00m to an extent of Acs31-02Gts in Mulamalla village and Acs71-07Gts in Rekulapally village by sending the requisition in prescribed proforma to the respective District Collectors subject to condition of obtaining an undertaking from the land owners that they will not make any claim in future on the subject (submerged) lands acquired by TSGENCO. Accordingly, Land Acquisition proposals in the filled in proformae (Form-I & II) duly indicating the sketch showing the Survey Nos. were submitted to the respective RDOs. 1. Further, in respect of Mulamalla village as per the request of the RDO/Wanaparthy an amount of **Rs.3,13,60,500.00** towards land compensation and administrative charges were deposited with RDO in two instances and the amount is also disbursed to the respective ryots of Mulamalla village and Additional Collector Wanaparthy Dist. has furnished Utilization Certificate and Acquaintance Rolls (Form -E and Form -G) as per the Consent Award passed by the District Collector/Wanaparthy Dist. for the said amount. Further, transfer of title of lands/Mutation for the submerged lands acquired in favour of TSGENCO is completed for an extent of Acs28-29Gts and updated in Dharani portal also and the balance extent of Acs2-13Gts is yet to be completed. Further, an amount of Rs.7,20,360.00, Rs.2,70,000.00 and Rs 1,53,720.00 towards publication charges of Declaration Notification Proposals was deposited with three different agencies in respect of Mulamalla Village. 2. In respect of Rekulapally village Collector and Dist. Magistrate of Jogulamba Gadwal Dist. has issued Form -C in the District Gazette .The negotiations are yet to be held and the amount is yet to be deposited with RDO.
6	Land Acquisition of Assigned land to an extent of Ac45-03Gts in survey No 401 in Mulamalla village	0	0	0	0.0	3	1.7	4.70	As per the request of the Collector & District. Magistrate/Wanaparthy District and approval of TSGENCO management, Land Acquisition proposals were furnished to the concerned RDO for an extent of ACs45-03 Gts and subsequently, the Collector and District Magistrate/Wanaparthy District has issued preliminary notification proposals vide District Gazette No.52/2022,Dt:10.10.2022 and the same is published in the Eenadu local news paper. Further, the RDO/Wanaparthy District has submitted Form -D to the Dist. Collector and requested to attend the Negotiation committee meeting to be held on 16.11.2022. The meeting was postponed.
7	Crop compensation							0.00	In Revised Administrative approval, provision was made for crop compensation as detailed at Sl.No.5
a	Amounts already paid for the years 2016-17 and 2017-18	0	0	0.5	0	0	0	0.00	Due to submergence of lands due to back water on account of construction of Weir, the crops were getting damaged. As per the orders passed by the respective Collectors of Mulamalla & Rekulapally villages to pay crop compensation for the years 2016-17 & 2017-18, the following amounts were deposited : (i) Mulamalla: Rs:8.49Lakhs (ii)Rekulapally:Rs:42.17Lakhs

S.No	Asset	Capitalization (Cr)				*Expenditure Proposed for balance Amount		Total	Remarks including Justification
		2018-19	2019-20	2020-21	2021-22	2022-23	2023-24		
6	Amounts to be paid for the years 2018-19, 2019-20 and 2020-21	1	0	0	0.0	0	0	0.00	As per the observations made in 2016, 2017 and 2018 monsoon seasons, the back water of Weir touched up to EL+301.00m resulting in submergence of lands in Rekulapally and Mulamalla villages. Accordingly, TSGENCO management has accorded approval for acquiring the agricultural lands from EL+299.00m up to EL+301.00m to an extent of Acs31-02Gts in Mulamalla village and Acs71-07Gts in Rekulapally village by sending the requisition in prescribed proforma to the respective District Collectors subject to condition of obtaining an undertaking from the land owners that they will not make any claim in future on the subject (submerged) lands acquired by TSGENCO. Accordingly land acquisition proposals were furnished and therefore there is no requirement of further crop compensation to be paid.
8	Land of Acs1-23Gts and Acs3-04Gts of I&CAD dept /Invoice for Acs3-04Gts Residential qtrs land	2	0	0	0.0	0	0.3	0.30	Permission was accorded by the Principal Secretary to Govt., to use the land to an extent of Acs1-23Gts for recreation & Welfare facilities for the staff of LJHEP & I&CAD. Further, Payment towards land Acquisition of LJHEP residential quarters will be made upon invoice received from I&CAD authorities. Provision is made to meet the expenditure in Revised Administrat ive approval vide T.G.O.O.419/HPC&HP/2015,Dt:18.03.2015.
9	Demarcation of land acquired on left and right bank of Krishna river	0	0	0	0.0	0.1	0.3	0.40	As stated under Sl.No.5, after lands in Mulamalla and Rekulapally villages are acquired, it is proposed to establish boundaries for the lands to avoid encroachment.
10	Construction of DE type quarters, SE type quarters, Canteen	0	0	0	0	0	0.70	0.70	As per the provision made in the DPR, all the essential buildings as necessitated at the Project are to be taken up. The works are proposed to be taken up after completion of the project in full shape.
11	Recreation facilities at newly allotted I & CAD land	0	0	0	0	0.1	0.0	0.10	Land was allocated by I&CAD dept., once the handing over process is over, levelling the land and out door sports works such as cricket pitch football &volley ball shall be taken up in allotted land for Employees.
12	Construction of Vidyut kala vedika	0	0	0.18	0.00	0.52	0	0.52	The work was taken up after construction and occupance of Quarters in 2016. Hence taken up after cut-off date. Work is in progress and will be completed in all respects by 31.12.2022.
13	Removal of necking in TRC	0	0	0	0.0	6	10	16.00	During construction of TRC , it was observed that there was necking in the river Krishna at a point beyond confluence point where the TRC and diverted River meet. Accordingly, a provision was made for Rs:18.00Crores in Revised Adm. Approval in the year 2015 for project works sanctioned vide T.G.O.O.419/HPC&HP/2015, Dt:18.03.2015 , for removal of these heaps for free flow of water from TRC. After conducting tail water studies with generation data of 2017 to 2020 vis-a-vis design parameters, it was assessed that the removal of heaps and making a channel passage within river for 1.1Km will reduce the head up in TRC and thereby avoid any impact on installed capacity. Hence, it is proposed to take up the work.
14	Construction of wall along the TRC to avoid entry of silt into TRC	0	0	0	0	0	0.8	0.80	In the DPR, it was included to construct wall along TRC on Weir side to avoid entering of silt into TRC. It is proposed to takeup the work after receipt of Report from consultancy M/s ConTec Design & Engineers Solutions, Hyderabad. as the final report from the M/s.ConTec Design & Engineers Solutions is received, the work will be taken up shortly based on the approval from the Head Quarters.
15	Tail water studies	0	0	0	0.1	0.1	0	0.10	As stated above at Sl.No.13, to remove the necking in TRC, Tail water studies were taken up by consultancy M/s Contec Design Engineers Solutions, Hyd. to study the back water effect and power potential studies and to suggest suitable remedial measures. Remarks on the Final Draft Report furnished by the Agency was submitted to the Chief Engineer/Civil/Hydel for according approval. On approval, balance Payment will to be made to the Consultant Agency.
16	Corporate Social Responsibility	0	0	0	0.0	0.5	0.5	1.00	1. Natural nala on right side of Weir is passing through the agricultural lands of Rekulapally village collecting excess rain water from agricultural lands as well as flood water during monsoon season. Due to construction of Weir across the River Krishna, the water is heading up on the upstream side of Weir in the flood season and this in turn raises the water level in the nala leading to Farmer's inaccessibility to another side of agricultural lands. The farmers of Rekulapally village had conducted Dharna at offices of the TSGENCO and requested to provide access across the nala and they were assured to provide access road across the Nala at that time. As such an amount of Rs:12.74Lakhs was accorded for taking up the work and the work is completed in all aspects. 2.District Collector, Wanaparthy, had furnished the line estimates/proposals for taking up certain infrastructure facilities in Schools and Health centres under CSR policy in surrounding villages of the Lower Jurala Project for an amount of Rs:161.56Lakhs and TSGENCO has accorded approval for Rs:1.00Crores. 3.Accordingly, as per the requisition received from the Dist. Collector &Dist Magistrate, Wanaparthy Dist. The DD Bearing No.779888 Dt:25.03.2021 an amount of Rs.76,89,250/-(Rupees Seventy six Lakhs Eighty Nine Thousand Two Hundred and Fifty only) was deposited with the Dist. Collector &Dist Magistrate, Wanaparthy Dist. in the month of March 2021.
17	Formation of permanent Ramp in TRC	0	0	0	0.0	0.2	1.1	1.30	During construction of Power house, a temporary ramp has been provided to access the TRC near Ch.900.00m. Due to existence of the ramp, during rainy season, the soil gets eroded and deposits in TRC causing obstruction to the flow which in turn impacts Power generation. Permanent ramp with concrete is essentially required for conveyance of heavy vehicles to remove the silt accumulated in TRC during Annual maintenance.
18	Providing 2nd lift in all blocks of Residential quarters and in Power house	0	0	0	0	0.64	0.0	0.64	Only one lift is provided in each block of Quarters and in Power house with provision for stand by lifts.
19	Compound wall and chain link mesh	0	0	0	0	0.0	0.96	0.96	There is no protection/fencing on downstream from RR masonry wall on L/s of weir 2nd block to dump yard. It is necessary to provide protection from encroachers and intruders to LJHEP complex, safeguarding the material or equipment from theft/damage.
20	Removal of muck in TRC at Ch.900.00m	0	0	0.3	0	0	0	0.00	Due to impulsive floods during the year 2019 of about 8.36lakh cusecs, the entire river section on D/s of weir got distorted resulting in deposition of muck in TRC from Ch900 to 1200m and ramp, an access to TRC washed out with big boulders exposed. The work completed.
21	Flood dykes	0	0	0	0	0.00	0.5	0.50	As per DPR, protection works have to be taken up as necessitated . Hence, Flood dykes are proposed for protecting the low lying areas adjacent to the Project.
22	BT road/WBM road along the compound wall	0	0	0	0.0	0.28	0	0.28	For patrolling around the compound wall of Power House including Stores area and ALSTOM/GE sheds by the Security personnel, it is proposed to lay BT road/WBM road along the compound wall covering Power house, Switchyard and other important structures
23	Water proofing/ Grouting in Power house	0	0	0.86	0.0	0.0	0.21	0.21	During floods, seepages were observed at various locations of Power house. As such, to lock the seepages grouting works were taken up. Provision is made for Future grouting works as it is necessary till consolidation of concrete walls and other structures.
24	Construction of divide wall along sluice canal	0	0	0	0	0.0	0.8	0.80	During floods the water overflows over the Weir beyond crest level of EL+299.00M and there is possibility of water entering TRC which may effect the power generation due to head variations and there is also possibility of silt getting accumulated.

S.No	Asset	Capitalization (Cr)				*Expenditure Proposed for balance Amount		Total	Remarks including Justification
		2018-19	2019-20	2020-21	2021-22	2022-23	2023-24		
25	Miscellaneous works and furniture equipments	0	0	0	0.15	0.00	1.30	1.30	In case of any work necessitated as per site conditions for increasing the life span of the project such as and for procurement of furniture and equipment for Offices , Control room , Guest house and Project hostel as per the requirement.
26	Procurement of Cement, Steel and other materials to take up above works, department supply of cement and steel	0	0	0	1.4	0.40	2.20	2.60	
27	Plantation	0	0	0	0.25	0.25	0.25	0.50	
	TOTAL	**5.29**	**3.84**	**2.57**	**6.22**	**25.94**	**24.98**	**50.92**	

*** S.No.25 is just a provision made for future works

Superintending Engineer Civil O&M,
Jurala Hydro Electric Projects (LJHEP&PJHEP),
Atmakur 509131, Wanaparthy Dist.

Capitalization of PE&MM Dvn/LJHEP works

I. Actual expenditure incurred for the FY: 2019-20 to FY:2021-22.

Sl. No.	Description of the work	2019-20	2020-21	2021-22	2022-23	Reasons for delay for works in the scope	Justification for works beyond the original scope
1	Supply of logic catridge and logic cover for governing system and pressure relief valves for lubrication system utilization at LJHEP,Atmakur. PO No: 5300001029	0.0961					Logic Cartridges, Logic Covers and Pressure relief valves for Governing System are required for smooth operation of Poppet in the Poppet Housing, to achieve requisite damping time and to avoid instant pressure rise in the Hydraulic circuit. Though these materials are given by M/s GEPIL under Mandatory spares, they are utilised as and when required during Repair and Maintenance works. As these items are of Hydac make and need to be procured from OEM, M/s Hydac India Pvt.Ltd for the first time after erection, they are booked under Capital budget.
2	Supply of Logic Cartridge and Logic Cover for Lubrication System and Ball Valve with Lockable Device for H.P Injection System for utilization at LJHES/Atmakur PO No: 5300000792	0.0997					Logic Cartridges and Logic Covers for Lubrication System are required for smooth operation of Poppet in the Poppet Housing and for achieving requisite damping time to avoid instant pressure rise in the Hydraulic circuit. Though these materials are given by M/s GEPIL under Mandatory spares, they are utilised as and when required during Repair and Maintenance works. As these items are of Hydac make and need to be procured from OEM, M/s Hydac India Pvt Ltd for the first time after erection, they are booked under Capital budget.
3	Supply of PRV valve Logic Catride and Logic Cover, Loading/Unloading valve Logic Catridge and Logic Cover, Minimess Test Coupling and Pressure relief valve for Governing system for utilization at LJHES/Atmakur. PO No. 5300000793	0.099					Logic Cartridges, Logic Covers and Pressure relief valves for Governing System are required for smooth operation of Poppet in the Poppet Housing, to achieve requisite damping time and to avoid instant pressure rise in the Hydraulic circuit. Though these materials are given by M/s GEPIL under Mandatory spares, they are utilised as and when required during Repair and Maintenance works. As these items are of Hydac make and need to be procured from OEM, M/s Hydac India Pvt.Ltd for the first time after erection, they are booked under Capital budget.
4	Design, manufacture, testing at manufacturer's works, inspection, packing and supply of 2 Nos Triple Screw Pumps for Governing System (Model/Type:D3S 70/120, Capacity: 300 LPM, Discharge Pr. :61 Bar (RPM:1450) for Lower Jurala Hydro Electric Project (6X40MW), Atmakur, Wanaparthy (Dist.), Telangana PO No: 5300001245			0.1782			Triple Screw Pumps for Governing System (Model/Type:D3S 70/120, Capacity: 300 LPM, Discharge Pr. :61 Bar, RPM:1450) are required for smooth/safe operation of Wicket gates, Runner blades and various associated equipment in Governing system and to meet any untoward Emergencies/break downs. Only two pumps are supplied as Mandatory spare by M/s GEPIL that are utilised in units #6 and #1. As these pumps are of Delta make and need to be procured from OEM, M/s Delta PD pumps Pvt.Ltd for the first time after erection, they are booked under Capital budget.

5	UHEP-MMSD-2-Repair and servicing of 40 T gantry crane including supply of required spares erected at tail race channel of 6x40 MW Lower Jurala Hydro Electric Project, Atmakur (SAP PO No. 4900029512)	0.1219					DT gantry crane was fabricted erected by Civil wing/TSgenco.It was extensively used during erection,testing of D¯ gates and attending diving services .After extensive use of DT gantry crane , it was handed over where on it was found to be not working in its intended way and EM brake coils failed repeatedely. All the mechanical parts wore out and the functionality of the crane was not upto the mark. The work involves lifting and lowering of DT lements which are very heavy parts, diving team moves along with the crane which is very risky. To avoid any unwanted and un foreeen emergencies DT gantry crane repair was proposed
6	UHEP – PE & MMSD-II –Requirement of diving team for underwater services for carrying out replacement of cup seals of distributer lever arms at UHEP, Atmakur-Regularization P.O. (SAP P.O. No. 5200003676)	0.03					An amendment was requested for diving team services as the PO quantities exhausted and not sufficient to meet the cup seals rectification work of distributor lever arms leakge of all the units.
7	TSGENCO -HPC&HP -UHEP (6X40 MW))-Design, manufacture, testing at manufacturer#s works inspection, packing, supply and commissioning of 1No. 90KW Non Clog Submersible Pump and MotorSet along with suitable starter panel and cable for Drainage water system at Lower Jurala Hydro ElectricProject (6X40MW), Atmakur, Wanaparthy (Dist ,), Telangana # Detailed Purchase Order- Issued -Reg.(SAP P.O. No. 5300001101)		0.185				At UHEP Drainage system consists of two nos. 150 HP Non clog submersible pumps . Both the pumps were sent for repairs for multiple times. Further it would be difficult to operate the drainage system with one pump if either of the two pumps fails, as it takes minimum 2-3 months (or even more) to rectify and re-erect.For hassle-free operation of drainage system it was requested to procure one more Non clog submersible pump.
8	UHEP-MMSD-II-Providing hand railing on intake service gates hoist beams on upstream of powerhouse at El.+313.60m ,hand railing on DT gantry crane , Upstream gantry crane , toeguard for gantry cranes for the saftey of the workmen at UHEP, Atmakur (SAP P.O. No. 4900030374)		0.16				Initially hand railing was not provided on intake hoist beam at EL +316.60 m. For attending general or breakdown maintenance of intake gates hydraulic cylinders, it is very difficult to carry out the work. Keeping in view of safety of workmen and to facilitate the maintenance activites it was proposed to provide hand railing.
	Total	0.4467	0.3450	0.1782			

Signature valid
Digitally signed by VENKATA SUBBA REDDY
Date: 2022

II. Proposed Additional capitalization for FY:2022-23 & FY 2023-24				
Sl. No.	Description of the work	2022-23	2023-24	Justification for works beyond the original scope
1	Procurement of Heat Exchangers for Governing and lubrication systems	0.3		Heat Exchangers for Governing and lubrication systems provide adequate cooling for the circulating oil thereby preventing excessive rise of oil temperature. Though Heat Exchangers are provided by M/s GEPIL under Mandatory spares they will be utilised as and when required during Repair and Maintenance works. As these items need to be procured from OEM, M/s ALfa laval Pvt.Ltd for the first time after erection, they may be booked under Capital budget.
2	Procurement of Valves for Lubrication and Governing systems		0.25	Valves for Lubrication and Governing systems are essential in maintaining required flow and diverting oil to different parts of the circuit.They are not provided by M/s GEPIL under Mandatory spares. As the items are very criticial/essential in Repair and Maintenance activities and procured for the first time after erection, they may be booked under Capital budget.
3	Procurement of Pumps and spares for Leakage oil system, Cooling water system and Shaft seal system	0.45		Leakage oil pumps are very crucial in maintaining adequate pressure in Runner cone and hub.Shaft seal and cooling water pumps help in maintaining desired flows in cooling water circuit. Only one number Cooling water and leakage oil pumps are provided by M/s GEPIL under Mandatory spares. No spare shaft seal pumps are provided. These pumps are required during Repair and Maintenance works. As these items need to be procured from OEM, M/s Johnson pumps Pvt.Ltd for the first time after erection, they may be booked under Capital budget.
4	Removal/Rectification of Pitting & Rust on Runner cone and Hub of all 6 units		0.45	Pitting and Rust formation is a slow phenomena observed mainly at Runner area (Low pressure zones). Since it involves rectification or replacement of entire Runner for the first time after erection, the expenditure may be booked under Capital budget.
5	Replacement of Runner Piston seals and other seals associated with Runner-Opening/closing chambers		0.5	Piston and Runner chamber seals are prone to wear/tear during operation. Since all units are in operation for 6 years, the seals/gaskets are prone to damage, hindering overall operation of Runner & Wicket gates. Since it involves re assembly of entire Runner for the first time after erection, the expenditure may be booked under Capital budget.
6	Replacement of Wicket gate Servomotor seals		0.3	Wicket gate piston seals are prone to wear/tear during operation. Since all units are in operation for 6 years, the seals/gaskets are prone to damage, hindering operation of Wicket gates along with heavy loss of operating oil. As it may involve re assembly of entire Piston, Counter weight & operating ring for the first time after erection,the expenditure may be booked under Capital budget.

7	Supply,installation,testing & Commissioning of 2 Nos 6 KVA UPS with 192V battery bank (12V 26 Ah VRLA type batteries 32 pieces) required for MCR at LJHES, Atmakur (PO No: 5300000823 SE / O&M PJHEP H62 2018 - 19 / / DT. 20.08.2018)	241952						The work is not in the scope of DPR. Arranged separate UPS for MCR to avoid power supply disturbance to MCR systems.
8	TSGENCO-SLBHES Complex -JHEP Supply of 100W,200W high bay lights utilization at LJHES/Atmakur– Detailed Purchase Order issued –Regarding.(SAP P.O. no. 5300000869)	148814						The work is not in the scope of DPR. The failed high bay lighting with 400W MH and 200W MH lamp is proposed to change with 200W and 100W LED lighting for reducing the auxiliary consumption.
9	TSGENCO - SLBHES Complex -JHEP– Supply of cables for Indoor works at LJHEP/ Atmakur Detailed Purchase Order Issued–Regarding. (SAP P.O. no. 5300000846)	19470						The work is not in the scope of DPR. The cables are for the use of PH electrical mainteance works .
10	TSGENCO-SLBHES Complex -JHEP– Supply of 100 W False ceiling LED lights for utilization at LJHES/Atmakur – Detailed Purchase Order issued– Regarding.(SAP P.O. no. 5300000941)	83558						The work is not in the scope of DPR. The failed lighting with 200W MH lamp @ **Office floor** is proposed to change with 100W LED lighting for reducing the auxiliary consumption.
11	TS GENCO – JHE Projects- LJHES – Supply of Air Vent Blower with Model no:1600M-EX for utilization at LJHES, Atmakur -Detailed Purchase Order-Issued (SAP P.O. no. 4500016282)	77710						The work is not in the scope of DPR. To carry out the works in the Generator pit, air vent blowers is necessary for proper air circulation.
12	TSGENCO-SLBHES Complex -JHEP – Supply of 20W Retro Tube Light utilization at LJHES/Atmakur – Detailed Purchase Order issued –Regarding.(SAP P.O. no. 5300000868)	54432						The work is not in the scope of DPR. The failed Power House lighting in all floors are changed with 20W LED tube lights for reducing the auxiliary consumption.
13	LJHEP - O&M Dvn -IEMSD - Procurement of Power Cables 120sqmm and 16sqmm for use in power house LJHEP, Atmakur - Indent submitted – Reg. (SAP P.O. no. 5300000918)	90624						The work is not in the scope of DPR.These cables are proposed for extension of 3-phase LT supply to all 6-units intake gate motors
14	LJHEP - O&M Dvn -IEMSD - Procurement of Power Cables 120sqmm and 16sqmm for use in power house LJHEP, Atmakur - Indent submitted – Reg. (SAP P.O. no. 5300000920)	154278						The work is not in the scope of DPR.These cables are proposed for extension of 3-phase LT supply to all 6-units intake gate motors and extension of LT supply To DT crane and stop log gate crane.
15	TSGENCO-SLBHES Complex -JHEP– Supply of Office Furniture Utilization at O&M Division, LJHES, Atmakur – Detailed Purchase Order issued-reg. (SAP P.O. no. 5300000929)	265824						The work is not in the scope of DPR. As the Office establishment is not ordained for the newly formed sub divisions and O/o DE/O&M Dvn LJHEP after COD of units.
16	Design,Manufacture,testing at manufactures works,inspection,packing and transportation to site of Thermo Vision Camera with allied software (Make:- FLIR Systems Model - FLIR E-75) for Lower Jurala Hydro Electric Project, Atmakur(Po No: 5300000957)	6018000						The work is not in the scope of DPR. It is very essential instrument to find hot spot points in 220kV switch yard for preventieve maintenance.

17	Supply of Transformer Oil Filter Machine with Spares utilization at LJHES Atmakur(Po No:5300000711)	1345200.00						It was not included in the DPR and it is very essential to filter transformer oil for maintaning the BDV,DG and ppm etc., Satisfactory values for smoth operation.
18	Supply of Kitchenware and Dining set for Guest House and Canteen Mess in the Colony at LJHES, Atmakur – Detailed Purchase Order issued-Regarding. PO NO:5300001015		13578.7					The work is not in the scope of DPR.For providing material for Mess/Canteen at LJHES colony
19	TS GENCO – JLI Project – O&M Division- EMSD-I SD- Supply of 4 Nos 12V,130AH 25 plates Battery for Diesel fire Hydrant and DG-set-2 required for utilization at JHE Projects -Detailed Purchase Order-Issued.(SAP P.O. no. 4500016494)		24400					The work is not in the scope of DPR.As the 2 No. DG sets are commissioned in the year 2015. DG-II is kept for service for erection works to the M/s VARKS. The same DG set is utilized by M/s GEPIL for erection and commissioning activites. As the 24V Dc for excitation through batteries are not proper. Hence, the 2 No. 130AH batteries are replaced with new one.

20	TSGENCO- JHEP-O&M circle-LJHES- Supply of 415V L & T make Air Circuit Breakers used in Reserve Boards and Station Auxiliary Boards of LV Switchgear at LJHES, Atmakur- Detailed Purchase Order-Issued (SAP P.O. no. 5300001220)			579978				The work is not in the scope of DPR. Procured to maintain as spare breakers.
21	TSGENCO- JHEP-O&M circle-LJHES- Supply of 415V, 3- Phase Geared Auto backwash motors used at LJHES, Atmakur- Detailed Purchase Order-Issued. (SAP P.O. no 5300001221)			516928				The work is not in the scope of DPR. Procured to maintain as spares.
22	Design, manufacture, testing at manufacturer#s works, inspection, packing & transportation to site, software adaptation, loading, verification and commissioning of 2 Nos. Programmable Multi Function Controller (MFC1000) in UCB panels of Lower Jurala Hydro Electric Project. (PO.No.4900031677 CE(HPC&HP)/SE(PI)/610/P15 2020-21 Dt:04.09.2020.)			1779000				The work is not in the scope of DPR. Procured to maintain as spares.
23	Design, manufacture, testing at manufacturer#s works, packing & transportation to site of 1No Programmable Multi Function Controller(MFC1000) for utilization in UCB panels of Lower Jurala Hydro Electric Project (6X40MW), Atmakur, Wanaparthy (Dist.), Telangana (PO No: 5300001234 CE(HPC&HP) SE(PI) / 610 / P15 / 2020 - 21 / / DT: 18.02.2021)			2242000				The work is not in the scope of DPR. Procured to maintain as spares.
24	Providing of lighting erection ,commissing,testing at EL-307.00 M from Unit #6 intake gates to weir location at LJHES(Po No:4900028397)			######## 1068794.00				The work is not in the scope of DPR. For lighting at weir site location.
25	Supply and installation of Generator transformer heat exchangers and Y Strainers at LJHES Atmakur(PO No: 5300001323 CE/O&MSLBHES/DE(A&P)/ADE/AEP/JURALA/H18/2021-22/Dt:09.12.21)				######## 1508000.00			The work is not in the scope of DPR. Procured to maintain as spares.
26	Supply of 3 Nos 220 KV/440 pF Capacitor Voltage Transformers at LJHES,Atmakur(PO No: 5300001347 CE/O&MSLBHES/DE(A&P)/ADE/AEP/JURALA/H18/2021-22/Dt:22.03.22				6890000			The work is not in the scope of DPR. Procured to maintain as spares.
27	Design, manufacturing, testing at manufacture's work, packing and transportation to site of TRCD Actuators suitable for the operation of the runner and guide vanes of Lower Jurala Hydro Electric Project(6*40MW)(PO No: 5300001285 CE(HPC&HP) SE(PI) 610 P15 / 2021 - 22 / DT: 14.07.2021)				######## 2700000.00			The work is not in the scope of DPR. Procured to maintain as spares.

TELANGANA STATE POWER GENERATION CORPORATION LIMITED
Vidyut Soudha, Khairathabad, Hyderabad-500 082
CIN:U40102TG2014SGC094070, Phone No.040-23499890,
FAX No.04023499166 Website:www.tsgenco.co.in,
Email ID:ce.hpc@tsgenco.co.in

From
Chief Engineer (HPC &HP),
TSGENCO, Projects wing,
3rd Floor, VIDYUT SOUDHA,
KHAIRATABAD, HYDERABAD-500082.
Ph.No.040-23499312/311
Fax-040-23499399

To
M/s Bharath Heavy Electricals Limited
Power sector-Marketing,
Integrated office complex,
Lodhi Road. New Delhi-110003
Fax:011-24366555

Registered Post With Ack. Due

Amndt Lr.No. CE(HPC&HP)/SE(HD-I)/PCHES/221/D.No. 03/21,Dt.04.01.2021

Sir,

Sub: TSGENCO-HPC&HP-PCHES- Pulichintala Hydro Electric Project (4x30 MW) – Design, Manufacture, testing at Manufacturer's works, Inspection, Packing, Supply and delivery at site, Supervision of erection testing and commissioning of 4 sets of vertical Kaplan Turbine and Generator along with the associated auxiliary & ancillary equipment, total Control & monitoring equipment,4 No.s 11Kv/220Kv, 40MVA OFWF type Generator-Transformers , 500 KVA Unit Auxiliary Transformers, 11Kv segregated bus ducts – **Amendment-III- Issued** - Reg.

Ref: 1.P.O.No. JM 3782/2479/CPH/511/PULICHITALA/D.No. 67/07, Dt. 25.05.2007
2. Amndt Lr.No. CE(HPC&HP)/PCHES/221/D.No.116/18,Dt.01.05.2018
3. Amndt Lr.No. CE(HPC&HP)/PCHES/221/D.No.350/19,Dt.29.11.2019
4. M/s BHEL Lr. ref: PCHES/HBG-TSGENCO/L-004, Dt: 23.07.2020

*****

After careful consideration of your request made vide ref.(4) cited above, the following **clause No. 47** of the purchase order under reference (1) cited above is herewith amended and shall be read as below.

AMENDMENT-III

47.1 Efficiency guarantee: The weighted average efficiency of full size turbine under rated net head of 24 m at rated speed of 125 rpm is guaranteed as per formula

The weighted average efficiency shall be proved by Model Test of Turbine.

47.2 Output Guarantee: - Deleted-

All the other terms and conditions of the purchase order as read with the Amendment-II shall remain unaltered.

Yours faithfully

CHIEF ENGINEER
(HPC & HYDEL PROJECTS)

Copy to the:

1. FA & CCA Accounts)/TSGENCO/Vidyut Soudha/Hyderabad- 082.
2. FA & CCA (Res.& CFO)/TSGENCO/Vidyut Soudha/Hyderabad- 082.
3. Sr. Accounts Officer /Pay& Accounts /TSGENCO/Vidyut Soudha/Hyderabad – 082.
4. Superintending Engineer/O&M/PCHES,Vazinepally, Malla Reddy Gudem, Suryapet
5. Divisional Engineer/Plant Erection/PCHES, Vazinepally, Malla Reddy Gudem, Suryapet Dt. -246
6. Accounts Officer, PCHES Circle/PCHES,Vazinepally, Malla Reddy Gudem, Suryapet Dt. -246
7. Assistant Divisional Engineer/Stores/PCHES, Vazinepally, Malla Reddy Gudem, Suryapet.

भारत हेवी इलेक्ट्रिकल्स लिमिटेड

पावर सैक्टर - हाइड्रो व्यापार समूह

Bharat Heavy Electricals Limited

Power Sector-Hydro Business Group

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मनोज कुमार सिन्हा
महाप्रबंधक

Manoj Kumar Sinha
General Manager

Ref: PCHEP/HBG-TSGENCO/L-004
Date: 23.07.2020

Director (Hydel)
Telangana State Generation Corporation Ltd.
'A' Block, Vidyut Soudha,
Khairathabad
Hyderabad – 500082

Sub: Pulichintala HES (4X30 MW) – Regarding acceptance/ confirmation for non-conductance of field efficiency test

Ref:
1. MoM dt 06.11.2009
2. BHEL Letter No MS-1-06-0503 dated 26.10.2018
3. BHEL Letter No MS-1-06-0503 dated 26.09.2019
4. NSTPD/HBG-TSGENCO/L-002 dated 04.06.2020
5. NSTPD/HBG-TSGENCO/L-003 dated 25.06.2020

Dear Sir,

This is in continuation to earlier correspondence done vide letter dated 25.06.2020 regarding non-conductance of field efficiency test for Pulichintala project. The technical reasons for non-conductance of field efficiency test are enclosed herewith in Annexure-A. You are requested to consider these reasons and convey your acceptance/ confirmation regarding non-conductance of field efficiency test for the project.

As already communicated vide letter dtd. 25.06.20, the provisions made by BHEL in our books for Pulichintala project will be vacated after waiver of FE test from TSGENCO. Vacations of these provisions shall help BHEL in improving its financial position. Hence, you are once again requested to convey your acceptance/ confirmation regarding non-conductance of field efficiency test for the project.

Thanking you and assuring you of our best attention, always.

Yours sincerely

23/7/20

(M. K. Sinha)

Chief Engineer (HPC) & Hydel Projects
TSGENCO, Vidyut Soudha, Hyderabad.
Rec. No. 1291
05 AUG 2020
SE/HD-I
CE(HPC&HP)

CC:
Chief Engineer (HPC)
Room no 259, II floor,
Telangana State Generation Corporation Ltd.
'A' Block, Vidyut Soudha
Khairathabad, Hyderabad – 500082

Technical issues in conducting Field Efficiency Test for Pulichintala HEP

A. **Discharge measurement in Penstock**- IEC 60041 Clause No. 10.2.4- "Measurement in short penstocks. A Penstock is defined as short if the straight length is less than 25 times diameter. No existing standard deals with discharge measurement in short penstocks or intakes, especially for low head plants."

Penstock diameter in case of Pulichintala HEP is 5.88m & straight length 27.6 m (approx), which is less than 5D. Therefore no method as per IEC is applicable for discharge measurement in Penstock.

B. **Discharge measurement in open channel**- IEC60041 Clause No. 10.2.5

I. Discharge measurement can be carried out in downstream channel if following requirements are met.

1. As per IEC 60041 clause 10.2.5.1 measurement of discharge by current meter in open channel, it is mandatory to have artificial channel that is channel must be lined so as to avoid any water leakage both ways.
2. As per IEC 60041 clause 10.2.5.2 measurement of discharge by current meter in open channel, it is mandatory to have measurement section at minimum distance of 10 times hydraulic radius (Hydraulic radius is defined as Ratio of wetted cross-sectional area to Wetted perimeter) from any device and channel should be constant cross section i.e. lined till minimum distance of 5 times hydraulic radius.
3. Bridge across the width of channel over measurement section to be fabricated/built so as to work across and install current meter across the width.
4. During testing, other three machines should be stopped and leakage through by-pass gate should be zero.

All the above three requirements require civil works.

II. Even if above three requirements are met it will have to be checked whether minimum depth of flow would be 0.8 m at all loads at which testing will be carried out with single machine operation (refer clause number 10.2.5.2 of IEC 60041) for the applicability of current meter method. However, from the data/drawings available, the depth of flow is less than 0.8, therefore this method also cannot be used.

I. **COMMERCIAL ISSUES :**

Pulichintala Hydro Electric Project

a. **LD Deductions :**

BHEL again informed that liquidated damages for delay in supplies is to be levied only after the expiry of the contractual delivery period i.e. 30 months for Unit –I, 32 Months for Unit –II, 34 Months for Unit-III and 36 Months for Unit – IV. Liquidated damages should not be levied on mile stones on individual supplies as being done now by APGENCO and requested for the refund of the amount recovered towards L.D. till date., Further, BHEL requested that since the commissioning of the unit is likely to be delayed because of the project being inundated under floods, the contractual delays period for supplies may please be extended to 42 months for Unit – 1 and 2 months interval there after for the subsequent units.

BHEL will submit the detailed revised delivery schedule accordingly, to process the delivery extension case.

b. **Release of Payment :**

BHEL cited that the release of payment in Pulichintala Hydro Electric Project is getting delayed to 45 to 50 days after receipt of material at site as against within 30 days as stipulated in the contract. APGENCO agreed to ensure release of payment within 30 days after receipt of material and correct invoices at site as agreed in the contract.

c. **Deletion of Field Efficiency Test :**

BHEL explained that the filed efficiency test was not envisaged in their offer due to non –availability of various parameters (Reasons explained in BHEL's offer) as per IEC. 60041. Hence, the same is not possible to be conducted and requested to delete the Clause No.47.2 of the Purchase Order. Also in the second para of Clause 47.1 (i.e. efficiency guarantee), it was requested that "The weighted average efficiency shall be proved by Model Test of Turbine", may be added.

d. BHEL requested APGENCO to amend their letter CPH/221/PCHES/ BHEL.PO/D.No.91/09, Dt:28.04.2009 Sl.No.3

- H.S. Lubricant Pump Set – Remarks to be read as "Deleted from Governor Portion"

The formal amendment on the above mentioned letter may be issued as addendum to the contract.

06/11/09

Sriramsagar and Nagarjuna Sagar Tail Pond:

1. **Levying of liquidated damages :-**

   Deduction of LD on the contract price which includes Taxes and duties, Freight charges and supervision charges liquidated damages should not be levied on the statutory duties, Freight and supervision charges. It should be levied on ex-work price only for the reasons already explained in our earlier letter Dt:04.07.2009.

2. **Release of with held payments:-**

   BHEL requests that balance 5% with held on account of delay in supplies and last 5% on commissioning to be released against submission of BHEL's Corporate Guarantee.

3. The balance supplies like Cooling Water pump set, Vibration Monitors etc., in respect of Sriramsagar Project shall be completed immediately in order to commission the unit by the end of November, 2009. M/s BHEL shall notify the status/completion by 10th November, 2009.

COMMON

All the BHEL contracts are supply contracts with supervision of erection also. The Erection, Testing and commissioning is being done by APGENCO departmentally. Hence, IT should not be deducted from our supply bills. Moreover, it is clearly mentioned in the contract, that IT deduction are leviable on supervision charges only. BHEL requested that the deducted amount on account of IT deduction may be refunded to BHEL.

APGENCO has informed that all the above Commercial issues will be examined and revert back shortly.

APGENCO also has informed that the erection works are getting delayed due to

1) Delay in furnishing of drawings and delivery of equipment
2) Mismatching of the equipment,
3) Delay in deputation of experienced supervising engineers to the site and maintaining the continuity of supervision during erection.

and requested M/s BHEL to take necessary action on the above to avoid further delays. M/s BHEL agreed to take necessary action to avoid delays.

APGENCO **M/s BHEL**

06.11.09

ANDHRA PRADESH POWER GENERATION CORPORATION LIMITED

From
The Chief Engineer Electricity (Projects)
Projects wing
IIIrd Floor, 'A' Block,
Vidyut Soudha
Hyderabad-500082.
Fax:040-39839399.

To
Mr.S.Y.H.Rizvi,DGM,
Hydro sales & service division,Block-I
Annexe,
M/s Bharath Heavy Electricals Limited.
Piplani, Bhopal (MP)-462022
Fax: 0755-4201147

Lr.No.CPH/221/PULICHINTALA/D.No.225/09.Dt.22.08.2009
Sir,

Sub: APGENCO- Pulichintala Hydro Electric Project (4X30MW) -Approval of Model test-Reg.

Ref: 1. P.O.No.JM3782/2479/CPH/511/PULICHINTALA/D.No.67/07,Dt:25.05.2007.
2. HSS/Pulichintala/RZV/4283,Dt20-12-2008
3. HL/836T/1669 dt 17.12.08

With reference to the letters 2nd and 3rd cited above, the Model test report furnished by you is found to be generally in order and here by approved.

However this approval does not absolve you of your responsibility for the satisfactorily performance of the equipment, as per guaranteed technical particulars of the Purchase Order 1st cited .

Yours faithfully,

22.8.09

CHIEF ENGINEER ELECTRICITY
(PROJECTS)

Copy communicated to:
1. The Superintending Engineer/Civil Nagarjuna Sagar Tail Pond Dam Circle Pylon, Nagarjuna SagarNalgonda Dist-508203
2. The Executive Engineer/Civil/APGENCO/Pulichintala HES/AE-2,K.L.Rao sagar Colony/Jaggaiahpeta/Krishna Dist-521175

//D:\BHEL corres\latest BHEL comments.doc//

PULICHINTALA HES (4x30MW)

Reasons for time overrun of the project

i) Certain vertical cracks are observed on service bay side during excavation and apprehended to GSI on 28.11.2007.

a) Time taken for finalization of G.S.I. recommendations.

b) Even after GSI recommendations the work was delayed due to working on steep slopes, slippery conditions.

c) The contractor could not take up the full earth work excavation in TRC as the land acquisition process completed on 10-06-2008.

ii) Inundation of the power house due to floods and heavy rains during October' 2009 and September' 2011 and the Dewatering & De-silting was taken at least 3 months in each year.

iii) Due to increase in quantities of Excavation (1, 48,400.00 Cum), RCC M-20 (28150.00Cum), the contractor of civil works stopped the works duly requesting to raise the prices for the increased and balance quantities based on the latest SSR rates. After issue of notices as per agreement terms, the contractor has finally resumed the work.

iv) Erection contract was awarded to M/s Hy-power Associates, Jabalpur on open tender basis on Dt 28.08.2009. The E&M erection work contract is terminated on Dt.03.08.2013 as the contractor is not willing to continue the work with P.O rates (the contract period was completed) and insisting for abnormal price escalation, which are on high side. Erection contract was awarded to M/s Yantra Epcom Solutions Pvt. Ltd., Hyderabad on Dt: 17.02.2014 by calling open tenders duly terminating the previous contract on M/s Hy-Power Associates. Even after the commencement of work by M/s Yantra Epcom Solutions Pvt. Ltd., Hyderabad, following are slippages which caused further delay in erection and commissioning

Divisional Engineer
O&M / PCHES
TS Genco/ Nazimapally

Superintending Engineer
O&M Circle, Pulichintala NE

a) Dimensional deviation in most of the equipment such as runner, stator, rotor and assembly parts such as GV servo motor base plates, regulating ring etc supplied by M/s BHEL against the approved drawings

b) The hardware such as screws, bolts & nuts etc are not received as per drawing and requirements.

c) The rubber cord and O rings are not received as per drawings and requirement

d) Only one number of 135T/30 T EOT crane is available for erection works for all four units due to which the erection of multiple works could not be carried out simultaneously

e) The vital dimensions of runner assembly and runner envelope are not as per drawing. Hence, assembly of runner took lots of time

f) The stator received from equipment supplier i.e. M/s BHEL was in partial wound condition and remaining winding was to be carried out at site in the service bay for all units

g) Most of the times, clearances and clarifications from design wing of M/s BHEL were delayed due to which erection work was further delayed

Divisional Engineer/
O&M / PCHES
TS Genco/ Vazinopally

Superintending Engineer
O&M Circle, Pochampad &
TSGENCO, Vazinopally.

Reasons for increase in the cost of project are as below:

1) Price Escalation:

a. **Administrative** approval was accorded as per the price Index of 2006-07. There is a gap of 8 years from DPR Stage to actual execution stage, hence the cost of labour, material etc have been increased and also

i. Due to increase in the Excise Duty and Service Tax.
ii. Due to increase in the IDC.
iii. Due to increase in the Interest Rate. (ROI as per DPR is 10.25%, Actual ROI is 12.50%).
iv. Due to Increase in the land cost.
v. Due to Increase in the concrete quantities and Hydro Mechanical Works in civil works.
vi. Due to increase in the quantity and price of steel and cement.

2) Increase in the estimated quantities of civil works when compared with DPR is due to following reasons:

i. Due to increase in length and width of the power house as per M/s BHEL requirement
ii. Due to formation of cracks surface in rock surface on L/s of Power House GSI recommended for flattened side slopes and back filling with concrete.
iii. Due to construction of new retaining wall as per the suggestions of GSI.
iv. Due to increase in length, Diameter and thickness of Penstock.
v. Increase in quantities of gates due to providing of DT gates for all the DT vents as per CBIP recommendations.

3) The time overrun of the project is also one of the reasons for increase in the estimated cost. The reasons for time overrun are as given below:

i. Due to inundation of power house area in 2009 & 2011 floods and the Dewatering & De-silting was taken at least 3 months in each year.
ii. Due to heavy seepage of water due to poor rock strata.
iii. Due to execution of additional quantity es as per site conditions.

There is no change in the estimated cost of E&M works as compared with DPR/administrative approval. The establishment charges administrative and general

Checked

N. Rao
Divisional Engineer
O&M / TSGENCO
TS Genco/ Vazinepally

expenses are varied (increased) as compared with DPR rates from Rs.14.19Cr. to Rs.49.59Cr. The IDC is varied (increased) from Rs.38Cr. to 105.49 Cr.

In view of reasons mentioned above, the overall increase in cost of the Project and levellised tariff w.r.t DPR is tabulated below.

Sl.No.	Items	Rs. in Crores		
		As per Adm. Approval and DPR	Revised estimate Cost	Diff. w.r.t. DPR
	A. Project Cost			
1	Civil Works	112.23	192.83	80.60
2	E&M Works	215.58	215.58	0
3	Establishment, Adm & General expenses (EDC)			
a.	Under E&M head (As per sheet-2 enclosed)	6.42	36.42	30.00
b.	Under Civil head(As per sheet-1 enclosed)	7.77	13.17	5.40
	Sub-Total (a+b)	14.19	49.59	35.40
	Total (1+2+3)	342.00	458.00	**116.00**
3	IDC	38.00	105.49	67.49
	Total Cost	**380.00**	563.49 Or say **563.50**	**183.49** **or say** **183.50**

The revised estimate for Civil & E&M works and EDC of the Project is worked out for an amount of Rs.563.50 Cr. including IDC. The same was approved in 8th TSGENCO Board.

Chief Engineer

N. Ram

meeting, the Board of directors has accorded administrative approval for the additional amounts to a tune of Rs.183.50 Crores duly revising administrative approval for Rs. 563.50 Crores (Rupees Five Hundred and Sixty Three Crores and Fifty Lakhs only) for execution of E&M, Civil works, IDC and Establishment, General & Administration Charges of Pulichintala Hydro Electric Scheme (4 x30MW) vide **T.G.O.O. No. 423 /HPC&HP/ 2015 Date: 19 .03.2015 along with the following** breakup details.

Sl.No.	Items	Revised estimate Cost in Cr.
A.	**CIVIL**	
1.	Civil Works	192.83
2.	Establishment, Adm. & General expenses	13.17
	Sub-Total	206.00
B.	**E&M**	
1.	E&M Works	215.58
2.	Establishment, Adm. & General expenses	36.42
	Sub-Total	252.00
	Total (A+B)	458.00
C.	**IDC**	105.49
	Grand Total	563.49 Or say **563.50**
(Rupees Five Hundred and Sixty Three Crores and Fifty Lakhs only)		

Divisional Engineer
O&M / Power
TS Genco/ Vijayawada

Station : pulichintala hydro electric scheme (4X30MW)

Format-A :Contract Details

Details of Contracts for Major Contracts(FY 2020-21)

S.No	Name of Package/ Work	Scope of Work in Brief	Named Contractor	Original Schedule as per contract		Estimated Contract Price	Actual Schedule		Actual Completed Cost	Time Over Run	Cost Over Run	Variation in scope of work,If any	Break up of Cost Over Run Rs(Crores)			Reason for Time Over Run	Liquidated Damage	
				Start Date	Completion Date	Rs(Crores)	Start Date	Completion Date	Rs(Crores)	Days	Rs(Crores)		Variation in Scope	Price Validation	Any Other Reason		Max. can be levy as per contract conditions	Actual levied/likely to be levied
		FY 2020-21																
1		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing System for generators cable tray erection complete, Cable Laying & its termination - Providing Assembly and Welding of Runner (Two Halves) of Unit-I & IV at PCHES site (Supplemental Extra work slip No- 20)	M/s YANTRA EPCOM SOLUTIONS PVT LTD			4,42,395.00	18.10.2016	12.02.2017	4,42,395.00		0.00							
2		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination - Providing Assembly and Welding of Runner (Two Halves) of Unit-I & II at PCHES site (Supplemental Extra work slip No- 18)	M/s YANTRA EPCOM SOLUTIONS PVT LTD			4,09,490.00	12.07.2016	23.07.2016	4,09,490.00		0.00							
3		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination - Providing Assembly of Runner blades of Unit-I at PCHES site (Supplemental Extra work slip No- 23)	YANTRA EPCOM SOLUTIONS PVT LTD			2,93,286.00	22.12.2014	02.02.2015	2,93,286.00		0.00							
4		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination - Providing Assembly of Runner blades of Unit-II at PCHES site (Supplemental Extra work slip No- 24)	YANTRA EPCOM SOLUTIONS PVT LTD			3,22,090.00	05.01.2016	10.04.2016	3,22,090.00		0.00							
5		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination - Providing Assembly of Runner blades of Unit-III & IV at PCHES site (Supplemental Extra work slip No- 25)	M/s YANTRA EPCOM SOLUTIONS PVT LTD			7,02,550.00	10.03.2017	02.10.2017	7,02,550.00		0.00							

N. Rao
Divisional Engineer
O&M / PCHES
TS Genco/ Vazinepally

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6		Local Transportation of the equipment from stores to power house. Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination- Providing Trail assembly of TGB Housing sump ring and Oil retaining sleeve of Unit-I at PCHES site. (Supplemental Extra work slip No- 26)	M/s YANTRA EPCOM SOLUTIONS PVT LTD			1,20,498.00	01.02.2016	15.02.2016	1,20,498.00		0.00							
7		Local Transportation of the equipment from stores to power house. Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination- Providing Trail assembly of TGB Housing sump ring and Oil retaining sleeve of Unit-II at PCHES site. (Supplemental Extra work slip No- 27)	M/s YANTRA EPCOM SOLUTIONS PVT LTD			1,32,492.00	10.09.2016	15.09.2016	1,32,492.00		0.00							
8		P Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination- Providing Trail assembly of TGB Housing sump ring and Oil retaining sleeve of Unit III & IV at PCHES site. (Supplemental Extra work slip No- 23)	M/s YANTRA EPCOM SOLUTIONS PVT LTD			2,89,647.00	06.08.2017	16.08.2017	2,89,647.00		0.00							
9		Local Transportation of the equipment from stores to power house. Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination, Matching and welding of spiral casing inlet pipe and closing piece of penstock due to ovality of penstock of Unit-I, at PCHES site (Supplemental Extra work slip No- 34)	YANTRA EPCOM SOLUTIONS PVT LTD			1,08,466.00	26.12.2014	02.01.2015	1,08,466.00		0.00							
10		Local Transportation of the equipment from stores to power house. Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination. Matching of spiral casing inlet pipe and closing piece of penstock due to ovality of penstock, cutting of inlet pipe and preparation of V groove joint making on spiral inlet pipe, welding of spiral casing inlet pipe pieces along with penstock unit III at PCHES site. (Supplemental Extra work slip No- 35)	M/s YANTRA EPCOM SOLUTIONS PVT LTD			1,31,424.00	05.09.2016	15.09.2016	1,31,424.00		0.00							
11		Local Transportation of the equipment from stores to power house. Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination. Removal of ovality for compensating cone of eight parts and to make required profile to fix between runner envelope and draft tube cone of unit-I at PCHES site. (Supplemental Extra work slip No- 36)	M/s YANTRA EPCOM SOLUTIONS PVT LTD			1,12,100.00	09.01.2015	09.01.2015	1,12,100.00		0.00							
12		Local Transportation of the equipment from stores to power house. Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination. Removal of ovality for compensating cone of eight parts and to make required profile to fix between runner envelope and draft tube cone of unit-II at PCHES site. (Supplemental Extra work slip No- 37)	M/s YANTRA EPCOM SOLUTIONS PVT LTD			1,29,210.00	19.12.2015	24.12.2015	1,29,210.00		0.00							
13		Local Transportation of the equipment from stores to power house. Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination. Removal of ovality for compensating cone of eight parts and to make required profile to fix between runner envelope and draft tube cone of unit-III at PCHES site. (Supplemental Extra work slip No- 38)	M/s YANTRA EPCOM SOLUTIONS PVT LTD			1,41,010.00	26.09.2016	05.10.2016	1,41,010.00		0.00							

N. Rao
Divisional Engineer
CSM / PCHES
TS Genco

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14		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination. Removal of ovality for compensating cone of eight parts and to make required profile to fix between runner envelope and draft tube cone of unit-IV at PCHES site (Supplemental Extra work slip No- 39)	M/s YANTRA EPCOM SOLUTIONS PVT LTD			1,41,010.00	13.02.2017	28.02.2017	1,41,010.00		0.00										
15		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination.- Fixing of draft tube drain valves and centre line of stay ring of Unit-I & II at PCHES site (Supplemental Extra work slip No- 40)	M/s YANTRA EPCOM SOLUTIONS PVT LTD			1,99,090.00	12.06.2016	09.07.2016	1,99,090.00		0.00										
16		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination. - Holes enlarging bolting stay ring and tapping of runner envelope holes for alignment of stay ring and runner envelope of Unit-I and welding of monorail base plate and enlarging of holes for base plate to match of Unit-I & II at PCHES site (Supplemental Extra work slip No- 41)	M/s YANTRA EPCOM SOLUTIONS PVT LTD			57,773.00	01.03.2016	10.03.2016	57,773.00		0.00										
17		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination. - Holes enlarging bolting stay ring and tapping of runner envelope holes for alignment of stay ring and runner envelope of Unit-III and welding of monorail base plate and enlarging of holes for base plate to match of Unit-III & IV, at PCHES site (Supplemental Extra work slip No- 42)	M/s YANTRA EPCOM SOLUTIONS PVT LTD			72,641.00	21.02.2017	28.02.2017	72,641.00		0.00										
18		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination. - Centre line of stay ring with respect of draft tube of Unit-III & IV at PCHES site (Supplemental Extra work slip No- 43)	M/s YANTRA EPCOM SOLUTIONS PVT LTD			65,891.00	25.12.2015	27.12.2015	65,891.00		0.00										
19		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination for PCHES (4X30MW) - Labour charges for enlargement of holes of floor plates, support angles of floor plates, walkways, ladders, hand rails, oil retaining sleeves, support plates of pads of turbine guide bearing, support plates of pads for generator guide bearing, thrust bearing etc., of Unit - I at PCHES site (Supplemental Extra work slip No-44)				38,421.00	01.05.2016	04.05.2016	38,421.00		0.00										
20		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination for PCHES (4X30MW) - Labour charges for enlargement of holes of Splice plates for connecting bus duct enclosures, flexibles of generator transformer for Adjustment of bus duct support structure for the Units-I and repairing of brake jack panels for Unit-I at PCHES site (Supplemental Extra work slip No-29)	YANTRA EPCOM SOLUTIONS PVT LTD			1,54,450.00	05.04.2016	28.04.2017	1,54,450.00		0.00										
21		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination for PCHES (4X30MW) - Labour charges for enlargement of holes of Splice plates for connecting bus duct enclosures, flexibles of generator transformer for Adjustment of bus duct support structure for the Unit-II at PCHES site (Supplemental Extra work slip No- 30)	YANTRA EPCOM SOLUTIONS PVT LTD			1,15,089.00	01.10.2017	19.10.2017	1,15,089.00		0.00										

Checked

N.Rao
Divisional Engineer
O&M / PCHES

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22		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination for PCHES (4X30MW) - Labour charges for enlargement of holes of Splice plates for connecting bus duct enclosures, flexibles of generator transformer for Adjustment of bus duct support structure for the Unit- IV at PCHES site (Supplemental Extra work slip No: 31)	YANTRA EPCOM SOLUTIONS PVT LTD			1,29,796.00	12.10.2017	23.10.2017	1,29,796.00		0.00								
23		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination for PCHES (4X30MW) - Labour charges for Fitting and removing of shutter plates for bottom bracket sole plates and stator sole plates for grouting of sole plate pockets in Unit-I at PCHES site (Supplemental Extra work slip no 32)	YANTRA EPCOM SOLUTIONS PVT LTD			46,388.00	28.12.2015	15.01.2016	46,388.00		0.00								
24		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination for PCHES (4X30MW) - Labour charges for enlargement of holes of Splice plates for connecting bus duct enclosures, flexibles of generator transformer for Adjustment of bus duct support structure for the Units-II and repairing of brake jack panels for Unit-II at PCHES site (Supplemental Extra work slip No: 33)	YANTRA EPCOM SOLUTIONS PVT LTD			1,82,323.00	19.09.2017	29.09.2017	1,82,323.00		0.00								

Checked

N.Rao

Divisional Engineer
O&M / PCHES
TS Genco/ Vaninepally

Station: pulichintala hydro electric scheme (4X30MW)

Format-A :Contract Details

Details of Contracts for Major Contracts

S.No	Name of Pakage/Works	Scope of Work in Brief	Name of Contractor	Original Schedule as per contract		Estimated Contract Price	Actual Schedule		Actual Completed Cost	Time Over Run	Cost Over Run	Variation in scope of work,if any	Break up of Cost Over Run Rs(Crores)			Reason for Time Over Run	Liquidated Damages	
				Start Date	Completion Date	Rs(Crores)	Start Date	Completion Date	Rs(Crores)	Days	Rs(Crores)		Variation in Scope	Price Validation	Any Other Reason		Max. can be levy as per contract conditions	Actual levied/like ly to be levied
		FY 2019-20																
1		Removal of Shaft seal Oil header Vapour seal of Generator and reassembly of Shaft seal, Oil header and Vapour seal of Generator including realignment of the machine centering of runner shaft and measurement of clearances for runner blade with respect to runner envelope and Turbine and generator bearing clearances of Unit-I	M/s YANTRA EPCOM SOLUTIONS PVT LTD			21.16.330.00	18.11.2016	08.06.2017	21.16.330.00		0							
3		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete Cable Laying & its termination - Providing assembly and Welding of Spiral Test Cone (Halves) along with inner cone for spiral casing pressure test of Unit-I,II,III & IV at PCHES site (Supplemental Extra work slip No- 15)	M/s YANTRA EPCOM SOLUTIONS PVT LTD			4.81.457.00	28.05.2014	11.12.2014	4.81.457.00		0							
4		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete Cable Laying & its termination - Providing Assembly and Welding of Test Cylinder (Two Halves) for spiral casing pressure test of Unit-I,II,III & IV at PCHES site. (Supplemental Extra work slip No- 21)	M/s YANTRA EPCOM SOLUTIONS PVT LTD			6.54.562.00	16.04.2014	22.04.2014	6.54.562.00		0							
5		Collection of the equipment supplied by the TSGENCO from TSGENCO stores, supply of structural materials such as supporting structures, tower structures, insulators, bus bar conductors and hardware etc as specified in detailed to complete the work, transport of all materials to site, execution of civil works in the switchyard, erection of structures, bus bar and equipment etc and obtaining approval/clearances from central electrical inspectorate (CEI)/ electrical inspectorate govt. of Telangana at Pulichintala Hydro electric scheme(4X30MW)-(Supplemental Extra work slip No 22)	M/s YANTRA EPCOM SOLUTIONS PVT LTD			6.32.223.00	01.11.2016	30.11.2016	6.32.223.00		0							
6		Collection of the equipment supplied by the TSGENCO from TSGENCO stores, supply of structural materials such as supporting structures, tower structures, insulators, bus bar conductors and hardware etc as specified in detailed to complete the work, transport of all materials to site, execution of civil works in the switchyard, erection of structures, bus bar and equipment etc and obtaining approval/clearances from central electrical inspectorate (CEI)/electrical inspectorate govt. of Telangana at Pulichintala Hydro electric scheme(4 X30MW)- Hire charges for supply of water for PCC, RCC works of foundations of various equipment in 220KV switchyard, curing charges, Hire & lcle charges of air compressor 8.5cmm (diesel) with trolley for blasting of hard rock soil for 6 Nos earth pits and for foundation of equipments in Feeder-I & feeder-II at 220KV switchyard area and also conveyance all materials for finished item of work (Supplemental Extra work slip No 17)	M/s YANTRA EPCOM SOLUTIONS PVT LTD			1.48.353.00	05.09.2016	20.10.2016	1.48.353.00		0							

Checked

N.Rao

Divisional Engineer
O&M / PCHES
TS Genco Nalgonda

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Format-A :Contract Details

Station: pulichintala hydro electric scheme (4X30MW)

Details of Contracts for Major Contracts(FY 2021-22)

S.No	Name of Pakage/Works	Scope of Work in Brief	Name of Contractor	Original Schedule as per contract		Estimated Contract Price	Actual Schedule		Actual Completed Cost	Time Over Run	Cost Over Run	Variation in scope of work,if any	Break up of Cost Over Run Rs(Crores)			Reason for Time Over Run	Liquidated Damage	
				Start Date	Completion Date	Rs(Crores)	Start Date	Completion Date	Rs(Crores)	Days	Rs(Crores)		Variation in Scope	Price Validation	Any Other Reason		Max. can be levy as per contract conditions	Actual levied/likely to be levieed
		FY 2021-22																
1		Design, Manufacture, Supply, Installation, Testing & Commissioning of Public Addressing System (32 Points approx.) and all its accessories for trouble free operation in powerhouse and switchyard at Pulichintala HES site (4X30MW), Telangana.	M/s BNA TECHNOLOGY CONSULTING LIMITED			4.13.000.00	16.11.2021	17.12.2021	4.13.000.00		0.00							
2		Pulichintala Hydro Electric Project (4x30 MW) - Design, Manufacture, testing at Manufacturer's works, Inspection, Packing, Supply and delivery at site. Supervision of erection testing and commissioning of 4 sets of vertical Kaplan Turbine and Generator along with the associated auxiliary & ancillary equipment, total Control & monitoring equipment,4 No.s 11Kv/220Kv, 40MVA OFWF type Generator-Transformers 500 KVA Unit Auxiliary Transformers, 11Kv segregatco bus ducts	M/s BHARATH HEAVY ELECTRICAL			20.19.128.00	01.03.2021	30.04.2021	20.19.128.00		0.00							

Divisional Engineer
O&M / PCHES
TS Genco/ Vazinepally

Details of Initial spares of PCHES as on COD

S.No	PO No	Name of the Firm	Name of the spares	Qty	Amount (Rs.)
1	JM3782, Dt.25.05.2007	M/s BHEL	TURBINE & STATION AUXILARIES	1 Set	1,11,97,000.00
2	JM3782, Dt.25.05.2007	M/s BHEL	GOVERNER	1 Set	53,77,000.00
3	JM3782, Dt.25.05.2007	M/s BHEL	GENERATOR	1 Set	1,38,83,000.00
4	JM3782, Dt.25.05.2007	M/s BHEL	MANDATORY SPARES FOR C&M - COMMON FOR 4 UNITS	1 Set	18,00,000.00
5	JM3782, Dt.25.05.2007	M/s BHEL	SPARES FOR UPS	1 Set	2,00,000.00
6	JM3782, Dt.25.05.2007	M/s BHEL	SPARES FOR BATTERY SYSTEM	1 Set	2,00,000.00
7	JM3782, Dt.25.05.2007	M/s BHEL	SPARES FOR ALARM PANEL	1 Set	2,00,000.00
8	JM3782, Dt.25.05.2007	M/s BHEL	Supporting insulators	25 Nos	50,000.00
9	JM3782, Dt.25.05.2007	M/s BHEL	Flexible Jumpers both at Generator end and GT end(i.e 3Phases)	1 Set	40,000.00
10	JM3782, Dt.25.05.2007	M/s BHEL	P.Ts(VT-1,VT-2,VT-3 1No each)	1 Set	1,20,000.00
11	JM3782, Dt.25.05.2007	M/s BHEL	Surge Capacitor	3 Nos	45,000.00
12	JM3782, Dt.25.05.2007	M/s BHEL	Lightning Arrestor	3 Nos	45,000.00
13	JM3782, Dt.25.05.2007	M/s BHEL	SAPRES OF 40 MVA GT (SET)	1 Set	11,51,000.00
14	JM3782, Dt.25.05.2007	M/s BHEL	SEE - MANDATORY SPARES - COMMON FOR 4 UNITS	1 Set	16,25,000.00
15	JM3782, Dt.25.05.2007	M/s BHEL	SEE - SPECIAL TOOLS - COMMON FOR 4 UNITS	1 Set	2,03,000.00
16	LPO No:08/2012-13, Dt.22.12.2012	M/s SRINIVAS ENGINEERING CORPORATION	Spraes for 75 Ton Hind crane	1 Set	1,91,016.00
17	5300000126, Dt.26.11.2014	M/s SIRI ENTERPRISES	Spares for 135/30T EOT Crane	1 Set	1,15,316.00
18	5300000383, Dt.05.11.2015	M/s GRACE TRANTECH SYSTEMS	Spares for 135/30T EOT Crane	1 Set	1,88,842.50
19	5300000498 Dt.12.09.2016	M/s SMITH & SHARKS PROJECTS (India) PVT LTD	Spares for Fire fighting system	1 Set	1,63,796.15
20	5300000571, Dt.28.03.2017	M/s ANDREW YULE & COMPANY LTD	Spares for 220KV/33KV, 10/12.5MVA ONAF Oil cooled & insulated Power Transformer	1 Lot	5,80,000.00
21	5300000601 Dt.02.05.2017	M/s VIRGO ENGINEERS	Spares for Torqtight wrench HTW-40s & Torqtight wrench HTW-40L	1 Set	1,10,000.00

N. Rao
Divisional Engineer, APGENCO, Vijayawada

22	5300000662, Dt.04.12.2017	M/s TRANSPADE ENGINEERS PVT LTD.	EOT Crane spares	1 Set	1,18,000.00
23	5300000672 Dt.16.12.2017	M/s GE T&D INDIA LIMITED	Spare materials for 220KV SF6 circuit	1 Set	57,500.00
24	5300000724, Dt.10.04.2018	M/s DUBAS ENGINEERING PVT.LTD.	Essential Spares for 220V FC+FCBC battery chargers	1 Set	1,17,364.80
25	5300000759, Dt.13.06.2018	M/s GRACE TRANSTECH SYSTEMS	Spares for Torqtight wrench HTW-40L	1 Set	1,09,200.00
26	5300000809, Dt.01.08.2018	M/s GRACE TRANSTECH SYSTEMS	Essential Spares for EOT Crane & Control Panels	1 Set	1,82,504.42
27	5300000851, Dt.02.11.2018	M/s SRI VAISHNAVI ELECTRICAL ENGINEERS	250KVA DG Set spares	1 Set	72,691.71
28	5300000879, Dt.12.12.2018	M/s S.D. Narahari Rao	Spares for 90KW Vertical Pump	1 Set	1,31,930.00
				Total	3,82,74,161.58

Divisional Engineer
O&M / PCHES
TS Genco/ Vadinepally

ANNEXURE-I

FY 2022-2023													
	Actuals						Projections						
PCHES	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23	Total
Gross Generation in (MU)	12.252	7.913	8.368	16.634	50.528	42.300	35.000	30.000	15.000	10.000	10.000	10.000	247.995
Auxiliary Consumption in (MU)	0.08411	0.04801	0.05832	0.08399	0.23564	0.18531	0.274563	0.169578	0.06777	0.05886	0.091223	0.081999	1.440
Net Generation in (MU)	12.168	7.865	8.310	16.550	50.292	42.115	34.725	29.830	14.932	9.941	9.909	9.918	246.555

FY 2023-2024													
PCHES	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24	Total
Gross Generation in (MU)	6.000	3.000	2.000	12.000	25.000	47.000	53.000	33.00	10.00	12.00	12.00	12.00	227.000
Auxiliary Consumption in (MU)	0.04150	0.02459	0.02547	0.06559	0.08599	0.20590	0.30507	0.18842	0.07530	0.06540	0.10137	0.09111	1.276
Net Generation in (MU)	5.959	2.975	1.975	11.934	24.914	46.794	52.695	32.812	9.925	11.935	11.899	11.909	225.724

Divisional Engineer
O&M / PCHES
TS Genco/ Vazinepally

Superintending Engineer
O&M Circle, Pulichintala HE
TSGENCO, Vazinepally.

Overhauling Works carried out in the year 2022-23 in PCHES site.

UNIT	DURATION OF OVERHAULS	DIVISION	Remarks
UNIT – 3	01.05.2022 to 30.06.2022	Electrical Maintenance	Overhauling works to adjust the LGB settings and clearance of stator coolers and LGB oil coolers etc., by Electrical Maintenance sub division
		Mechanical Maintenance	Replacement of bushes for oil header TGB gap setting, Replacement of shaft seal rubber caulking of draft tube and penstock gates by Mechanical Maintenance sub division
UNIT - 3	01.07.2022 to till to date	Mechanical / Electrical Maintenance	To work on runner assembly by dismantling the Generator & Turbine. Inspection and assessment will be carried out in the presence of M/s. BHEL.

Overhauling Works to be carried out in the year 2023-2024 in PCHES site.

Name of the station	Unit No	SCHEDULE		No of days	Type of planned Maintenance(Annual/Capital/R&M)
		FROM	TO		
PCHES	1	01.04.2023	15.04.2023	15	ANNUAL
	2	16.04.2023	30.04.2023	15	ANNUAL
	3	01.05.2023	15.05.2023	15	ANNUAL
	4	16.05.2023	30.05.2023	15	ANNUAL

Assistant Engineer
General sub division, PCHES
TSGENCO, Vazinepally

Assistant Divisional Engineer
General sub division, PCHES
TSGENCO, Vazinepally

Divisional Engineer
O&M division, PCHES
TSGENCO, Vazinepally

Superintending Engineer
O&M Circle, Pulichintala HE
TSGENCO, Vazinepally.

Non TariffIncome for the below components:

a) Income from statutory Investments-Nil

b) Interst on Advanc to suppliers-Nil

c) Rental from staff Quarters-Nil

d) Rental From Contractors-Nil

e) Income from investing consumer seeurity Deposit-Nil

f) Income from hire charges from contractors and others -Nil

Superintending Engineer
O&M Circle, Pulichintala HE
TSGENCO, Vazinepally.

ANNEXURE

Energy Forecast(2022-23)

Generating Stations	Gross Energy Availability (MU) (Actuals)						Gross Energy Availability (MU) (Projections)							Yearly Auxiliary Consumption (MU)	Net Energy Availability at IEX Bus(MU)	Remarks
	April'22	May'22	June'22	July'22	Aug'22	Sep'22	Oct'22	Nov'22	Dec'22	Jan'23	Feb'23	Mar'22	Total 2022-23			
MHS PALAIR	0.49	0.49	0.48	0.45	0.27	1.49	1.44	1.49	1.49	1.32	1.49	16.65	0.14	9.635	

Energy Forecast(2023-24)

Generating Stations	Gross Energy Availability (MU) (Projections)													Yearly Auxiliary Consumption (MU)	Net Energy Availability at IEX Bus(MU)	Remarks
	April'23	May'23	June'23	July'23	Aug'23	Sep'23	Oct'23	Nov'23	Dec'23	Jan'24	Feb'24	Mar'24	Total 2023-24			
MHS PALAIR	1.49	1.49	1.44	1.49	1.49	1.44	1.49	1.44	1.49	1.49	1.34	1.49	17.53	0.05475	7.47525	

Overhaul Schedule of MHS Palair Site for the control period (FY:2022-23 to FY:2023-24)

A) Maintenance schedule for the FY 2022-23 is as follows

Name of the Station	Unit No.	SCHEDULE		Type of planned maintenance (Annual/Capital/R&M)
MHS/PALAIR	1	01.05.2022	31.05.2022	Annual overhaul schedule
	2	01.06.2022	30.06.2022	Annual overhaul schedule

B) Maintenance schedule for the FY 2023-24 is as follows

Name of the Station	Unit No.	SCHEDULE		Type of planned maintenance (Annual/Capital/R&M)
MHS/PALAIR	1	01.05.2022	31.05.2022	Annual overhaul schedule
	2	01.06.2022	30.06.2022	Annual overhaul schedule

Assistant Engineer
MHS Palair Sub-Division
PALAIR, TSGENCO

Assistant Divisional Engineer
O&M / MHS / Palair

Superintending Engineer
O&M Circle, Pulichintala MR
TSGENCO, Vazinapally.

TELANGANA STATE POWER GENERATION CORPORATION LIMITED

PERFORMANCE OF GENERATION STATIONS

Sl.No.	Station Name	Financial year	Installed Capacity at the year end	Energy Generated (Units)	Plant Availability (%)		Auxiliary Consumption Mu)	Colony Consumption
					Unit #1	Unit #2		
1	Mini Hydel Station/ Palair	2018-19	2x1000 KW	535755	100%	100%	0.003	Nil
		2019-20	2x1000 KW	179100	100%	100%	0.007771	
		2020-21	2x1000 KW	NIL	LC	LC	0.004248	
		2021-22	2x1000 KW	1600470	25%	100%	0.039515	
		2022-23 RE	2x1000 KW	1120085	100%	100%	0.014	
		2022-23	2x1000 KW	2000000	100%	100%	0.014	
		2023-24	2x1000 KW	3000000	100%	100%	0.03	

* Generation upto 19.10.2021 is 1120085kw

Statement showing new R&M proposals of capital expenditure at MHS,Palair

Sl.No.	Name of the equipment/ material/works/services	Units	RE 2021-22	2022-23	Remarks
1	Palair MHS (2X1MW) Refurbishment works of Palair MHS (Supply of Turbine, Mech. Auxiliaries, Panels and Spares for palair Project)	2Nos	LS	LS	The cost of the estimate for each unit is Rs 45,54,320.00 as per the quotation received from M/s Boving Feuress Pvt LTD.

Assistant Divisional Engineer
O&M / MHS / Palair.

Divisional Engineer
O&M Division, Pulkal
TS 506001, Warangal

Superintending Engineer
O&M Circle, Pulkal
TSGENCO, Warangal

Format-I :Contract Details

Scheme wise Capitalisation with financial Package-(2019-20)

Station : pulichintala hydro electric scheme (4X30MW)

S.No	Name of Pakage /Works	Scope of Work in Brief	Actual Completed Cost
			Rs
		FY 2019-20	
1		PCHES- Supply, Installation, Testing and Commissioning of LED lights of various ratings in 4 No of Turbine Pits and at the entrance of Power House at PCHES site.	2,18,347
2		Supply, transportation, fabrication, painting, oil leakage testing and manufacturing of 13KL capacity of cylindrical shaped MS oil tank for filtration and storage of transformer oil at PCHES site- Purchase Order	5,57,790.00
3		Supply, Transportation, Erection of 8 Mtr Street light poles with all required cables and junction boxes from Guest house to boundary of TSGENCO land and Jungle Clearance along the road at PCHES site	3,04,911.00
4		PCHES- Cleaning, Painting to all Metal Surfaces of Generator Transformers (GT-3 & GT-4) & its accessories and equipments in 220KV Switchyard at PCHES site	1,79,543.00
5		Removal of Shaft seal, Oil header, Vapour seal of Generator and reassembly of Shaft seal, Oil header and Vapour seal of Generator including realignment of the machine, centering of runner, shaft and measurement of clearances for runner blade with respect to runner envelope and turbine and generator bearing clearances of Unit-I.	21,16,330.00
6		Erection, Commissioning, Adaption and Integration of 1No Remote Terminal Unit(RTU) along with Interface cabinet, Relays, Transducers, Switches etc for Pulichintala power House by M/s Joohitha Power Systems Pvt.Ltd	1,45,988.00
7		Painting with Polyurethene paint of approved quality (All shades) for Floor Plates, Brush gear casing, Oil bath & Oil headers with 2 coats for the Units-I, II III & IV including supply of paint and other consumables at PCHES Site	1,61,724.00
8		Supply, transportation, loading, unloading, fabrication, labour charges and Painting of 24 No.s Stands with dimensions of (L2.0M* B1.0M* H2.1336M) each stand with 3 racks at Stores Godown-2, PCHES site	9,88,834.00
9		Excavation & remove of excess rock soil, laying of PCC & RCC for foundation of 33KV 800Amps VCB and lightening arresters in 220KV/33KV yard, supply & fixing of 33KV 3Cx400Sqmm O/D End Kit and refilling of murrum/block cotton soil in 33KV /415V,1MVA Station auxiliary transformer yard at PCHES site	3,85,035.00
10		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination - Providing assembly and Welding of Spiral Test Cone (Halves) along with inner cone for spiral casing pressure test of Unit-I,II,III & IV at PCHES site (Supplemental Extra work slip No- 19)	4,81,457.00
11		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination - Providing Assembly and Welding of Test Cylinder (Two Halves) for spiral casing pressure test of Unit-I,II,III & IV at PCHES site (Supplemental Extra work slip No- 21)	6,54,562.00
12		Painting with two coats of plastic emulsion paint (White Colour) for dust proofing on new plastered wall surfaces in Air Washer Room including cost of materials, labour charges and T&P materials at PCHES Site	98,742.00
13		Supply, Transportation, Fixing of 90W LED Street lights with suitable bracket from Guest house to boundary of TSGENCO land along the road at PCHES site	1,65,795.00

Checked.

N.Ra.
Divisional Engineer

Executive Engineer
Pulichintala HE
TSGENCO, Nalgonda.

14		Supply, Installation, testing and commissioning of 2.5 Sqmm copper cable for DC lighting and LDBs with MCBs and MCCBs in Different areas of Power House for Shortage quantity of P.O.5300000395 at PCHES site	3,82,355.00
15		Establishment of Local Area Network at PCHES power house building and shifting of RF Mast Tower fom Construction office to Power House Building at PCHES Site, Vazinepally	7,11,66/.00
16	v	Filtration of 30 KL servo 68 oil of OPU system for all 4 units at Pulichintala Hydro Electric Scheme (4 X 30 MW) Suryapet (D), Telangana	3,13,880.00
17		Laying of RCC slabs and supply, laying of GI water pipe line for earth pits in 220KV/33KV, 10/12.5MVA power transformer yard at PCHES site	1,75,438.00
18		Supply, Installation and Commissioning of CC Cameras at various locations of PCHES Site, Vazinepally	6,43,832.00
19		Labour charges for Shifting of the material & cable drums from existing place to Construction Godowns and Scrap yard and stocking of the material at PCHES site	82,901.00
20		Erection of monorail system over Unit-4 sump for maintenance of 110KW dewatering pump	2,00,284.00
21		Erection, testing and commissioning of 110 KW Vertical Turbine pump set along with Valves, Control panel and associated equipment at Dewatering sump-II at PCHES	1,29,140.00
22		Collection of the equipment supplied by the TSGENCO from TSGENCO stores, supply of structural materials such as supporting structures, tower structures, insulators, bus bar conductors and hardware etc. as specified in detailed to complete the work, transport of all materials to site, execution of civil works in the switchyard, erection of structures, bus bar and equipment etc and obtaining approval/clearances from central electrical inspectorate (CEI)/ electrical inspectorate govt. of Telangana at Pulichintala Hydro electric scheme(4X30MW)-(Supplemental Extra work slip No.22)	6,32,223.00
23		Collection of the equipment supplied by the TSGENCO from TSGENCO stores, supply of structural materials such as supporting structures, tower structures, insulators, bus bar conductors and hardware etc. as specified in detailed to complete the work, transport of all materials to site, execution of civil works in the switchyard, erection of structures, bus bar and equipment etc and obtaining approval/clearances from central electrical inspectorate (CEI)/electrical inspectorate govt. of Telangana at Pulichintala Hydro electric scheme(4X30MW)- Hire charges for supply of water for PCC, RCC works of foundations of various equipment in 220KV switchayard, curing charges, Hire & Idle charges of air compressor 8 5cmm (diesel) with trolley for blasting of hard rock soil for 6 Nos earth pits and for foundation of equipments in Feeder-I & feeder-II at 220KV switchyard area and also conveyance all materials for finished item of work (Supplemental Extra work slip No.17)	1,48,353.00
24		Labour charges for Servicing of Runner Aeration Valve and filtration of oil of TGB Housing sump tanks of Unit-I,II,III & IV at PCHES site	1,93,641.00
25		Labour charges for Fabrication and Painting of 5 No.s Stands with dimension of (L2 0 M*W1 0 M*B2 1336 M) each stand with 3 racks at EM Sub division Stores Godown with MS material at PCHES site	79,285.00
26		Laying of RCC slabs in 33KV yard, Laying of 120Sqmm power cable, fabricating of MS Stands for SF6 Circuit breaker and other miscellaneous works in 220KV switchyard at PCHES site	1,93,668.00
27		Providing plastering for beds in Air washer room at PCHES-Purchase Order	7241
28		Extension of air vents of service gates of unit 1, 3 and 4 in switch yard	12,79,465.00
29		Supply of SIEMENS contactors for TTCD pumps and Telemecanique contactors for TTCD control panel-NEAR VAZINEPALLY(VILLAGE	15,771.00
30		Supply of T&P for operation works of Electrical maintenance sub-division	1,02,561.00
31		Supply of 10 No of Single Phase,230V,16" (400mm) Wall mounted Fans and other general electrical material for power house at PCHES Site.	1,82,146.00
32		Design manufacture, testing at manufacturer's works, inspection, packing, supply and supervision of erection & commissioning of 5 Nos. triple screw pumps for pressure pumping set along with motor stool, suction & discharge pipe, coupling & mounting plate suitable for Pulichintala HES, Telangan	49,68,588.00
33		Design, Manufacture, Supply, Installation and commissioning of Filter machine to Pulichintala HES site (4X30MW), Telangana	12,98,000.00
34		Supply of consumables and Spare materials of 220KV switch yard at PCHES site.	1,36,880.00

Checked.

N.Ra
Divisional Engineer
O&M / PCHES

CE/Operation
TSGENCO, Hyderabad.

35		Design, Manufacturing, Supply, Commissioning and Supervision of 3 Ton Mechanical Hoist for monorail system over Unit-4 at PCHES site	2,37,180.00
36		Supply of Dust collector papers for (ELC-100) Electro static filter machine, Dome lights and Jaw contacts of 1000A breaker at PCHES site	1,69,158.00
37		Supply of Wall mounted Fans for newly constructed offices at PCHES Site	1,27,204.00
38		Supply of "Layer 2, 24 Ethernet 10/100/1000 Base- T with 4 SFP Switch (Manageable switch)" at PCHES Project site.	44,840.00
39		Supply of Current Transmitter (Retransmission unit Model CV-007 with three port isolation between power supply, input, output) for Penstock Intake Gate position feedback to SCADA at PCHES site	61,183.00
40		Design, manufacture, testing at manufacturers works, packing, supply of HYDAC Pressure switches at Pulichintala HES(4X30MW), Telangana	6,33,575.00
41		Supply of Digital Anemometers for Ventilations system at PCHES Site	35,400.00
42		Supply of various materials and Electrical consumables required for erection of LAN work and spares for maintenance of Telephone & IT sub-division at PCHES Site.	1,76,568.00
43		Supply of Furniture, Almirah for construction division at PCHES Site	1,13,811.00
44		Design, manufacture, testing at manufacturer's works, inspection, packing, supply of Air circuit Breakers for SAB and UAB at Pulichintala HES, Telangana	4,53,229.00
45		Supply of License free Walkie Talkies for Pulichintala HES Site.	45,100.00
46		Supply of Spares for GRP, CRP, UAB & SAB at PCHES site	2,27,150.00
47		Supply, Installation & Commissioning of 64 lines EPABX system for Intercom communication system at PCHES Site.	1,91,962.00
48		Supply of critical spares for Penstock Intake Gate system at PCHES Site	1,19,416.00
49		Supply of spare materials for power house Indoor lighting at PCHES Site–Near-Vazinepally (Village).	1,78,027.00
50		Supply of spares and consumables for computers Network & Telecom related items at PCHES site.	60,434.00
51		Supply of 15 HP Submersible pumps along with Starter Panel at PCHES Site	1,95,072.00
52		Rotor Rim Spacers U-1	7,88,242.00
53		CLAMP METER,LKGE,LCD,31/2 DIGITS,DCM10A	28,112
54		MULTIMETER,4000C,W/LEADS&HOLSTER,DM3540	2,747
55		AUTO TRANSFORMER,240/0-270V,20A,1PH	8,363
56		CLAMP METER,LKGE,LCD,31/2 DIGITS,DCM10A	28,112
57		MULTIMETER,4000C,W/LEADS&HOLSTER,DM3540A	2,747
58		BUSH,PTFE	1,76,116
59		Throttle with filter	4,500
60		W.L Transmitter for GV Control (Rador Ty	8,87,335
61		Setting Device Micro Switches & Pressure,Speed Segnal Device(Magnetic Pick Up),Balanc	51,797
62		SOLENOID VALVE,CLOSING,DG4V-3S,350 BAR	105916
63		Rotor Rim Spacers U-2	7,88,242.00
64		Pilot Valve Complete with code sleeve,Resistance type temperature Detector	27024
65		Rotor Rim Spacers U-3	7,88,242.00
66		Auxillary Relays,Speed Setting indicator	4504
67		Output Setting Indicartor,Servo Valve,NUT,M48X4MM PITCH,EN24,WELDING ELECTROD	354708
68		Steel wire rope,D.C.Limit Motor	22500
69		SPARES,F/10/12.5MVA,220/33KV TRANSFORMER	623826
70		Laying of MS pipe line from downstream side of River Bed and Installation of 22.5 HP Submersible pump for hydraulic pressure testing of spiral casing of Unit-IV and cutting, Welding of 450X1200 mm segment to Unit III Pit liner at PCHES Site	6,852.00
71		Output Setting Indicartor,Servo Valve,NUT,M48X4MM PITCH,EN24,WELDING ELECTROD	156897
72		Rotor Rim Spacers U-4	7,88,242.00
73		Output Setting Indicartor,Servo Valve,NUT,M48X4MM PITCH,EN24,WELDING ELECTROD	2252
74		Unit-4 COD Tax Amount	151217
75		METER,MULTI FUNCTION,TY:3450,63.5V,1/5A,:LOCAL REMOTE SWITCH RP 146A TB3	154503
76		Supply of RTU and its Auxiriaries	1677570
77		AIR CONDITIONER,SPLIT,3.25T,RBZ039HBDW	276337
78		Installation charges 3.25 Ton Split AC	18043

Checked.

N.Ra.
Divisional Engineer
O&M / PCHES

Executive Engineer
O&M Circle, Pallampeta

79		Providing 1 No. (1+10) seater Toofan or equivalent vehicle of 12 hours availability on hire basis for conveyance of Engineering staff and accounts personel for attending works at Pulichintala HES along with drivers from 01.12.2018 to 31.03.2019 or from the date of actual utilization to 31.03.2019	-3025
80		BARS,TMT,12MM,IS 1786 Fe 500/550 D	367 28
81		Supply, Installation, Testing and Commissioning of LED lights ofvarious ratings in 4 No of T	255076
82		Supply, Transportation, Erection of 8 Mtr Street light poles with all required cables and junction boxes from Guest house to boundary of TSGENCO land and Jungle Clearance along the road at PCHES site	304909
83		Laying of PCC & RCC, Supply, transportation and erection of 7.5 mtr Height 1.0Mtrs lenght arm GI street light poles and its accessories of armoured copper cable, 120watts LED lamps and 70Watts LED lamps in SAT yard area and New Project Hostel area at PCHES site .	1015469
84		Supply of Lighting spares of PCHES site	182146
85		Up keeping of all Control panels such as Generator Transformers(GT's), Generator Transformer oil coolers, Circuit breaker Marshaling boxes, Unit Marshaling box, DG Set, communication module panels and UPS and energy meter panels etc for the period of 6 Months (From 01.10.2018 to 31.03.2019)	37546
86		Supply, Installation, testing and commissioning of 2.5 Sqmm copper cable for DC lighting and LDBs with MCBs and MCCBs in Different areas of Power House for Shortage quantity of P.O.5300000395 at PCHES site	382355
87		BARS,TMT,12MM,IS 1786 Fe 500/550 D	39922
88		BARS,TMT,12MM,IS 1786 Fe 500/550 D	10779
89		Supply, Laying and Termination of Various Incomer cables to Local Distribution Boards fror	7,35,258.00
90		PORTLAND CEMENT (PPC) FLY ASH,IS 1489	35200
91		BARS,TMT,12MM,IS 1786 Fe 500/550 D	31937
92		PORTLAND CEMENT (PPC) FLY ASH,IS 1489	13200
93		PORTLAND CEMENT (PPC) FLY ASH,IS 1489	3073
94		31/2core120 sq.mm armouredAluminiumCable	65928
95		BARS,TMT,12MM,IS 1786 Fe 500/550 D	9900
96		PORTLAND CEMENT (PPC) FLY ASH,IS 1489	8140
97		Supply, fabrication, transportation, laying of RCC, chipping of concret, painting and erection	2,97,937.00
98		BARS,TMT,12MM,IS 1786 Fe 500/550 D;BAR,TMT,6.00MM DIA	2883
99		Supply of 32mm PVC Conduit for power house lighting at PCHES Site	59,820.00
100		CABLE,CONTROL14CX2.5SQMM,ARMOURED;CU,SCR	56283
101		Supply, Laying and Termination of Various Incomer cables to Local Distribution Boards fror	308113
102		Labour charges of dismantling, chipping for equipmets existing in 11KV/415V switchgear and supply, laying, renovation, Painting of equipments in 33KV/415V, 2MVA switchgear yard at PCHES site.	1,80,193
103		Supply, laying, testing and commissioning of 2.5 Sqmm copper cable, 32mm PVC conduit for Shortage quantity of main P.O.5300000395 for lighting of Office Rooms and Power Sockets in Office Rooms and Differnt Locations of Power House and also for DC Lighting in Power House at PCHES site.	4,50,818.00
104		Providing 1 No. (1+10) seater Toofan or equivalent vehicle of 12 hours availability on hire basis for conveyance of Engineering staff and accounts personel for attending works at Pulichintala HES along with drivers from 01.12.2018 to 31.03.2019 or from the date of actual utilization to 31.03.2019	60510
105		Annual Maintenance of 25 Nos 1.5/2.0 Ton split air conditioners available in New Guest House, Project Hostel and Administrative Offices at PCHES site near Vazinepally village for the year 2018-19	86,756.00
106		Up keeping of all Control panels such as Generator Transformers(GT's), Generator Transformer oil coolers, Circuit breaker Marshaling boxes, Unit Marshaling box, DG Set, communication module panels and UPS and energy meter panels etc for the period of 6 Months (From 01.10.2018 to 31.03.2019) at PCHES site, Vazinepalli 4th and final bill	73,193.00
107		Supply, Transportation, erection, testing and commissioning of 3 Nos 3 tonne, 3 Phase split type Air Conditioner and all standard accessories in Unit Control room at PCHES, Vazinepally.	2,85,831.00
108		PORTLAND CEMENT (PPC) FLY ASH,IS 1489	35200

Checked.

N. Ram
Divisional Engineer
O&M / PCHES

109		Extension of 3-Phase,440V Power Supply to Newly Erecting Electric Motor Pumps at Tail Race of Power House at PCHES site	3,43,097.00
110		Making of holes to the floor in various locations of powerhouse and Erection of Battery Charger, Battery Bank in Network Panel Room, Lighting Main Distribution Board in SAB Room in Power House, Supply of 100x16mm GI Earth Flat and Reconditioning of Earth Pits, Replacing of Silica Gel in SwitchYard at PCHES site.	1,39,016.00
111		ABT Single meter box (1075x600 MM);Securre meter 3Ph,4wireCvt,220KV/√3/110	163123
112		Overhauling, Repair and Replacement of Spare parts of 8Ton Escort crane Engine and Air Compressor Unit at PCHES Site- Vazinepally Village-1st and final bill	1,27,861.00
113		Supply, Installation, testing and commissioning of Lighting Equipment including design of Illumination requirement for Pulichintala HES (4x30MW)-1st & Final Bill	4,73,676
114		GEAR OIL, SERVOMESH 120	117975
115		GREASE,SERVO GEM2	36905
116		Cable Tray Covers of Different Sizes	41616
117		P.T. C.T. 450X50mm, 2.5 M Len 3mm Thick&P.T. C.T. 150x50mm, 2.5 M Len 3mm Thick	220776
118		FR CABLE TRAY COVER,165x50x2500MM,3.5MM	73012
119		Cable Trays	67836
120		ANGLE,M.S.50X50X6MM	91817
121		3½ core 150 Sq.mm Aluminum power Cable&12 pair 0.5 Sq.mm Screened Cable	104688
122		Spares of C&P Sub Division	83661
123		3 ½ core 120 Sq.mm Aluminum power Cable	92686
124		closing of Temp. advance for rewinding of 15KW dew	20000
125		FERRULE TUBE,1.5SQMM,2.5SQMM	16362
126		Design, manufacture, testing & inspection at manufacturer's works, packing, supply and delivery at site, erection, testing and commissioning of 1 No lift(13 passenger persons) for PULICHINTALA HES Power House (4x30MW) with facility of V3F drive and ARD (Automatic Rescue Device) etc., supply of spares and AMC for 2 years	6,69,591.00
127		Spares for 13 Passenger lift	194788
128		AMC for 13 passenger lift	27201
129		Providing 1 No. (1+10) seater Toofan or equivalent vehicle of 24 hours availability on hire basis for conveyance of Engineering staff and accounts personel for attending works at Pulichintala HES along with drivers from 01.12.2018 to 31.03.2019 or from the date of actual utilization to 31.03.2019.	65,788.00
130		SUPPLY OF CONSUMABLES FOR OPERATION & MAINTENANCE OF EM, MM, C & P A	33,254.00
131		Supply of T&P for operation works of Mechanical maintenance sub-division -Near Vazinepa	1,88,544.00
132		ANGLE,MS -75X75X8MM;CHANNEL,75X40MM,MS,ANGLE,MS,40X40X5MM;ANGLE,MS,	221387
133		Supply of Hylam sheets and petroleum gelly for PCHES -Near Vazinepally(Village)	50,070.00
134		SUPPLY OF CONSUMABLES FOR OPERATION & MAINTENANCE OF EM, MM, C & P A	81950
135		EXPENDITURE FOR CAPITAL WORKS (CWIP)	19,942.00
136		DRINKING WATER COOLER,SDLX480 80/40 LTRS	50094
137		ANGLE,MS,40X40X5MM;ANGLE,MS,40X40X5MM	30709
138		Supply of T&P for operation works of General & Safety	116228
139		FAN,WALL MOUNTING,400MM,230V,1PH,50HZ	61056
140		Supply of Printed stationary for the year 2019-20 for the office use at PCHES site	406768
141		CHAIN PULLEY BLOCK,3 TON,MDL CB030	236640
142		Supply of Different type of Fuses	6519
143		ERW PIPE,MS,355.60 ODX9.50MM,Piston,Pressure reducer	278941
144		Labour charges for Dismantling of Plinth Sheds and shifting of removed materials to scrap yard at PCHES site, Vazinepally.	57,875.00
145		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination - Providing Assembly of Runner blades of Unit III & IV at PCHES site. (Supplemental Extra work slip No- 25)	7,02,550.00
146		Supply of certain materials for erection 220KV/33KV,12.5MVA/10MVA SAT yard at PCHES NEAR VAZINEPALLY(VILLAGE	88,078.00

Divisional Engineer
O&M / PCHES

147		Supply, Transportation, Excavation & erection of 12.9Mts spun poles and dismantling of exiting 3Nos, 9.1Mtr PSCC poles for Construction of Pylon at Entrance of PCHES site.	2,25,318.00
148		Excavation of soil, laying of PCC, Supply, transportation, Paving, erection, termination, testing and commissioning of 33KV line from 220KV/33KV,12.5MVA transformer to 33KV/440V,1MVA transformer at PCHES site.	10,39,259.00
149		Excavation of soil, laying of PCC, Supply, transportation, loading,unloading, erection, cable termination, testing and commissioning of equipment required for 33KV/440V, 1MVA Station Auxiliary transformer(SAT) & Its line equipments at PCHES site.	7,89,385.00
150		Switchyard-Supply of hard red soil/murrum with fine gravel and 40mm HBG metal for filling in 220KV/33KV Station auxiliary Transformer(SAT) Switchyard area at PCHES project site.	6,11,562.00
151		Supply, labour charges of two coat wall paint and leveling of HBG metal in 220KV switchyard at PCHES site	79,865.00
152		Construction of 5 Nos. Fire Protection walls between 11KV/220KV Transformers at Switch Yard of PCHES Site Vazinepalli.-2nd & final bill	3,32,402.00
153		Overhauling, Repair and Replacement of spare parts of 8Ton Escort crane engine and Air Compressor Unit at PCHES Site- Vazinepally.	1,27,861.00
154		Supply,laying and testing of 2.5 Sqmm copper cable in existingPVC Conduit for Shortage quantity of main P.O.5300000395 for the Generator Annexure floor Roof Lighting at PCHES site.-1st & Final Bill	5,53,088.00
155		Supply of Various Meters and Spares of various Electrical equipment and starter panels at PCHES site	1,99,331.00
		Total Rs	4,41,52,861

Checked

N-Rao
Divisional Engineer
O&M / PCHES
TS Genco/ Vazinepally

Superintending Engineer
O&M Circle, Nalgonda (N&E)
Nalgonda, Nalgonda Dist.

Format-I :Contract Details

Scheme wise Capitalisation with financial Package-(2020-21)

Station : pulichintala hydro electric scheme (4X30MW)

S.No	Name of Pakage/ Works	Scope of Work in Brief	Actual Completed Cost
			Rs
		FY 2020-21	
1		Supply of 15 HP Submersible pumps along with Starter Panel for dewatering in sump-1 at PCHES Site.	97,536.00
2		Inspection, Servicing of Servo Valve of HMC Cabinet of Unit-IV for utilizing as spare at PCHES.	2,89,749.00
3		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination - Providing Assembly and Welding of Pit liner (Two Halves) of Unit-III & IV at PCHES site. (Supplemental Extra work slip No- 20)	4,42,395.00
4		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination - Providing Assembly and Welding of Pitliner (Two Halves) of Unit-I & II at PCHES site.(Supplemental Extra work slip No- 18)	4,09,490.00
5		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination - Providing Assembly of Runner blades of Unit-I at PCHES site (Supplemental Extra work slip No- 23)	2,93,286.00
6		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination - Providing Assembly of Runner blades of Unit-II at PCHES site. (Supplemental Extra work slip No- 24	3,22,090.00
8		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination- Providing Trail assembly of TGB Housing sump ring and Oil retaining sleeve of Unit-I at PCHES site. (Supplemental Extra work slip No- 26)	1,20,498.00
9		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination- Providing Trail assembly of TGB Housing sump ring and Oil retaining sleeve of Unit-II at PCHES site. (Supplemental Extra work slip No- 27)	1,32,492.00

Divisional Engineer
C&M / PCHES

10		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete. Cable Laying & its termination- Providing Trail assembly of TGB Housing sump ring and Oil retaining sleeve of Unit-II at PCHES site. (Supplemental Extra work slip No- 28)	2,89,647.00
11		Supply of Temperature Recorders and spares at PCHES site	1,09,751.00
12		Supply of Spares for 33KV Sub station at PCHES site - Reg.	1,77,177.00
13		Supply of T&P for operation works of Electrical Maintenance sub-division at PCHES site	2,33,239.00
14		Supply of spare parts for PP set for Unit – II & IV at PCHES Site	1,79,950.00
15		Design, manufacture, testing at manufacturer's works, inspection, packing, supply and delivery of FRLS(Fire Retardant low smoke) PVC insulated, copper power and instrumentation cables and aluminum Power cables for Pulichintala Hydro Electric Scheme (4 X 30 MW),Telangana	22,79,605.00
16		Supply of 310*100*2500 mm size Cable tray covers at PCHES site.	1,67,506.00
17		Supply of spare materials for power house Outdoor lighting at PCHES Site.	1,80,475.00
18		Supply of Spare Materials for 245KV,1600A, 40KA/1sec SF6 Circuit breaker at PCHES site.	4,49,423.00
20		Supply of various materials and Electrical consumables required for erection of Telephone and LAN work and spares for maintenance of Telephone & IT sub-division at PCHES Site	1,51,937.00
21		Supply of Spares of cooling water flow relays at PCHES site	1,39,657.00
22		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination. Matching and welding of spiral casing inlet pipe and closing piece of penstock due to ovality of penstock of Unit-I. at PCHES site (Supplemental Extra work slip No- 34)	1,08,466.00
23		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination. Matching of spiral casing inlet pipe and closing piece of penstock due to ovality of penstock ,cutting of inlet pipe and preparation of V groove joint making on spiral inlet pipe welding of spiral casing inlet pipe pieces along with penstock unit-III at PCHES site (Supplemental Extra work slip No- 35)	1,31,424.00
24		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination. Removal of ovality for compensating cone of eight parts and to make required profile to fix between runner envelope and draft tube cone of unit-I at PCHES site (Supplemental Extra work slip No- 36).	1,12,100.00
25		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination. Removal of ovality for compensating cone of eight parts and to make required profile to fix between runner envelope and draft tube cone of unit-II at PCHES site (Supplemental Extra work slip No- 37)	1,29,210.00

Checked.

N-Ray/O&M Circle, Public Health
TSGENCO, Yazinopally
O&M / PCHES
TS Genco/ Yazinopally

26		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination. Removal of ovality for compensating cone of eight parts and to make required profile to fix between runner envelope and draft tube cone of unit-III at PCHES site (Supplemental Extra work slip No- 38)	1,41,010.00
27		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination. Removal of ovality for compensating cone of eight parts and to make required profile to fix between runner envelope and draft tube cone of unit-IV at PCHES site (Supplemental Extra work slip No- 39)	1,41,010.00
28		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination.- Fixing of draft tube drain valves and centre line of stay ring of Unit-I & II at PCHES site. (Supplemental Extra work slip No- 40	1,99,090.00
29		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination. - Holes enlarging bolting stay ring and tapping of runner envelope holes for alignment of stay ring and runner envelope of Unit-I and welding of monorail base plate and enlarging of holes for base plate to match of Unit-I & II at PCHES site. (Supplemental Extra work slip No- 41)	57,773.00
30		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination. - Holes enlarging bolting stay ring and tapping of runner envelope holes for alignment of stay ring and runner envelope of Unit-III and welding of monorail base plate and enlarging of holes for base plate to match of Unit-III & IV, at PCHES site. (Supplemental Extra work slip No- 42)	72,641.00
31		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination - Centre line of stay ring with respect of draft tube of Unit-III & IV at PCHES site. (Supplemental Extra work slip No- 43)	65,891.00
32		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination for PCHES (4X30MW) - Labour charges for enlargement of holes of floor plates, support angles of floor plates, walkways, ladders, hand rails, oil retaining sleeves, support plates of pads of turbine guide bearing, support plates of pads for generator guide bearing, thrust bearing etc , of Unit - I at PCHES site. (Supplemental Extra work slip No-44)	38,421.00

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33		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination for PCHES (4X30MW) - Labour charges for enlargement of holes of Splice plates for connecting bus duct enclosures, flexibles of generator transformer for Adjustment of bus duct support structure for the Units-I and repairing of brake jack panels for Unit-I at PCHES site. (Supplemental Extra work slip No- 29)	1,54,450.00
34		Supply, erection and commissioning of High Mast lighting pole near proposed solar plant erection area at PCHES Site	5,56,151.00
35		Annual Maintenance of 38 No of 1 5/2.0/3.25 Ton split air conditioners available in Power House, New Guest House, Project Hostel and Administrative Offices at PCHES site for the year 2019-20	1,30,407.00
36		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination for PCHES (4X30MW) - Labour charges for enlargement of holes of Splice plates for connecting bus duct enclosures, flexibles of generator transformer for Adjustment of bus duct support structure for the Unit-III at PCHES site. (Supplemental Extra work slip No- 30)	1,15,089.00
37		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination for PCHES (4X30MW) - Labour charges for enlargement of holes of Splice plates for connecting bus duct enclosures, flexibles of generator transformer for Adjustment of bus duct support structure for the Unit- IV at PCHES site. (Supplemental Extra work slip No- 31	1,29,796.00
38		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination for PCHES (4X30MW) - Labour charges for Fixing and removing of shutter plates for bottom bracket sole plates and stator sole plates for grouting of sole plate pockets in unit-I at PCHES site (Supplemental Extra work slip no 32)	46,388.00
39		Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination for PCHES (4X30MW) - Labour charges for enlargement of holes of Splice plates for connecting bus duct enclosures, flexibles of generator transformer for Adjustment of bus duct support structure for the Units-II and repairing of brake jack panels for Unit-II at PCHES site. (Supplemental Extra work slip No- 33)	1,82,323.00
41		EARTH ROD,FRP TELESCOPIC,15FEET,F/220KV	85,780.00
43		220V DC Relay(Definite time relay),type	20,290.00
44		BARS,TMT,12MM,IS 1786 Fe 500/550 D	42,637.00
45		Supply, Transportation, fixing, testing and commissioning of 3/8" and 3/4 " Copper pipes of Air Conditioners and Making of holes to the floor in various locations of power house at PCHES site	94,636.00

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TB Gencol Vazinepally

46		FR CABLE TRAY COVER,315x50x2500MM,3.5MM	1,51,168.00
47		10x2.5Sq.mm Cu Control Cable(UnArmoured)	-36,039.00
48		3½ core 150 Sq.mm Aluminum power Cable	-7,277.00
49		3 ½ core 120 Sq.mm Aluminum power Cable	-48,196.00
50		3 ½ core 35 Sq.mm. Aluminum power cable	-3,928.00
51		3 ½ core 240 Sq.mm Aluminum power Cable	-50,889.00
52		19x2.5Sq.mm Cu Control Cable(UnArmoured)	-1,18,952.00
53		12Corex0.5Sq.mm(6pair) instr. Cable(Scr)	-6,803.00
54		8x0.5 Sq.mm 4 pair instr. cable(Screned)	-3,526.00
55		12 pair 0.5 Sq.mm Screened Cable	-4,296.00
		Total Rs.	90,92,148.00

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15/12/22

Format-I :Contract Details			
Scheme wise Capitalisation with financial Package-(2021-22)			
Station : pulichintala hydro electric scheme (4X30MW)			
S.No	Name of Pakage/Works	Scope of Work in Brief	Actual Completed Cost
			Rs
		FY 2021-22	
1		33KV,800A D/B AIR BREAK ISOLATOR	77,078.00
2		Providing Engineering services for testing and commissioning of Unit-III & IV Generator relay panels, Auto synchronization panel, Open circuit characteristics test and short circuit characteristic test of Unit-II, III & IV at Pulichintala HES-	2,12,400.00
3		CABLE,3 1/2C,AL,240SQMM,ARMOURED	-4,28,498.00
4		Spares of PA system	6,11,181.00
5		3½ core 150 Sq.mm Aluminum power Cable	80,415.00
6		3 ½ core 120 Sq.mm Aluminum power Cable	25,952.00
7		3 ½ core 240 Sq.mm Aluminum power Cable	10,827.00
8		VALVE ASSLY, UN LOADER,DW.01-PP00342	68,204.00
9		Lightning Arrestor	16,875.00
10		Pulichintala Hydro Electric Project (4x30 MW) – Design, Manufacture, testing at Manufacturer's works, Inspection, Packing, Supply and delivery at site, Supervision of erection testing and commissioning of 4 sets of vertical Kaplan Turbine and Generator along with the associated auxiliary & ancillary equipment, total Control & monitoring equipment,4 No.s 11Kv/220Kv, 40MVA OFWF type Generator-Transformers , 500 KVA Unit Auxiliary Transformers. 11Kv segregated bus ducts--service tax differrence amount release	2,25,042.00
11		Design, Manufacture, Supply, Installation, Testing & Commissioning of Public Addressing System (32 Points approx.) and all its accessories for trouble free operation in powerhouse and switchyard at Pulichintala HES site (4X30MW), Telangana.	20,86,722.00
		Total Rs.	29,86,198.00

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Assessment of Resources for annual plan 2023-24 & Revised Estimate 2022-23 of Pulinchintala HES (4X30 MW)

A	B	C	D	E	F	G	H	I	J	K	RE 2022-23 L=(G+J+K)	M	BE 2023-24 N
Project Definition	WBS Element	WBS Description	Budget as per Admin Approval	Budget released in SAP (CJ33)	Expenditure upto 30/09/2022 (CJI3)	Expenditure from 01/04/2022 to 30/09/2022	Pending commitment (CJI5)	Additional commitment from 01/10/2022 to 31/03/2023 (Documents to be enclosed)	Cash flow requirement from 01/10/2022 to 31/03/2023 (Against H)	Cash flow requirement from 01/10/2022 to 31/03/2023 (Against I)	(Expenditure from 01/04/2022 to 30/09/2022)+ Cash flow requirement from 01/10/2022 to 31/03/2023	Additional commitment from 01/04/2023 to 31/03/2024 (Documents to be enclosed)	Cash flow requirement from 01/04/2023 to 31/03/2024 (Against H and Against M)
		E&M System	220.03		216.94	0.026	0	0.1236	0	0.1236	0.1496	5.65	5.65
		Civil System											
		Project Consultancy											
		Project Management											

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O&M / PCHES
TS Genco/ Vazinapally

Superintending Engineer
O&M Circle, Pulichintala HE
TSGENCO, Vazinapally.

Abstract of Capital Budget Estimate for the year 2022-23

S.No.	Name of the work	Amount (Rs.)	Justification
1	Providing engineering services for T &C of unit-III & IV generator relay panels, auto sync panel, OCC & SCC of unit-II,III,& IV	150000.00	**This work is within the scope of original works.** The PO is pertaining for providing Engineering services for testing and commissioning of Unit-III & IV Generator relay panels, Auto synchronization panel, Open circuit characteristics test and short circuit characteristic test of Unit-II, III & IV at Pulichintala HES. The work was carried out vide PO No. 4900024177/CE(HPC&HP)/ SE(HD-I)/321/ F08 /2016-17/Dt.17.10.2017 of M/s SIEMENS INDIA LTD. In the year 2017 commissioning of Generator Relay Panels of Unit - III & IV wree carried out. In the year 2018 the commissioning of Auto Synchrinizer Panel were carried. Due to time constraint, continuous operation of Units and non availblity of LC the schemes Auto Reclosure and LBB operation of 220KV Chillakallu & Seethapuram Feeders were not carried. Later after continous persuance with M/s Siemens Ltd and due to covid-19 lockdown conditions. Service Engineer of M/s SIEMENS attedned the pending works on dt.22.01.2021 and successfully completed the all pending works in the year 2021.
2	Providing Engineering services for testing and commissiening of 220 KV line Control and Protection panels and Generator protection panels at Pulichintala HES	330000.00	**This work is within the scope of original works.** The PO is pertaining for providing Engineering services for testing and commissioning of Unit-III & IV Generator relay panels, Auto synchronization panel, Open circuit characteristics test and short circuit characteristic test of Unit-II, III & IV at Pulichintala HES. The work was carried out vide PO No. 4900018174/CE(HPC&HP)/ SE(HD-I)/321/ F07/2019-20/ Dt.08.01.2020 of M/s SIEMENS INDIA LTD. In the year 2017 commissioning of Generator Relay Panels of Unit - III & IV wree carried out. In the year 2018 the commissioning of Auto Synchrinizer Panel were carried. Due to time constraint, continuous operation of Units and non availblity of LC the schemes Auto Reclosure and LBB operation of 220KV Chillakallu & Seethapuram Feeders were not carried. Later after continous persuance with M/s Siemens Ltd and due to covid-19 lockdown conditions. Service Engineer of M/s SIEMENS attedned the pending works on dt.22.01.2021 and successfully completed the all pending works in the year 2021.

N.Ra
Divisional Engineer
O&M / PCHES

3	Implementation of Auto-Reclosure (A/R) feature and its testing in 3 No"s ABB make REL670 Relays for PJHES & LJHES and retrofitting, testing & commissioning of 2 No"s REL670 relays for PCHES vide PO No.4900030300/CE(HPC&HP)/SE(HD-I)/T12/F07/2019-20//DT.08.01.2020	116000.00	**This work is within the scope of original works** .The PO is pertaining for Implementation of Auto-Reclosure (A/R) feature and its testing in 3 No"s ABB make REL670 Relays for PJHES & LJHES and retrofitting, testing & commissioning of 2 No"s REL670 relays for PCHES and The work is not taken up due to the continous running of all the units in the season It is requested M/s Innotech vide Lr No SE/O&M/PCHES.F.NO .D.No 193/20.Dt:24.05.2021 to depute Service Engineers for retrofitting ,testing and commissioning of 2 No's REL 670 relays and due to prevailing corona pandemic the deputation of service engineers was not yet completed.
4	Local Transportation of 1No. rotor spider segment of Unit-1, cleaning of spider studs. Nuts & Bolts, coupling of two spider segments, tightening of spiders studs, nuts & bolts and alignment after tightening of rotor segments at PCHES Site, Vazinepally – Supplemental Extra Work Slip No#45	82536.00	**This is work is within the scope of original works** It was carried out by the erection contrator M/s YANTRA EPCOM SOLUTIONS PRIVATE LIMITED. This work is an extra work and carried out when a discerpance was found in the original equipmemt supplied by M/s BHEL, New Delhi.
5	Cleaning of rotor spider studs, Nut & Bolts of Unit-2, coupling of two spider segments, tightening of spiders studs, nuts & bolts and alignment of rotor segments of Unit-2 after tightening of rotor segments at PCHES Site, Vazinepally – Supplemental Extra Work Slip No#49	35780.00	**This is work is within the scope of original works** It was carried out by the erection contrator M/s YANTRA EPCOM SOLUTIONS PRIVATE LIMITED. This work is an extra work and carried out when a discerpance was found in the original equipmemt supplied by M/s BHEL, New Delhi.
6	Cleaning of rotor spider studs, Nut & Bolts of Unit-3, coupling of two spider segments, matching & tightening of spiders studs, nuts & bolts and alignment of rotor segments of Unit-3 after tightening of rotor segments at PCHES Site, Vazinepally – Supplemental Extra Work Slip No#50	39662.00	**This is work is within the scope of original works** It was carried out by the erection contrator M/s YANTRA EPCOM SOLUTIONS PRIVATE LIMITED. This work is an extra work and carried out when a discerpance was found in the original equipmemt supplied by M/s BHEL, New Delhi.
7	Cleaning of rotor spider studs, Nut & Bolts of Unit-4, coupling of two spider segments, tightening of spiders studs, nuts & bolts and alignment of rotor segments of Unit-4 after tightening of rotor segments at PCHES Site, Vazinepally Supplemental Extra Work Slip No#51	39662.00	**This is work is within the scope of original works** It was carried out by the erection contrator M/s YANTRA EPCOM SOLUTIONS PRIVATE LIMITED. This work is an extra work and carried out when a discerpance was found in the original equipmemt supplied by M/s BHEL, New Delhi

Divisional Engineer
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TS Genco/ Vazinepally

Superintending Engineer
O&M Circle, Paloncha
TSGENCO, Vazine

8	Local Transportation of the equipment from stores to power house. Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associatec equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination. Number of Trials for Lowering of Runner in the location to make clearences between runner hub and Runner Envelop for clearence checking, grinding of runner envelop and Assembly, Gousing ,Cleaning of studs by kerosene & trails for checking discrepancy of studs of stayring of Unit-I. (Supplemental Extra work slip No- 47)	119988.00	This is work is within the scope of original works It was carried out by the erection contrator M/s YANTRA EPCOM SOLUTIONS PRIVATE LIMITED. This work is an extra work and carried out when a discerpance was found in the original equipmemt supplied by M/s BHEL, New Delhi.
9	Local Transportation of the equipment from stores to power house. Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination for PCHES (4X30MW)- "Assembly, welding, gouging of spider segments with partition plate-I, partition plate-I & partition plate-II and partition plate-II & stay ring of Unit-I & II". (Supplemental Extra work slip No-46)	149938.00	This is work is within the scope of original works It was carried out by the erection contrator M/s YANTRA EPCOM SOLUTIONS PRIVATE LIMITED. This work is an extra work and carried out when a discerpance was found in the original equipmemt supplied by M/s BHEL, New Delhi.

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TB Canal Vadinapally

Superintending Engineer
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PCHES, Kothamangalam

10	Local Transportation of the equipment from stores to power house, Erection, testing and commissioning of 4 sets of Turbine and Generator equipment along with auxiliary and associated equipment in complete including SCADA control, protection, AC & DC systems, Power Transformers, 11 KV SP Bus Ducts, Dewatering and Drainage system, HP & LP Air System, Fire Extinguishing system for generators cable tray erection complete, Cable Laying & its termination for PCHES (4X30MW)- "Assembly, welding, gouging of spider segments with partition plate-I, partition plate-I & partition plate-II and partition plate-II & stay ring of Unit-III & IV". (Supplemental Extra work slip No-48)	172633.00	This is work is in the scope of original work and carried out by the erection contrator M/s YANTRA EPCOM SOLUCTIONS PRIVATE LIMITED. This work is extra work and carried out when a discerpancy was found in the original equipment supplied by M/s BHEL, New Delhi.
	Total (Rs.)	1236199.00	

Divisional Engineer
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Abstract of Capital Budget Estimate for the year 2023-24

S.No.	Name of the work	Amount (Rs.)	Justification
1	procurement of 220KV SF6 filled silica rubber coated Current Transformer PCHES site	8400000.00	The procurement is towards the spares for 220KV switch yard as intial spares are not procured
2	procurement of 40MVA, 220/11KV Power Transformer at PCHES site	46000000.00	The procurement of Generator Transformer is essential and necessary as no spare is available and to avoid generation loss when there is a failure in the existing transformers
3	Procurement of certain instruments such as thermovisior camera and fluid harmonic leakage current measurement at PCHES site	500000.00	The procurement is towards the T&P of the plant as it is necessary to meet the requirement in emergency situations
4	Design,fabrication,supply,erection of supporting structure for head race and tail race level sensors at upstream side and downstream side for communication to SCADA at PCHES site	750000.00	The procurement is towards the T&P of the plant as it is necessary to meet the requirement in emergency situations
	Total (Rs.)	55650000.00	

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10.3 Cavitation Test

Cavitation characteristics curves of Turbine were drawn for varying sigma versus Efficiency, Q_{ED}, P_{ED}.

Calculation Of Sigma Plant

Atmospheric pressure at site (IEC 60193 :1999 clause 2.5.4.2) :

$$H_B = 101325 \times [\, 1 - 2.2558 \times 10^{-5} \times Z]^{5.255}$$

Z is Elev in meter = 23.39 m Runnner center line

H_B = 101044.4 Pa

H_B = 101044.4 / (9.784 × 997) = 10.35826 m Water column

Vapor pressure at Site (IEC 60193 : 1999 Table B- 4) at 25° C

H_V = 3169 Pa

H_V = 0.324831 m water column

Suction Head at Site

Minimum TWL (one m/c running) = EL 24.72 m

Runner center line = EL 23.39 m

H_S = - 1.33 m

Sigma Plant at Site

$\sigma_P = [H_B - H_V - H_S] / H_P$ $\quad \sigma_P = 11.3634 / H_P$

At H_{max} = 27.68 m $\quad \sigma_P = 0.411$

At H_{rated} = 24.00 m $\quad \sigma_P = 0.473$

At H_{min} = 12.00 m $\quad \sigma_P = 0.947$

RECORD No. 263

HYDRO MACHINERY DEVELOPMENT STATION

CAVITATION TEST REPORT

DATE 09 Mar 2009

PROJECT NAME: PULICHINTALA
RUNNER BLADE ANGLE 16°
REPORT No. B-4-039

AIR TEMPERATURE 28.2°C

TEST RIG No. [illegible]
MODEL DIA [illegible]

CIRCUIT CLOSED LOOP
INITIAL LOAD 120 kg

PUMP SETUP PARALLEL

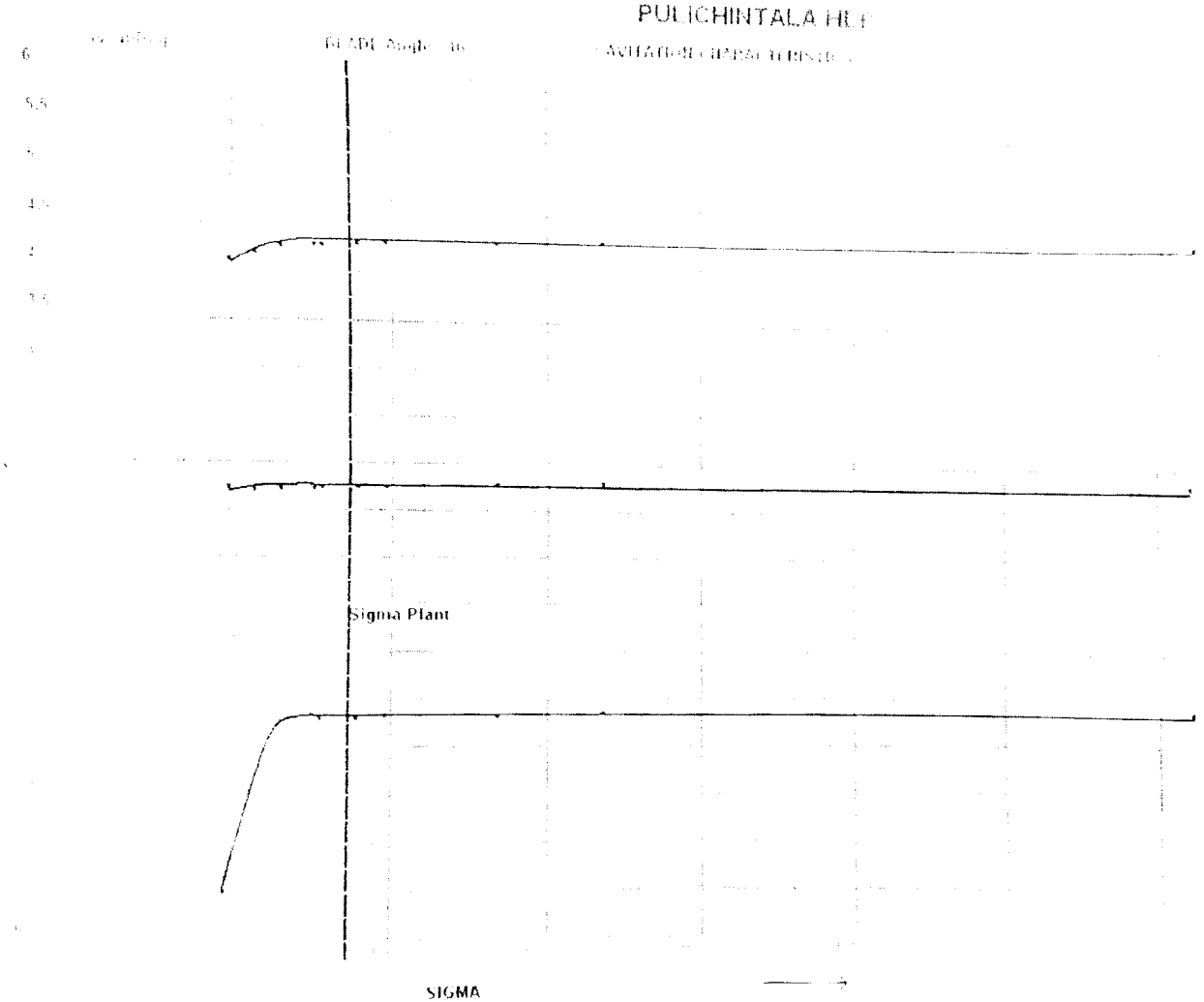
MODE TURBINE
PROTO DIA 4.6 m

CONST NII
PROTO HEAD 24 m

SI No	GA OPEN	FLOW RATE	PRESS HEAD	NETT HEAD	SUCT HEAD	ATMOS HEAD	TOTAL TORQUE	WATER TEMP	MODEL SPEED	OUTPUT POWER	MODEL EFFI	CAVI COEFF	UNIT SPEED	UNIT DISC	TURBINE EFFI	TURBINE OUTPUT	REMARK
	[illegible]	[illegible]	m	m	m	m	N-m	°C	RPM	kW	%	Sigma	RPM	l/s	%	MW	
		[illegible]	O2 kg/cm²		O3 kg/cm²	O4 kg/cm²	O1 Hz		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH m³/s	
[illegible]	[illegible]	[illegible]	9.011	9.4186	-0.146	9.8290	656.123	27.1	899.73	61.820	90.75	1.020	117.27	1510.29	92.85	34.135	CLEAR
			[illegible]		-0.0191	0.97748	6329.68		538.20	0.4381			37.48	0.4828		156.70	
[illegible]	[illegible]	[illegible]	[illegible]	9.4436	3.453	9.8275	654.946	27.2	901.63	61.839	90.71	0.636	117.36	1505.46	92.81	33.931	
			[illegible]		0.3394	0.97731	6324.57		538.23	0.4365			37.51	0.4812		156.07	
[illegible]	[illegible]	[illegible]	[illegible]	9.4800	4.069	9.8218	655.151	27.2	901.57	61.854	90.65	0.568	117.13	1498.18	92.75	33.948	
			[illegible]		0.4007	0.97671	6325.46		538.07	0.4341			37.44	0.4789		155.63	
[illegible]	[illegible]	[illegible]	9.073	[illegible]	4.755	9.8269	649.819	27.3	903.52	61.483	90.68	0.496	117.43	1490.61	92.78	33.527	
			[illegible]		0.4690	0.97721	6302.32		537.01	0.4321			37.54	0.4765		154.44	
[illegible]	[illegible]	[illegible]	9.124	9.5191	5.515	9.8207	637.825	27.4	904.66	60.425	89.13	0.413	117.29	1479.38	91.23	32.839	RAINING
			[illegible]		0.5447	0.97657	6250.27		536.89	0.4215			37.49	0.4729		153.47	
[illegible]	[illegible]	[illegible]	[illegible]	9.5058	5.174	9.8281	649.762	27.4	904.65	61.555	90.69	0.450	117.37	1484.24	92.79	33.441	MILD RAIN
			[illegible]		0.5108	0.97730	6302.07		536.92	0.4302			37.52	0.4744		153.87	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5.685	9.8268	622.636	27.5	904.64	58.985	87.11	0.397	117.54	1487.43	89.21	32.076	
			[illegible]		0.5617	0.97714	6184.35		536.90	0.4142			37.57	0.4755		153.97	
[illegible]	[illegible]	[illegible]	[illegible]	9.4787	4.920	9.8267	648.838	27.5	904.67	61.469	90.64	0.478	117.54	1489.45	92.74	33.393	START OF MILD RAIN
			[illegible]		0.4854	0.97713	6298.06		536.90	0.4315			37.57	0.4761		154.18	
[illegible]	[illegible]	[illegible]	9.101	9.4982	5.122	9.8248	649.187	27.5	904.48	61.489	90.62	0.455	117.39	1485.42	92.72	33.426	MILD RAIN
			[illegible]		0.5055	0.97694	6299.58		536.93	0.4303			37.52	0.4748		153.96	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9.8096	648.503	27.5	904.62	61.434	90.50	0.429	117.29	1481.73	92.60	33.382	
			[illegible]		0.5277	0.97542	6296.61		536.95	0.4286			37.49	0.4736		153.70	

[illegible] KHOBRE SANGEETA

M MANGLA


PULICHINTALA HE
Sigma Plant
SIGMA

RECORD No [illegible]

HYDRO MACHINERY DEVELOPMENT STATION

CAVITATION TEST REPORT

DATE 14 Mar 2009

PROJECT NAME PULICHINTALA HEP
RUNNER BLADE ANGLE 10°
REPORT No B-4-039

AIR TEMPERATURE 25°C

TEST RIG No [illegible] | CIRCUIT CLOSED LOOP | PUMP SETUP PARALLEL | MODE TURBINE | CONST GV
MODEL DIA [illegible] | INITIAL LOAD 120 kg | | PROTO DIA 4.6 m | PROTO HEAD 12 m

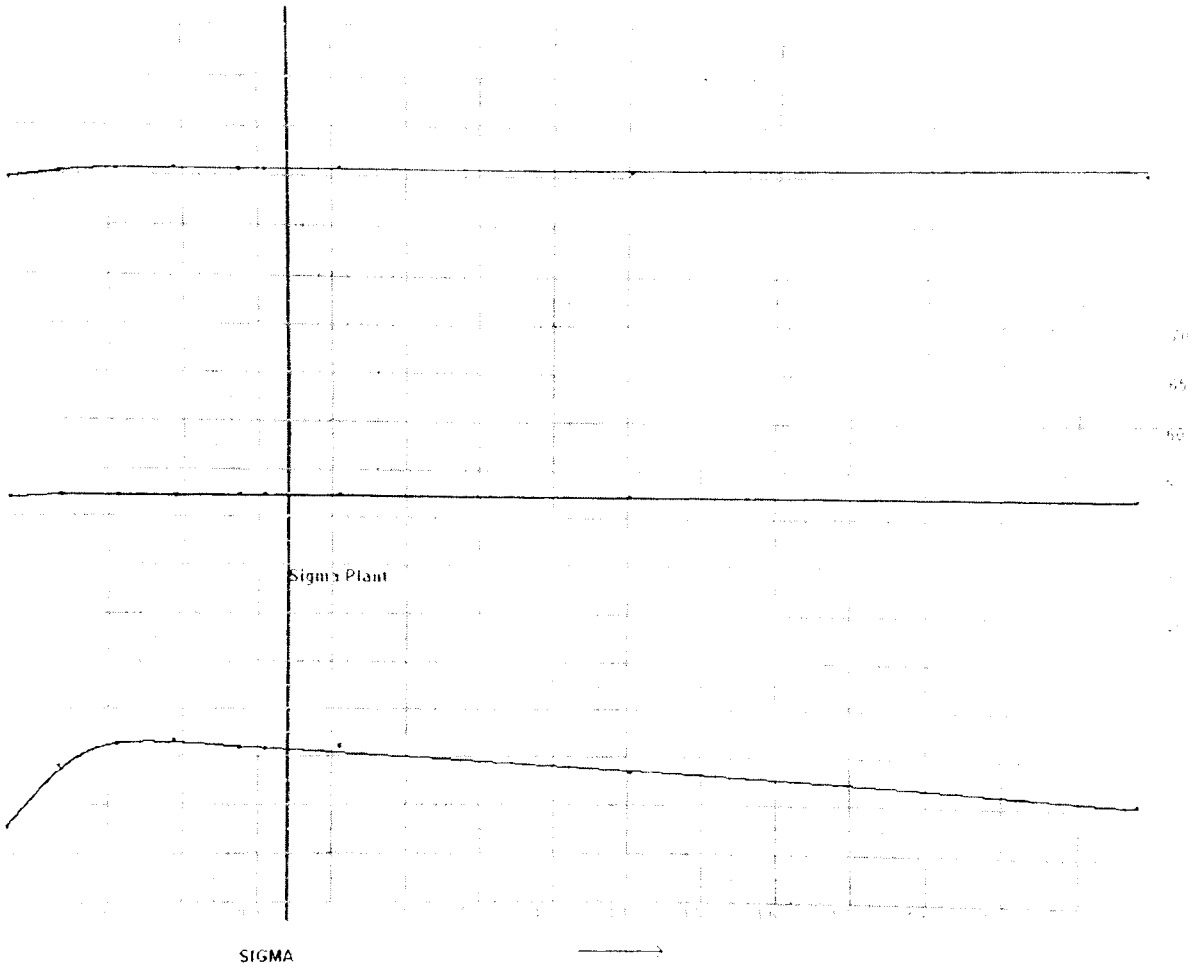
SL No	GV OPEN	FLOW RATE	PRESS HEAD	NETT HEAD	SUCT HEAD	ATMOS HEAD	TOTAL TORQUE	WATER TEMP	MODEL SPEED	OUTPUT POWER	MODEL EFFI	CAVI COEFF	UNIT SPEED	UNIT DISC	TURBINE EFFI	TURBINE OUTPUT	REMARK
	DEG	m³/s	m	m	m	m	N-m	°C	RPM	kW	%	Sigma	RPM	l/s	%	MW	
		Q5 Hz	Q2 kg/cm²		Q3 kg/cm²	Q4 kg/cm²	Q1 Hz		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH m³/s	
[illegible]	[illegible]	[illegible]	4.476	4.7172	-0.336	9.8142	239.906	26.7	900.57	22.625	86.16	2.076	165.86	1642.26	88.26	12.471	
		3223.35	0.4495		-0.0381	0.97612	4523.38		392.87	0.4523			53.02	0.5249		120.47	
2	[illegible]	0.6936	6.584	6.9411	-0.288	9.8097	355.313	26.7	1094.29	40.717	86.70	1.403	166.14	1645.52	88.80	12.508	
		3916.64	0.6596		-0.0333	0.97567	5024.22		476.91	0.4560			53.11	0.5260		120.51	
3	[illegible]	0.6931	6.573	6.9290	2.456	9.8105	356.556	26.8	1094.42	40.864	87.24	1.009	166.31	1645.65	89.34	12.547	
		3913.47	0.6584		0.2401	0.97573	5029.62		476.94	0.4589			53.16	0.5260		120.40	
[illegible]	[illegible]	[illegible]	6.592	6.9475	3.135	9.8033	357.272	26.8	1093.58	40.915	87.19	0.908	165.96	1642.02	89.29	12.592	
		[illegible]	0.6603		0.3077	0.97500	5032.73		476.92	0.4577			53.05	0.5249		120.38	
[illegible]	[illegible]	[illegible]	6.594	6.9498	3.389	9.8220	357.486	26.8	1093.66	40.942	87.21	0.874	165.94	1641.88	89.31	12.597	
		[illegible]	0.6606		0.3330	0.97686	5033.66		476.94	0.4577			53.04	0.5248		120.38	
[illegible]	[illegible]	[illegible]	6.594	6.9491	3.984	9.8157	357.950	26.9	1093.71	40.997	87.38	0.787	165.96	1641.32	89.48	12.612	
		[illegible]	0.6605		0.3922	0.97622	5035.67		476.98	0.4584			53.05	0.5246		120.33	
[illegible]	[illegible]	[illegible]	[illegible]	6.9559	4.515	9.8105	357.918	26.8	1093.74	40.995	87.29	0.709	165.88	1640.45	89.39	12.611	
		[illegible]	0.6612		0.4452	0.97571	5035.53		476.97	0.4577			53.02	0.5244		120.32	
[illegible]	[illegible]	[illegible]	6.608	6.9633	5.031	9.8102	356.288	26.9	1093.67	40.805	86.83	0.634	165.78	1638.82	88.93	12.557	
		[illegible]	0.6620		0.4965	0.97565	5028.45		477.01	0.4548			52.99	0.5238		120.28	
[illegible]	[illegible]	[illegible]	6.622	6.9747	5.503	9.8168	350.834	26.9	1093.69	40.181	85.58	0.566	165.65	1633.36	87.68	12.368	
		[illegible]	0.6633		0.5436	0.97631	5004.79		476.99	0.4468			52.95	0.5221		119.97	

NITIN KHODRE SANGEETA | M MANGLA

— 96 —

PULICHINTALA HEP

BLADE Angle 10 CAVITATION CHARACTERISTICS



RECORD No : 137

HYDRO MACHINERY DEVELOPMENT STATION

CAVITATION TEST REPORT

DATE 03 Mar 2009

PROJECT NAME: PULICHINTALA HEP
RUNNER BLADE ANGLE 5°
REPORT No : B-4-039

AIR TEMPERATURE 25°C

TEST RIG No :
MODEL D No : 4 —

CIRCUIT CLOSED LOOP
INITIAL LOAD 120 kg

PUMP SETUP : PARALLEL

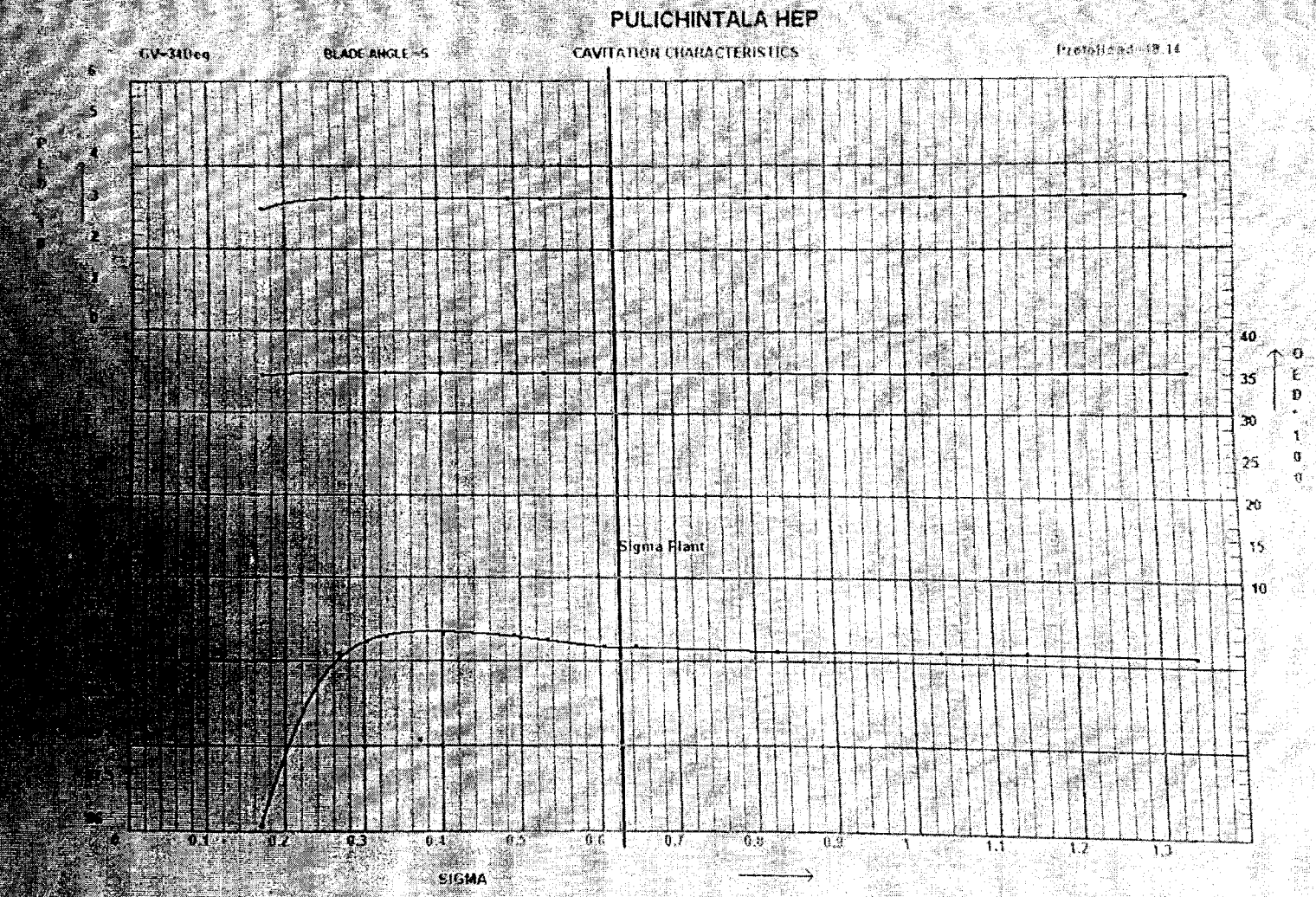
MODE : TURBINE
PROTO DIA 4.6 m

CONST GV
PROTO HEAD 18.14 m

SL No	GV OPEN	FLOW RATE	PRESS HEAD	NETT HEAD	SUCT HEAD	ATMOS HEAD	TOTAL TORQUE	WATER TEMP	MODEL SPEED	OUTPUT POWER	MODEL EFFI	CAVI COEFF	UNIT SPEED	UNIT DISC	TURBINE EFFI	TURBINE OUTPUT	REMARK
	DEG	m³/s	m	m	m	m	N-m	°C	RPM	kW	%	Sigma	RPM	l/s	%	MW	
		O3 Hz	O2 kg/cm²		O3 kg/cm²	O4 kg/cm²	O1 Hz		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH m³/s	
1	34.0	0.4693	6.971	7.1340	-0.130	9.7860	319.762	25.6	900.64	30.158	92.33	1.343	134.88	1098.11	94.43	16.589	
		2652.22	0.6983		-0.0176	0.97359	4869.94		427.81	0.3241			43.11	0.3510		99.06	
2	34.0	0.4689	6.956	7.1187	3.558	9.7803	319.095	25.6	900.62	30.095	92.40	0.827	135.02	1098.49	94.50	16.555	
		2650.28	0.6968		0.3500	0.97302	4867.05		427.79	0.3244			43.16	0.3511		98.99	
3	34.0	0.5340	9.014	9.2251	-0.104	9.7762	413.819	25.8	1024.59	44.401	92.38	1.034	134.94	1098.83	94.48	16.588	
		3017.15	0.9218		-0.0149	0.97259	5278.13		486.87	0.3244			43.13	0.3512		99.08	
4	34.0	0.5336	9.003	9.2140	3.473	9.7780	414.079	25.8	1024.59	44.429	92.57	0.647	135.02	1099.22	94.67	16.598	
		3015.04	0.9208		0.3415	0.97276	5279.26		486.83	0.3253			43.16	0.3514		99.06	
5	34.0	0.5334	9.002	9.2132	3.845	9.7772	413.962	25.8	1024.57	44.415	92.54	0.607	135.02	1099.43	94.64	16.594	
		3013.82	0.9207		0.3785	0.97267	5278.75		486.82	0.3252			43.16	0.3514		99.07	
6	34.0	0.5332	8.977	9.1882	4.535	9.7776	413.944	26.0	1023.24	44.356	92.79	0.533	135.03	1099.49	94.89	16.637	
		3012.71	0.9182		0.4473	0.97267	5278.67		486.77	0.3262			43.16	0.3515		99.07	
7	34.0	0.5332	8.974	9.1847	4.918	9.7752	414.423	26.1	1023.19	44.405	92.94	0.491	135.05	1099.65	95.04	16.657	
		3012.47	0.9178		0.4854	0.97242	5280.75		486.79	0.3267			43.17	0.3515		99.07	
8	34.0	0.5329	8.978	9.1886	5.747	9.7759	414.245	26.1	1023.09	44.381	92.97	0.401	135.00	1097.96	95.07	16.653	
		3010.92	0.9183		0.5680	0.97248	5279.98		486.74	0.3263			43.15	0.3510		98.95	
9	34.0	0.5331	8.977	9.1871	6.962	9.7747	411.658	26.1	1022.97	44.099	92.30	0.268	135.00	1099.20	94.40	16.556	
		3011.97	0.8981		0.6891	0.97235	5268.75		486.72	0.3243			43.15	0.3514		99.07	
10	34.0	0.5332	8.977	9.1804	6.424	9.7772	414.063	26.2	1022.97	44.357	92.89	0.327	135.05	1099.81	94.99	16.650	
		3012.22	0.9174		0.6354	0.97259	5279.19		486.72	0.3266			43.17	0.3516		99.08	
11	34.0	0.5332	8.975	9.1859	6.648	9.7698	413.496	26.2	1022.91	44.293	92.70	0.302	135.00	1099.50	94.80	16.630	
		3012.29	0.9176		0.6577	0.97185	5276.73		486.72	0.3258			43.15	0.3515		99.09	
12	34.0	0.5270	8.983	9.1747	7.884	9.7761	379.953	26.3	1022.90	40.700	86.19	0.168	135.08	1088.63	88.29	15.308	
		2979.64	0.9172		0.7899	0.97244	5131.16		495.70	0.2999			43.18	0.3480		98.05	

NITIN KHODRE/SANGEETA

M MANGLA


PULICHINTALA HEP
GV=34Deg
BLADE ANGLE =5
CAVITATION CHARACTERISTICS
Sigma Plant
SIGMA
0.1
0.2
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0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
10
15
20
25
30
35
40

HYDRO MACHINERY DEVELOPMENT STATION

RECORD No 280

CAVITATION TEST REPORT

DATE 09 Mar 2009

PROJECT NAME: PULICHINTALA HEP
RUNNER BLADE ANGLE 16°
REPORT No B-4-039

AIR TEMPERATURE 28.2°C

TEST RIG No
MODEL DIA

CIRCUIT CLOSED LOOP
INITIAL LOAD 120 kg

PUMP SETUP PARALLEL

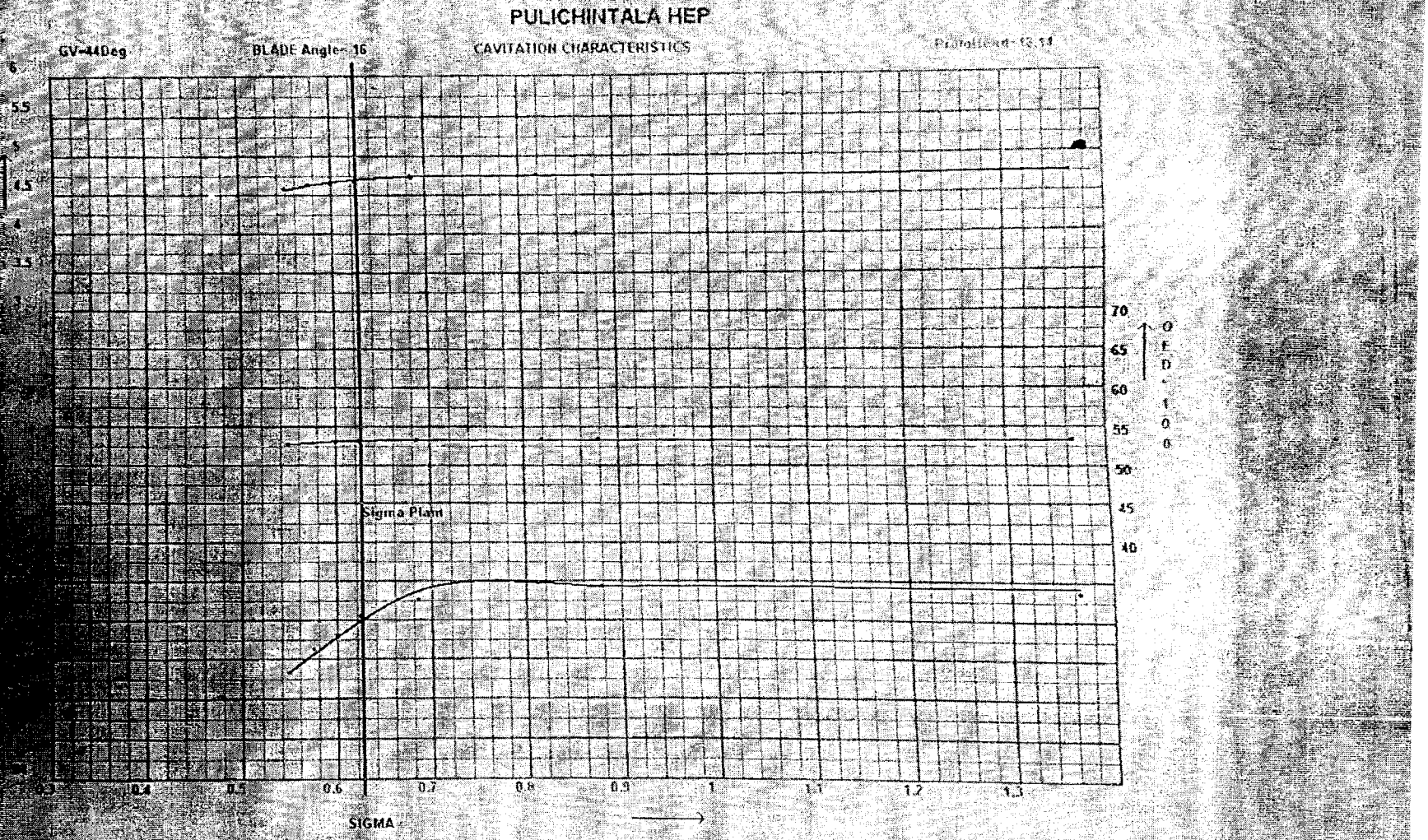
MODE TURBINE
PROTO DIA 4.6 m

CONST GV
PROTO HEAD 18.14 m

Sl No	GV OPEN	FLOW RATE	PRESS HEAD	NETT HEAD	SUCT HEAD	ATMOS HEAD	TOTAL TORQUE	WATER TEMP	MODEL SPEED	OUTPUT POWER	MODEL EFFI	CAVI COEFF	UNIT SPEED	UNIT DISC	TURBINE EFFI	TURBINE OUTPUT	REMARK
	DEG	m³/s	m	m	m	m	N-m	°C	RPM	kW	%	Sigma	RPM	l/s	%	MW	
		O5 Hz	O2 kg/cm²		O3 kg/cm²	O4 kg/cm²	O1 Hz		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH m³/s	
	22.50	0.7170	6.750	7.1312	-0.337	9.7926	469.474	28.0	899.81	44.237	88.73	1.366	134.78	1678.14	90.83	24.439	
		4046.93	0.6759		-0.0381	0.97360	5519.66		486.92	0.4759			43.08	0.5364		151.49	
2	22.50	0.7167	6.763	7.1436	3.131	9.7989	469.914	28.0	901.60	44.367	88.88	0.879	134.93	1675.98	90.98	24.364	
		4045.17	0.6771		0.3072	0.97421	5521.57		486.87	0.4761			43.13	0.5357		151.12	
3	22.50	0.7166	6.751	7.1420	3.561	9.7974	470.349	28.0	901.68	44.412	89.00	0.819	134.96	1675.85	91.10	24.382	
		4044.40	0.6770		0.3501	0.97405	5523.46		486.88	0.4768			43.14	0.5357		151.08	
4	22.50	0.7162	6.790	7.1699	4.497	9.7967	468.441	28.1	903.65	44.329	88.54	0.685	134.99	1671.76	90.64	24.180	
		4042.37	0.6798		0.4432	0.97398	5515.18		486.85	0.4732			43.15	0.5344		150.68	
5	22.50	0.7138	6.825	7.2026	5.092	9.7979	463.705	28.1	904.67	43.930	87.63	0.599	134.84	1662.42	89.73	23.888	
		4028.91	0.6833		0.5025	0.97409	5494.62		486.86	0.4657			43.10	0.5314		150.01	
	22.50	0.7147	6.806	7.1787	4.922	9.7880	465.285	28.2	904.58	44.075	88.11	0.623	135.05	1667.14	90.21	23.972	
		4033.54	0.6808		0.4856	0.97308	5501.48		486.83	0.4695			43.17	0.5329		150.20	
	22.50	0.7156	6.822	7.1986	5.263	9.7880	460.161	28.2	906.48	43.681	87.29	0.574	135.14	1660.93	89.39	23.613	
		4024.56	0.6829		0.5195	0.97307	5479.24		486.88	0.4634			43.20	0.5309		149.53	
	22.50	0.7130	6.840	7.2150	5.439	9.7875	456.984	28.2	906.56	43.384	86.67	0.548	135.00	1655.81	88.77	23.451	
		4019.76	0.6847		0.5370	0.97301	5465.46		486.83	0.4587			43.15	0.5293		149.23	

CHKD: EBC/DPE/SANGEETA

M MANGLA


PULICHINTALA HEP
CAVITATION CHARACTERISTICS
GV=44Deg
BLADE Angle= 16
Sigma Plant
SIGMA
6
5.5
5
4.5
4
3.5
0.4
0.5
0.6
0.7
0.8
0.9
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1.1
1.2
1.3
70
65
60
55
50
45
40

HYDRO MACHINERY DEVELOPMENT STATION

RECORD No : 548

CAVITATION TEST REPORT

DATE : 21 Mar 2009

PROJECT NAME: PULICHINTALA HEP
RUNNER BLADE ANGLE 0°
REPORT No: B-4-039

AIR TEMPERATURE 25°C

TEST RIG No : 1
MODEL DIA : 4 m

CIRCUIT CLOSED LOOP
INITIAL LOAD 120 kg

PUMP SETUP PARALLEL

MODE TURBINE
PROTO DIA 4.6 m

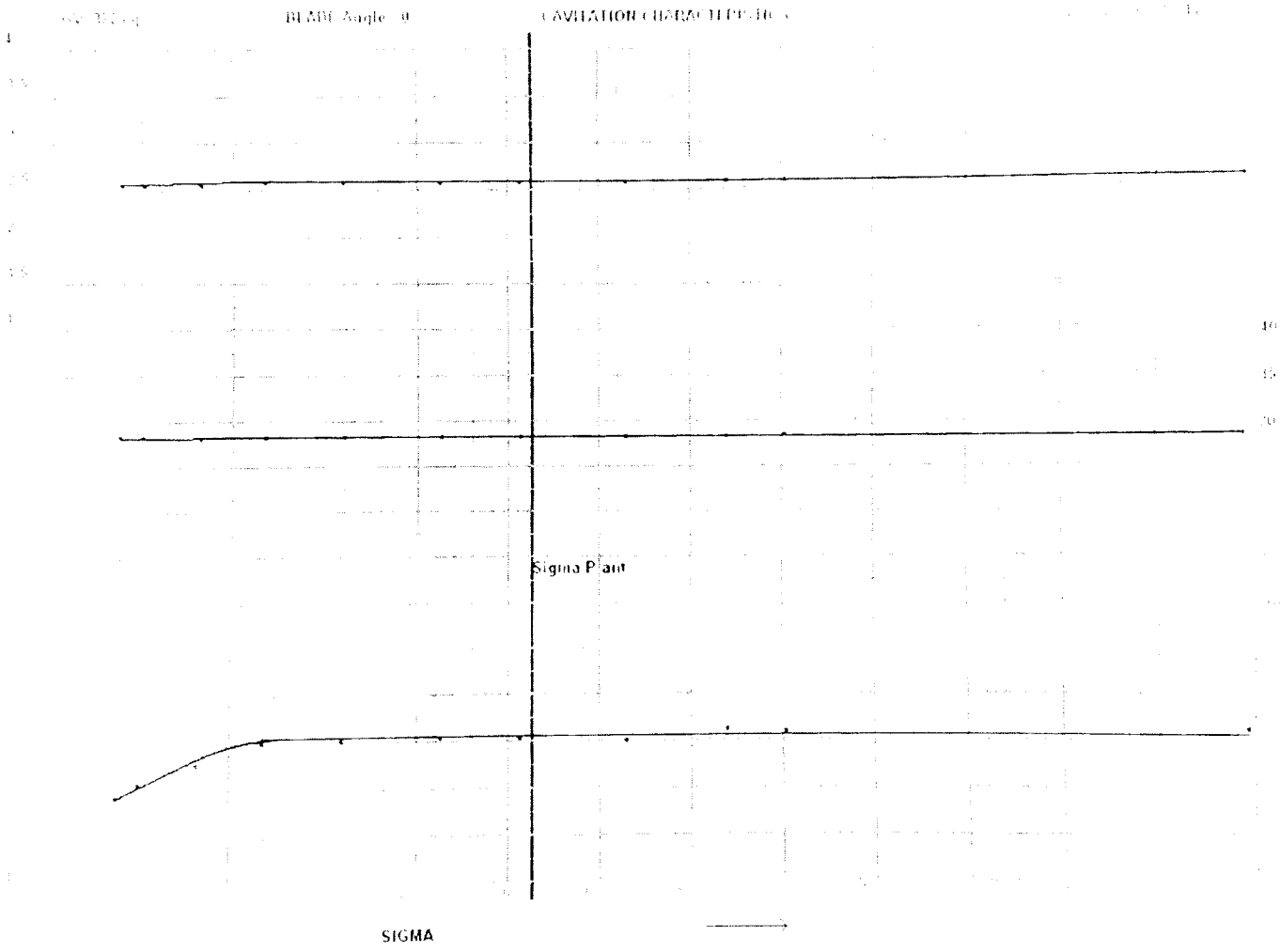
CONST GV
PROTO HEAD 18.14 m

SL No	GV OPEN	FLOW RATE	PRESS HEAD	NETT HEAD	SUCT HEAD	ATMOS HEAD	TOTAL TORQUE	WATER TEMP	MODEL SPEED	OUTPUT POWER	MODEL EFFI	CAVI COEFF	UNIT SPEED	UNIT DISC	TURBINE EFFI	TURBINE OUTPUT	REMARK
	DEG	m³/s	m	m	m	m	N-m	°C	RPM	kW	%	Sigma	RPM	l/s	%	MW	
		O5	O2		O3	O4	O1		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH m³/s	
		Hz	kg/cm²		kg/cm²	kg/cm²	Hz										
1	32.00	0.3796	6.972	7.0786	-0.422	9.8052	253.708	27.5	899.90	23.909	91.24	1.392	135.29	891.75	93.34	13.194	
		3145.24	0.6980		-0.0466	0.97499	4583.28		412.88	0.2600			43.25	0.2850		80.19	
2	32.00	0.3797	6.965	7.0716	3.052	9.8135	253.377	27.5	899.93	23.878	91.20	0.903	135.37	892.34	93.30	13.176	
		3145.59	0.6973		0.2993	0.97581	4581.84		413.74	0.2601			43.27	0.2852		80.21	
3	32.00	0.3797	6.980	7.0868	3.477	9.8075	254.084	27.5	899.96	23.946	91.25	0.840	135.23	891.48	93.35	13.212	CLEAR
		3145.82	0.6988		0.3417	0.97521	4584.91		413.63	0.2601			43.22	0.2850		80.21	
4	32.00	0.3796	7.004	7.1107	4.242	9.8021	254.234	27.5	899.97	23.960	91.02	0.729	135.00	889.79	93.12	13.220	CLEAR
		3145.36	0.7012		0.4179	0.97466	4585.56		413.77	0.2589			43.15	0.2844		80.19	
5	32.00	0.3795	6.991	7.0974	5.093	9.8192	253.823	27.6	899.89	23.919	91.07	0.613	135.11	890.33	93.17	13.201	
		3144.61	0.6999		0.5026	0.97635	4583.78		413.95	0.2592			43.19	0.2846		80.17	
6	32.00	0.3795	7.028	7.1352	5.689	9.8153	255.314	27.6	899.81	24.058	91.10	0.525	134.74	888.01	93.20	13.281	
		3144.70	0.7036		0.5620	0.97596	4590.25		414.14	0.2586			43.07	0.2839		80.19	
7	32.00	0.3792	6.995	7.1019	6.456	9.8221	253.441	27.6	900.84	23.908	91.05	0.420	135.21	889.32	93.15	13.154	SLIGHT
		3142.83	0.7003		0.6384	0.97662	4582.12		413.89	0.2589			43.22	0.2843		80.02	RAIN
8	32.00	0.3791	6.991	7.0973	7.053	9.8020	253.056	27.6	900.85	23.873	91.05	0.334	135.26	888.85	93.15	13.134	
		3141.96	0.6999		0.6979	0.97462	4580.45		413.90	0.2587			43.24	0.2841		79.95	
9	32.00	0.3793	7.034	7.1161	7.567	9.8264	251.742	27.7	900.83	23.748	90.60	0.264	135.13	886.17	92.70	13.068	
		3143.45	0.7042		0.7490	0.97704	4574.75		414.08	0.2567			43.20	0.2833		79.79	RAINING
10	32.00	0.3791	6.985	7.0913	7.993	9.8090	250.368	27.7	900.74	23.616	90.20	0.202	135.30	888.69	92.30	13.000	
		3141.96	0.6993		0.7914	0.97532	4568.79		414.18	0.2563			43.25	0.2841		79.92	
11	32.00	0.3792	6.980	7.0868	7.993	9.8166	288.452	27.7	966.08	29.182	89.92	0.177	135.20	890.90	92.02	13.021	PULSATING
		3142.39	0.6988		0.7914	0.97606	4734.06		443.52	0.2561			43.22	0.2848		80.17	FLOW

NITIN KHODRE/SANGEETA

M MANGLA

PULICHINTALA HEP



PULICHINTALA HEP Turbine Model witness Test : DAY 1 Test and Comments

Day no. 1 Date: 07/04/09

Schedule for the day	
First Half	Opening Meeting for briefing about model testing techniques and procedure. Familiarization with test bed. Presentation of Pre- witness test results.
Second Half	Calibration of Head Transducer, Cavitation Transducer, Torque Transducer, Checking of speed pick up Performance Test at $\beta = 5°$ at various guide vanes at different speed factors: i. Ned = 34.94, corresponding to protohead = 27.68m ii. Ned = 37.52, corresponding to protohead = 24 m (rated) iii. Ned = 53.07 ,corresponding to protohead = 12 m
Comments	
1.	Witness Test Schedule is accepted.
2.	Head, Cavitation, Torque calibrations coefficients are same as calculated at start of Pre-Witness Test. Speed check was found to be OK.
3.	Performance Test were conducted at $\beta = 5°$ at various guide vanes at different speed factors. Performance Test results were compared with pre witness Test Results and they were found to be quite matching. From these test scale up in efficiency is calculated as 2.2 %. For witness testing efficiency scale up will be taken 2.1 %. The same value of scale up was used for Pre - witness Test.

BHEL / NAFA(Hydrolab) APGENCO

Minutes of meeting regarding Model Witness testing for PULICHINTALA HEP (4 x 30 MW) held at Hydro Lab, BHEL Bhopal on 07/4/2009.

Members Present:

S/Shri

APGENCO

I.H.T. Ramesh Babu, SE/HD-II
N. Venugopal, ADE (CEE Projects /Vidyut Soudha)

BHEL, BHOPAL

M.Mangla, AGM (Hydro Lab)
SYH Rizvi , DGM (HSS)
Nitin Khodre, Dy. Manager(Hydro Lab)
Sangeeta Kerketta,Dy.Manager (Hydro Lab)
Kundan Maheshwari,Engineer Trainee

1. BHEL presented Model Test Procedure and explained the model test methodology Pre-witness test results were presented.
2. BHEL gave brief description of the laboratory and the visiting team was made familiar with the test bed.
3. It was agreed that testing would be carried out as per the approved Test Procedure as per the Contract Specification and model witness test program given at Annexure I.
4. It was agreed that the witness data and calibration certificates would be signed by BHEL & APGENCO as the testing progresses.
5. Model Witness Test Programme for PULICHINTALA HEP is attached at Annexure I.

BHEL / AGM (Hydro Lab)

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Annexure I

TENTATIVE WITNESS TEST SCHEDULE FOR PULICHINTALA HEP

Date	Activity
07-04-09	Opening Meeting Presentation of Pre-witness test results Familiarization with test bed Torque, speed, head Calibration Performance Test Start for first blade angle
08-04-09	Performance Test for first blade Angle contd. Cavitation test & pressure pulsation test for first blade Angle Runaway Test at first blade angle Runner Dismantling for angle change, Setting of angle
09-04-08	Assembly of model Performance Test for second blade Angle
10-04-09	Cavitation test & pressure pulsation test corresponding to different Heads Runaway test Runner Dismantling for angle change, Setting of angle
11-04-09	Assembly of model Performance Test for Third blade Angle Cavitation test & pressure pulsation test corresponding to different Heads Runaway test Runner Dismantling for angle change
	12-04-09 SUNDAY (Setting of angle & assembly of model)
13-04-09	Performance Test for fourth blade Angle Cavitation test & pressure pulsation test corresponding to different Heads Runaway test
*14-04-09	Runner Dismantling for angle change Setting of Angle, Assembly of model
15-04-09	Performance Test for Fifth blade Angle Cavitation test & pressure pulsation test corresponding to different Heads
16-04-09	Cavitation test & pressure pulsation test corresponding to different Heads Runaway test
17-04-09	Temperature Calibration Dismantling of model Loop connection for flow calibration Dimensional check of model
18-04-09	Dimensional check of model (contd.) Flow calibration check Closing meeting & handing over witness test Data

* 14-04-09 may be declared as holiday

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Page 2 of 2

HYDRO MACHINERY DEVELOPMENT STATION

CALIBRATION OF DIGIQUARTZ PRESSURE TRANSDUCER USED FOR CAVITATION

CERTIFICATE NUMBER	HLX/172/0409/02	DATE: 07/04/2009
AMBIENT TEMPERATURE	24°C ~ 25°C	
SPECIFICATION OF EQUIPMENT UNDER CALIBRATION	DIGIQUARTZ PRESSURE TRANSDUCER (L.P.)	
	MAKE	PAROSCIENTIFIC, INC.
	NUMBER	89679
	RANGE	0 to 100 PSI
	DIGIQUARTZ PRESSURE TRANSDUCER (Level)	
	MAKE	PAROSCIENTIFIC,INC
	NUMBER	95101
	RANGE	0 to 100 PSI
TRACEABILITY OF CALIBRATION	DEAD WEIGHT ROTARY PISTON MANOMETER	
	MAKE	ASTRO
	NUMBER	1514-86
	CERTIFICATE NO. FOR PISTON & CYLINDER DIA.	TSD/IC/GMR/05/043
	DEAD WEIGHTS FOR PISTON MANOMETER	
	MAKE	ASTRO
	SERIAL NUMBER	A100 D100 E100 E101 G100
	CERTIFICATE NO	PSL/213/0507/M/0225
	DATED	17.05.07
DIGIQUARTZ PRESSURE	Y = A x PRESSURE READ + B	
CALIBRATION COEFFICIENTS	A = 0.99837	B = 0.0046

BHEL/AGM (Hydro Lab)

APGE NCO

ADE/CE(P) Projects

Page 1 of 2

HYDRO MACHINERY DEVELOPMENT STATION

CALIBRATION OF DIGIQUARTZ PRESSURE TRANSDUCER USED FOR CAVITATION

CERTIFICATE NO. HLX/172/0409/02 DATE: 07/04/2009

Weight Applied	Standard Pressure Kg/cm²	Pressure Read Kg/cm²	Digiquartz Pressure Kg/cm²	Error %
A100	0.4514	0.447550	0.451421	-0.005
A100+E101	0.6512	0.647520	0.651065	0.021
A100+E101+E100	0.8496	0.846735	0.849955	-0.042
A100+D100	0.9519	0.948916	0.951970	-0.007
A100+D100+G100	1.0020	0.998965	1.001936	0.006
A100+D100+G100	1.0020	0.998965	1.001936	0.006
A100+D100	0.9519	0.948916	0.951969	-0.007
A100+E101+E100	0.8496	0.846899	0.850119	-0.061
A100+E101	0.6512	0.647520	0.651065	0.021
A100	0.4514	0.447550	0.451421	-0.005

BHEL/AGM (Hydro Lab)

APGENCO

SE/HD-2

AOE/CE/Projects

PULICHINTALA HEP Turbine Model witness Test: DAY 2 Test and Comments

Day no. 2 Date: 08/04/09

Schedule for the day	
First Half	Cavitation Tests at blade angle β = 5° were carried out for the following conditions & Pressure Pulsations were taken near plant sigma. i. Prototype head = 27.68 m, GV opening = 27.5° for proto output ~ 26 MW ii. Prototype head = 24.00 m, GV opening = 29.5° for proto output ~ 22.3 MW
Second Half	Cavitation Tests at blade angle β = 5 ° were carried out for the following conditions & Pressure Pulsations were taken near plant sigma. i. Prototype head =12 m, GV opening = 44° for proto output ~10.5 MW Runaway Test at blade angle β = 5° at various guide vane opening. Runner Dismantling for angle change, Setting of angle β = -5 °.
Comments	
1.	Cavitation Test demonstrated that efficiency at sigma plant is practically same as on higher sigma values. Cavitation Characteristic curves demonstrate that sufficient margin exists in sigma plant. Pressure pulsations were taken at sigma plant and were found to be within ± 1.3 % which is well within the safe range.
2.	From Runaway Test On CAM Runaway speed is 271.6, 262.3, 222.6 RPM corresponding to protohead of 27.68m, 24m, 12m respectively whereas maximum OFF CAM Runaway speed corresponding to 42^0 GV opening is 330.7 RPM.

BHEL / AGM (HydroLab)

SE/HO-2 ADE
APGENCO

RECORD No : 836

HYDRO MACHINERY DEVELOPMENT STATION

CAVITATION TEST REPORT

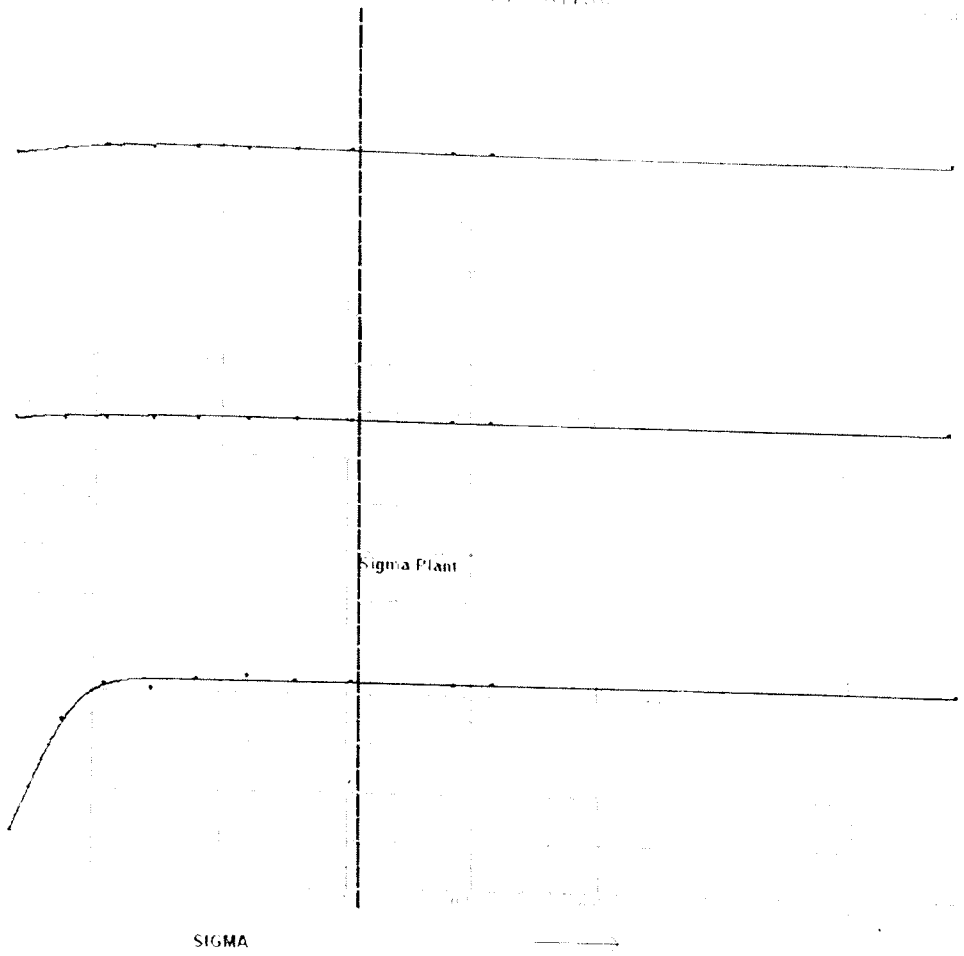
DATE : 08 Apr 2009

PROJECT NAME : PULICHINTALA HEP
RUNNER BLADE ANGLE : 5°
REPORT No : B-4-039

AIR TEMPERATURE : 23°C

TEST RIG No : 1 | CIRCUIT : CLOSED LOOP | PUMP SETUP : PARALLEL | MODE : TURBINE | CONST : GV
MODEL DIA : 4 m | INITIAL LOAD : 120 kg | PROTO DIA : 4.6 m | PROTO HEAD : 27.68 m

SL No	GV OPEN	FLOW RATE	PRESS HEAD	NETT HEAD	SUCT HEAD	ATMOS HEAD	TOTAL TORQUE	WATER TEMP	MODEL SPEED	OUTPUT POWER	MODEL EFFI	CAVI COEFF	UNIT SPEED	UNIT DISC	TURBINE EFFI	TURBINE OUTPUT	REMARK
	DEG	m³/s	m	m	m	m	N-m	°C	RPM	kW	%	Sigma	RPM	l/s	%	MW	
		O5 Hz	O2 kg/cm²		O3 kg-cm²	O4 kg/cm²	O1 Hz		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH m³/s	
1	27.5	0.4846	10.667	10.8409	-0.167	9.7811	501.598	27.2	899.98	47.273	92.27	0.884	109.33	919.84	94.37	26.073	
		2737.35	1.0662		-0.0213	0.97268	5659.07		512.06	0.2713			34.95	0.2940		102.36	
2	27.5	0.4838	10.663	10.8363	3.814	9.7807	500.546	27.2	900.06	47.178	92.28	0.516	109.37	918.46	94.38	26.014	CLEAR
		2732.65	1.0657		0.3753	0.97263	5654.51		512.56	0.2709			34.96	0.2936		102.18	
3	27.59	0.4836	10.671	10.8448	4.154	9.7848	500.721	27.2	899.95	47.189	92.27	0.485	109.31	917.74	94.37	26.029	CLEAR
		2731.53	1.0666		0.4092	0.97303	5655.27		512.55	0.2707			34.94	0.2934		102.15	
4	27.59	0.4825	10.675	10.8477	5.032	9.7781	499.773	27.3	900.00	47.102	92.28	0.403	109.30	915.57	94.38	25.978	PP TAKEN
		2725.41	1.0669		0.4966	0.97235	5651.15		512.64	0.2701			34.94	0.2927		101.92	MILD RAIN
5	27.5	0.4815	10.689	10.8606	5.515	9.7904	499.308	27.4	899.98	47.057	92.28	0.359	109.23	913.07	94.38	25.955	
		2719.60	1.0683		0.5447	0.97355	5649.13		512.65	0.2694			34.92	0.2919		101.70	
6	27.59	0.4809	10.704	10.8743	5.942	9.7960	498.839	27.4	899.95	47.012	92.35	0.320	109.16	909.82	94.45	25.932	MILD RAIN
		2711.59	1.0697		0.5872	0.97411	5647.10		512.52	0.2686			34.89	0.2908		101.41	
7	27.5	0.4795	10.718	10.8874	6.357	9.7820	497.438	27.4	900.03	46.884	92.28	0.280	109.11	906.36	94.38	25.856	LIGHT RAIN
		2702.59	1.0711		0.6285	0.97271	5641.02		512.67	0.2673			34.88	0.2897		101.07	
8	27.59	0.4794	10.738	10.9065	6.730	9.7814	494.373	27.4	900.16	46.602	92.07	0.245	109.03	900.70	94.17	25.690	RAINING
		2699.83	1.0732		0.6657	0.97264	5627.72		512.66	0.2651			34.85	0.2879		100.51	
9	27.59	0.4748	10.729	10.8965	7.129	9.7772	492.320	27.5	901.85	46.495	92.16	0.209	109.28	898.96	94.26	25.487	
		2691.94	1.0723		0.7054	0.97221	5618.81		512.62	0.2649			34.93	0.2874		100.09	
	27.5	0.4742	10.787	10.9539	7.487	9.7900	490.384	27.5	901.87	46.314	91.42	0.176	109.00	895.56	93.52	25.391	HEAVY
		2678.85	1.0780		0.7411	0.97348	5610.41		512.37	0.2617			34.84	0.2863		99.97	RAINING
1	27.59	0.4719	10.754	10.9194	7.992	9.7713	473.746	27.5	902.86	44.791	89.16	0.138	109.29	892.36	91.26	24.490	PULSATING FLOW
		2663.09	1.0748		0.7814	0.97161	5538.20		512.47	0.2543			34.93	0.2852		99.34	


Sigma Plant
SIGMA

RECORD No

HYDRO MACHINERY DEVELOPMENT STATION

CAVITATION TEST REPORT

DATE 08 Apr 2009

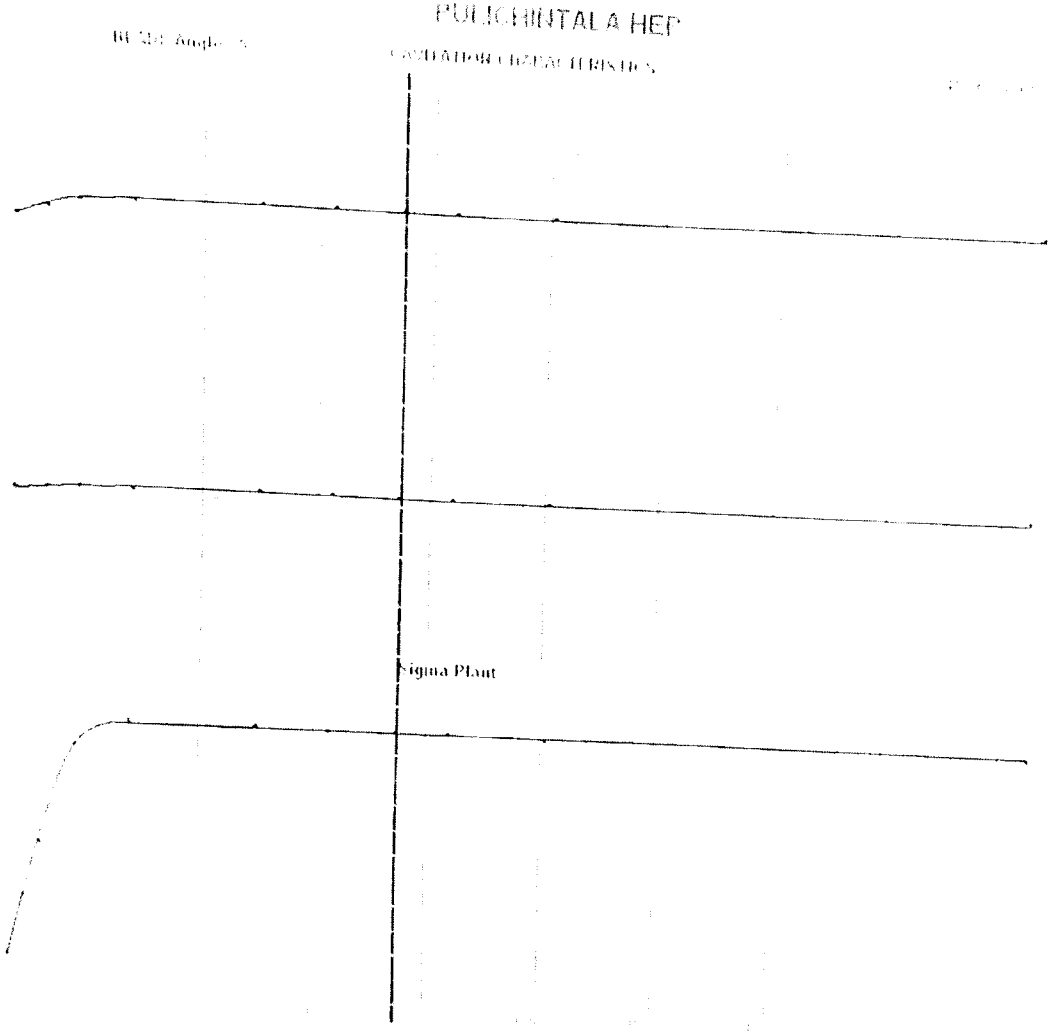
PROJECT NAME PULICHINTALA HEP
RUNNER BLADE ANGLE 5
REPORT No B 4039

AIR TEMPERATURE 23°C

TEST RIG No
MODEL DIA 4 m
CIRCUIT CLOSED LOOP
INITIAL LOAD 120 kg
PUMP SETUP PARALLEL
MODE TURBINE
PROTO DIA 4.6 m
CONST GV
PROTO HEAD 24 m

SI No	GV OPEN %	FLOW RATE m³/s	PRESS HEAD m	NET HEAD m	SUCT HEAD m	ATMOS HEAD m	TOTAL TORQUE N-m	WATER TEMP °C	MODEL SPEED RPM	OUTPUT POWER kW	MODEL EFFI %	CAVI COEFF Sigma	UNIT SPEED RPM	UNIT DISC l/s	RUN EFFI %	TURBINE OUTPUT MW	REMARK
			O2 kg/cm²		O3 kg/cm²	O4 kg/cm²	O1 Hz		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH m³/s	
					-0.231	0.97212	429.356	27.5	899.90	40.461	92.44	1.025	117.46	974.77	94.54	22.325	
					-0.0276	0.97159	5345.56		480.90	0.2880			37.55	0.3116		100.97	
					-0.3730	0.97189	429.512	27.6	899.94	40.478	92.45	0.603	117.43	974.09	94.55	22.329	CLEAR
					-0.3669	0.97235	5346.24		481.57	0.2879			37.53	0.3114		100.93	
					-4.516	0.97753	429.705	27.6	899.87	40.493	92.48	0.519	117.41	973.98	94.58	22.343	CLEAR
					-0.4452	0.97199	5347.07		481.10	0.2879			37.53	0.3113		100.93	
					-4.958	0.97717	429.208	27.6	899.87	40.446	92.49	0.472	117.46	974.02	94.59	22.317	PP TAKEN
					-0.4891	0.97162	5344.91		481.38	0.2879			37.55	0.3113		100.89	CLEAR
					-5.516	0.97745	429.301	27.6	899.84	40.453	92.47	0.413	117.40	972.86	94.57	22.323	CLEAR
					-0.5447	0.97189	5345.32		481.86	0.2876			37.53	0.3110		100.83	
					-6.112	0.97758	428.576	27.7	899.68	40.378	92.53	0.349	117.38	970.59	94.63	22.294	WEAK RAIN
					-6.621	0.97201	5342.17		481.43	0.2870			37.52	0.3102		100.61	
					-7.135	0.97657	426.410	27.7	900.00	40.188	92.54	0.239	117.32	963.39	94.64	22.165	SLIGHT RAIN
					-7.655	0.97101	5332.77		481.68	0.2849			37.50	0.3079		99.91	
					-8.563	0.97641	424.257	27.7	899.92	39.982	92.01	0.193	117.27	963.01	94.11	22.060	RAINING
					-8.459	0.97084	5323.43		481.77	0.2832			37.49	0.3078		99.92	
					-9.036	0.97632	413.932	27.7	899.97	39.011	90.07	0.166	117.28	959.90	92.17	21.532	HEAVY RAIN
					-9.741	0.97074	5278.62		481.46	0.2763			37.49	0.3068		99.58	
					-10.275	0.97631	463.002	27.8	900.65	38.009	87.84	0.138	117.17	954.27	89.94	20.943	PULSATING FLOW
					-10.790	0.97073	5231.19		482.09	0.2679			37.46	0.3050		99.09	

-112-


PULICHINTALA HEP
Sigma Plant
SIGMA

RECORD No 827

HYDRO MACHINERY DEVELOPMENT STATION

CAVITATION TEST REPORT

DATE 08 Apr 2009

PROJECT NAME PULICHINTALA HEP
RUNNER BLADE ANGLE 5°
REPORT No B-4-039

TEST RIG No 1 | CIRCUIT CLOSED LOOP | PUMP SETUP PARALLEL | MODE TURBINE | AIR TEMPERATURE 23°C
MODEL DIA 4 m | INITIAL LOAD 120 kg | | PROTO DIA 4.6 m | CONST GV
PROTO HEAD 12 m

PL No	GV OPEN	FLOW RATE	PRESS HEAD	NETT HEAD	SUCT HEAD	ATMOS HEAD	TOTAL TORQUE	WATER TEMP	MODEL SPEED	OUTPUT POWER	MODEL EFFI	CAVI COEFF	UNIT SPEED	UNIT DISC	TURBINE EFFI	TURBINE OUTPUT	REMARK
	DEG	m³/s	m	m	m	m	N-m	°C	RPM	kW	%	Sigma	RPM	l/s	%	MW	
		O5 Hz	O2 kg/cm²		O3 kg/cm²	O4 kg/cm²	O1 Hz		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH m³/s	
1	44.00	0.5913	7.092	7.3516	-0.252	9.7397	317.607	27.8	1124.99	37.417	88.28	1.307	165.97	1362.94	90.38	10.577	CLEAR
		3338.3	0.7100		-0.0297	0.96840	4860.59		458.87	0.3846			53.05	0.4357		99.92	
2	44.00	0.5911	7.095	7.3539	2.373	9.7355	317.709	27.8	1125.09	37.432	88.31	0.949	165.95	1362.41	90.41	10.579	PP TAKEN
		3337.50	0.7102		0.2317	0.96797	4861.03		459.11	0.3846			53.05	0.4355		99.89	CLEAR
3	44.00	0.5905	7.102	7.3603	3.646	9.7400	317.671	27.8	1125.19	37.431	88.28	0.776	165.90	1361.04	90.38	10.576	CLEAR
		3335.58	0.7109		0.3585	0.96840	4860.86		459.61	0.3841			53.03	0.4351		99.82	
4	44.00	0.5909	7.097	7.3555	4.549	9.7330	317.076	27.9	1127.20	37.428	88.31	0.652	166.25	1361.79	90.41	10.518	MILD RAIN
		3336.30	0.7104		0.4484	0.96771	4858.28		459.37	0.3844			53.14	0.4353		99.66	
5	44.00	0.5899	7.101	7.3591	5.474	9.7401	317.221	27.9	1125.16	37.377	88.30	0.527	165.91	1359.07	90.40	10.562	
		3330.40	0.7108		0.5406	0.96840	4858.91		459.42	0.3836			53.03	0.4344		99.67	
6	44.00	0.5897	7.111	7.3690	6.284	9.7374	314.554	27.9	1126.06	37.092	87.54	0.416	165.93	1357.68	89.64	10.458	SLIGHT RAIN
		3329.22	0.7118		0.6212	0.96813	4847.34		459.85	0.3799			53.04	0.4340		99.56	
7	44.00	0.5891	7.123	7.3802	6.689	9.7423	310.215	27.9	1127.14	36.616	86.38	0.361	165.96	1355.26	88.48	10.298	RAIN
		3325.80	0.7130		0.6615	0.96861	4828.51		459.84	0.3742			53.05	0.4332		99.36	

BHEL/AGM (Hydro Lab)

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SE/HDS

AOE/CE/Projects

PULICHINTAL HEP Turbine Model witness Test: DAY 3 Test and Comments

Day no. 3 Date:09/04/09

Schedule for the day	
First Half	Assembly of model. Performance Test at β = -5° at various guide vane openings at different speed factors: i. Ned = 34.94 corresponding to protohead = 27.68 m. ii. Ned = 37.52 corresponding to protohead = 24 m. iii. Ned = 53.07 corresponding to protohead = 12 m
Second Half	Cavitation Tests at blade angle β = -5° were carried out for the following conditions & Pressure Pulsations were taken near plant sigma. i. Prototype head = 27.68 m,GV opening =17.5° for proto output ~14.1 MW ii. Prototype head = 24 m,GV opening = 20.5° for proto output ~12.4 MW iii. Prototype head = 12 m, GV opening = 30° for proto output ~ 5.6 MW Runaway Test at blade angle β = -5° at various guide vane opening.
Comments	
1.	Performance Test were conducted at β = -5° at various guide vane openings at different speed factors. Performance Test results were compared with pre-witness Test Results and they were found to be quite matching.
2.	Cavitation Test demonstrated that efficiency at sigma plant is practically same as on higher sigma values. Cavitation Characteristic curves demonstrate that sufficient margin exists in sigma plant. Pressure pulsations were taken at sigma plant and were found to be within ± 0.9 % which is well within the safe range.
3.	From Runaway Test On CAM Runaway speed is 270.7, 269.6, 218.6 RPM corresponding to protohead of 27.68m, 24m,12m respectively whereas maximum OFF CAM Runaway speed corresponding to 42° GV opening is 349.6 RPM.

BHEL / AGM (Hydrolab)

APGENCO SE/HO: 2

RECORD No 861

HYDRO MACHINERY DEVELOPMENT STATION

CAVITATION TEST REPORT

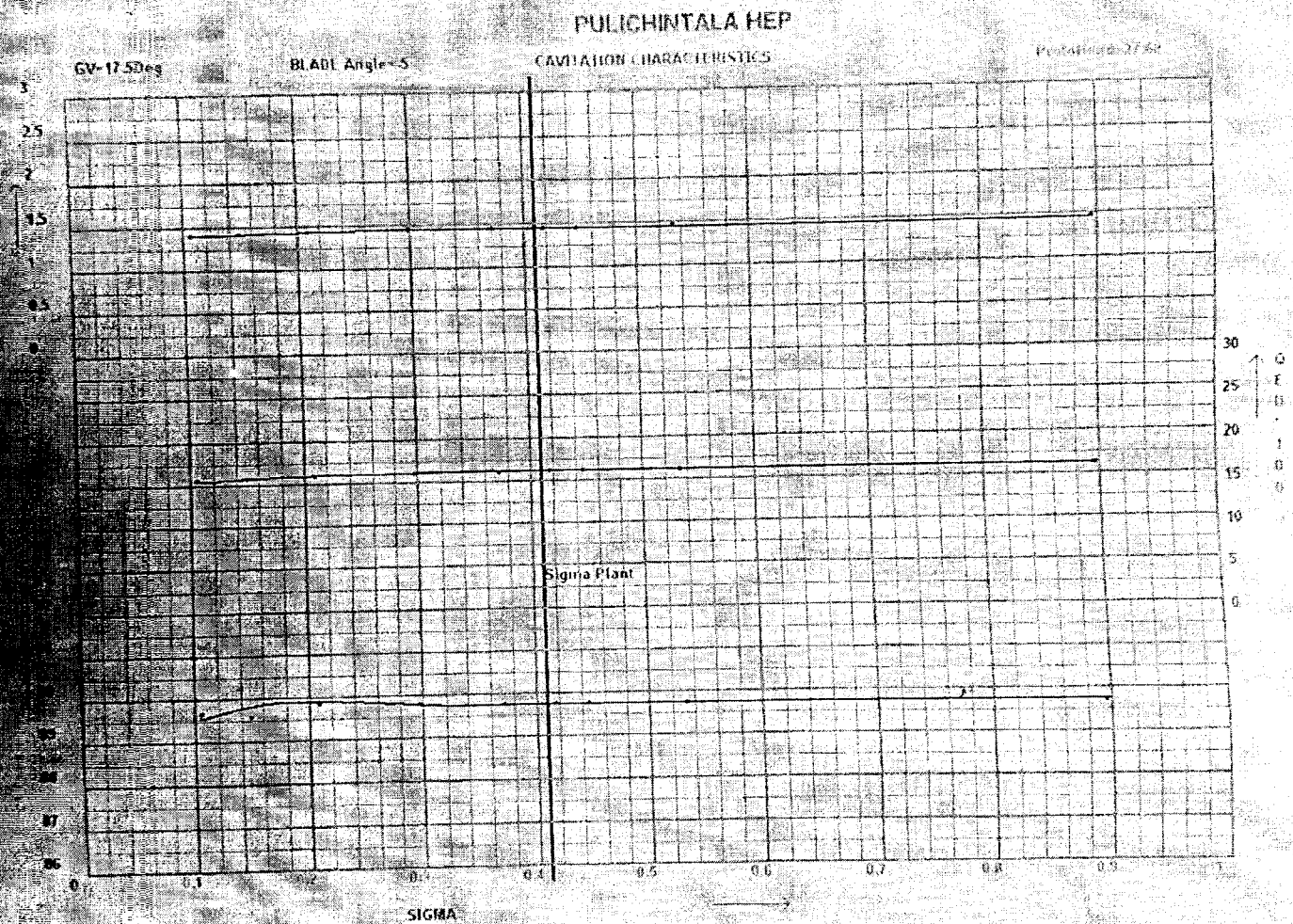
DATE 09 Apr 2009

PROJECT NAME PULICHINTALA HEP
RUNNER BLADE ANGLE -5°
REPORT No. B-4-039

AIR TEMPERATURE 24.3°C

TEST RIG No 1 | CIRCUIT CLOSED LOOP | PUMP SETUP PARALLEL | MODE TURBINE | CONST GV
MODEL DIA 4 m | INITIAL LOAD 120 kg | | PROTO DIA 4.6 m | PROTO HEAD 27.68 m

SL No	GV OPEN	FLOW RATE	PRESS HEAD	NETT HEAD	SUCT HEAD	ATMOS HEAD	TOTAL TORQUE	WATER TEMP	MODEL SPEED	OUTPUT POWER	MODEL EFFI	CAVI COEFF	UNIT SPEED	UNIT DISC	TURBINE EFFI	TURBINE OUTPUT	REMARK
	DEG	m³/s	m	m	m	m	N-m	°C	RPM	kW	%	Sigma	RPM	l/s	%	MW	
		O5	O2		O3	O4	O1		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH m³/s	
		Hz	kg/cm²		kg/cm²	kg/cm²	Hz										
1	17.50	0.2700	10.839	10.8934	-0.304	9.7780	272.979	25.3	900.98	25.756	89.74	0.895	109.19	511.31	91.84	14.159	CLEAR
		1528.30	1.0839		-0.0349	0.97286	4666.91		479.99	0.1466			34.90	0.1634		56.97	
2	17.50	0.2695	10.841	10.8945	3.643	9.7794	272.595	25.3	900.95	25.719	89.76	0.533	109.18	510.36	91.86	14.140	CLEAR
		1525.52	1.0840		0.3585	0.97299	4665.24		480.64	0.1464			34.90	0.1631		56.87	
3	17.50	0.2692	10.834	10.8872	4.577	9.7705	272.063	25.4	901.09	25.672	89.78	0.447	109.24	509.88	91.88	14.109	MILD RAIN
		1523.58	1.0833		0.4515	0.97210	4662.94		480.60	0.1463			34.92	0.1630		56.79	
4	17.50	0.2688	10.818	10.8720	4.918	9.7837	271.314	25.4	901.14	25.603	89.79	0.417	109.32	509.49	91.89	14.068	PP TAKEN
		1521.33	1.0818		0.4855	0.97340	4659.69		480.49	0.1463			34.94	0.1629		56.70	SLIGHT RAIN
5	17.50	0.2684	10.803	10.8560	5.396	9.7680	270.495	25.5	901.15	25.526	89.79	0.372	109.40	509.12	91.89	14.026	
		1519.10	1.0802		0.5331	0.97183	4656.13		480.51	0.1461			34.97	0.1627		56.62	
6	17.50	0.2674	10.801	10.8549	6.194	9.7604	269.506	25.5	901.11	25.432	89.80	0.298	109.41	507.28	91.90	13.976	SLIGHT RAIN
		1513.50	1.0800		0.6126	0.97107	4651.84		481.01	0.1457			34.97	0.1622		56.41	
7	17.50	0.2659	10.830	10.8821	7.169	9.7734	267.941	25.5	901.13	25.285	89.85	0.209	109.27	502.15	91.95	13.894	
		1506.13	1.0829		0.7098	0.97235	4645.05		480.56	0.1442			34.93	0.1605		55.91	
8	17.50	0.2647	10.850	10.9013	7.814	9.7720	265.321	25.5	901.12	25.037	89.61	0.149	109.17	497.26	91.71	13.759	RAINING
		1498.90	1.0849		0.7741	0.97221	4633.68		480.72	0.1425			34.90	0.1590		55.42	
9	17.50	0.2617	10.857	10.9077	8.289	9.7750	264.414	25.6	902.14	24.980	89.68	0.105	109.26	495.31	91.78	13.681	HEAVY RAIN
		1488.48	1.0856		0.8214	0.97250	4629.74		480.62	0.1420			34.93	0.1583		55.16	


PULICHINTALA HEP
CAVITATION CHARACTERISTICS
GV=17.5Deg
BLADE Angle=5
Sigma Plant
SIGMA

RECORD No : 870

HYDRO MACHINERY DEVELOPMENT STATION

CAVITATION TEST REPORT

DATE : 09 Apr 2009

PROJECT NAME. **PULICHINTALA HEP**
RUNNER BLADE ANGLE -5°
REPORT No. : B-4-039

TEST R'G No : 1
MODEL DIA : 4 m

CIRCUIT : CLOSED LOOP
INITIAL LOAD 120 kg

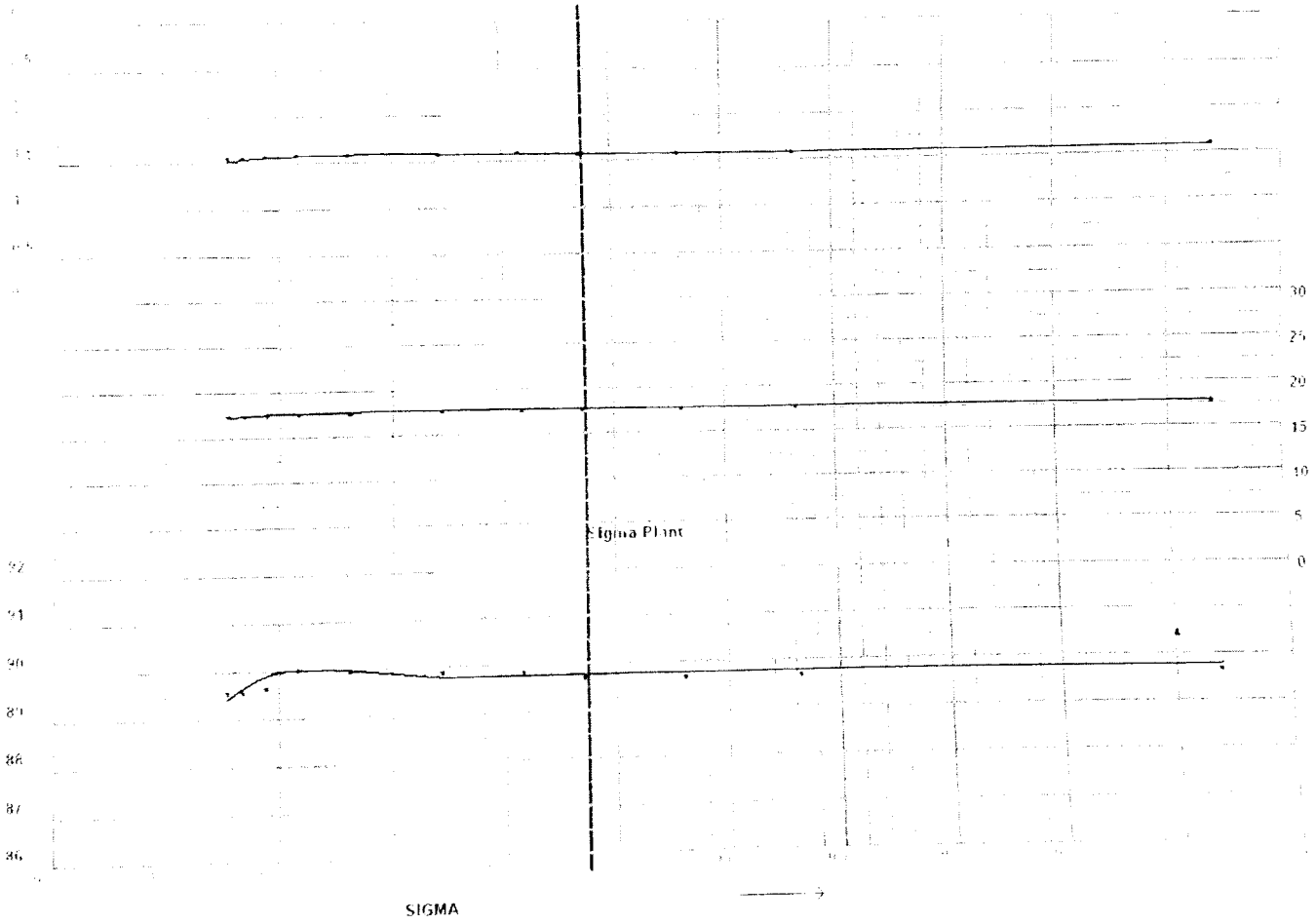
PUMP SETUP : PARALLEL

MODE : TURBINE
PROTO DIA : 4.6 m

AIR TEMPERATURE : 25°C
CONST : GV
PROTO HEAD : 24 m

SL No.	GV OPEN	FLOW RATE	PRESS HEAD	NETT HEAD	SUCT HEAD	ATMOS HEAD	TOTAL TORQUE	WATER TEMP	MODEL SPEED	OUTPUT POWER	MODEL EFFI	CAVI COEFF	UNIT SPEED	UNIT DISC	TURBINE EFFI	TURBINE OUTPUT	REMARK
	DEG	m³/s	m	m	m	m	N-m	°C	RPM	kW	%	Sigma	RPM	l/s	%	MW	
		O5 Hz	O2 kg/cm²		O3 kg/cm²	O4 kg/cm²	O1 Hz		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH m³/s	
1	20.50	0.2732	9.352	9.4078	-0.336	9.7681	238.538	25.7	900.14	22.485	89.67	1.038	117.39	556.68	91.77	12.397	CLEAR
		1546.07	0.9356		-0.0381	0.97179	4517.44		448.85	0.1595			37.52	0.1779		57.70	
2	20.50	0.2731	9.363	9.4184	3.177	9.7732	238.756	25.7	900.12	22.505	89.69	0.664	117.32	556.10	91.79	12.409	CLEAR
		1545.33	0.9367		0.3119	0.97230	4518.39		449.77	0.1595			37.50	0.1778		57.67	
3	20.50	0.2729	9.361	9.4164	4.153	9.7670	238.580	25.8	900.08	22.488	89.68	0.560	117.33	555.89	91.78	12.401	CLEAR
		1544.59	0.9365		0.4092	0.97167	4517.63		449.93	0.1594			37.50	0.1777		57.65	
4	20.50	0.2729	9.367	9.4222	5.003	9.7723	238.815	25.8	899.88	22.505	89.71	0.470	117.27	555.64	91.81	12.419	PP TAKEN
		1544.36	0.9371		0.4940	0.97220	4518.65		449.80	0.1593			37.48	0.1776		57.65	CLEAR
5	20.50	0.2726	9.358	9.4129	5.513	9.7598	238.662	25.8	899.96	22.492	89.83	0.415	117.33	555.39	91.93	12.408	
		1542.89	0.9361		0.5448	0.97095	4517.98		449.65	0.1594			37.51	0.1775		57.59	
6	20.50	0.2722	9.349	9.4036	6.195	9.7643	238.175	25.8	900.06	22.449	89.89	0.343	117.40	554.82	91.99	12.380	CLEAR
		1540.55	0.9352		0.6127	0.97140	4515.87		450.01	0.1594			37.53	0.1773		57.50	
7	20.50	0.2712	9.350	9.4041	6.962	9.7692	237.503	25.8	900.01	22.384	89.97	0.262	117.39	552.66	92.07	12.347	SLIGHT RAIN
		1534.61	0.9353		0.6891	0.97188	4512.95		449.82	0.1590			37.52	0.1767		57.28	
8	20.50	0.2701	9.347	9.4013	7.394	9.7639	236.597	25.9	900.05	22.300	90.02	0.216	117.42	550.52	92.12	12.298	LIGHT RAIN
		1528.45	0.9351		0.7321	0.97135	4509.02		449.46	0.1584			37.53	0.1760		57.05	
9	20.50	0.2695	9.372	9.4256	7.644	9.7613	235.433	25.9	900.94	22.212	89.64	0.188	117.38	548.53	91.74	12.215	
		1524.90	0.9375		0.7571	0.97108	4503.97		449.59	0.1571			37.52	0.1753		56.86	
10	20.50	0.2688	9.384	9.4372	7.831	9.7570	235.026	25.9	900.92	22.173	89.59	0.168	117.31	546.92	91.69	12.194	
		1521.36	0.9387		0.7757	0.97064	4502.20		449.47	0.1566			37.50	0.1748		56.73	
11	20.50	0.2686	9.367	9.4205	7.959	9.7555	234.414	25.9	900.92	22.116	89.58	0.154	117.41	546.99	91.68	12.163	HEAVY RAIN
		1520.20	0.9370		0.7884	0.97049	4499.55		449.50	0.1566			37.53	0.1748		56.68	

BHEL


Sigma Plant
SIGMA

RECORD No 881

HYDRO MACHINERY DEVELOPMENT STATION

CAVITATION TEST REPORT

PROJECT NAME: **PULICHINTALA HEP**
RUNNER BLADE ANGLE -5°
REPORT No.: B-4-039

DATE 09 Apr 2009

TEST RIG No
MODEL DIA 4 m

CIRCUIT CLOSED LOOP
INITIAL LOAD 120 kg

PUMP SETUP PARALLEL

MODE TURBINE
PROTO DIA 4.6 m

CONST GV
PROTO HEAD 12 m

AIR TEMPERATURE 23°C

SL No	GV OPEN	FLOW RATE	PRESS HEAD	NETT HEAD	SUCT HEAD	ATMOS HEAD	TOTAL TORQUE	WATER TEMP	MODEL SPEED	OUTPUT POWER	MODEL EFFI	CAVI COEFF	UNIT SPEED	UNIT DISC	TURBINE EFFI	TURBINE OUTPUT	REMARK
	DEG	m³/s	m	m	m	m	N-m	°C	RPM	kW	%	Sigma	RPM	l/s	%	MW	
		O5 Hz	O2 kg/cm²		O3 kg/cm²	O4 kg/cm²	O1 Hz		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH m³/s	
1	30.00	0.3362	7.709	7.7928	-0.336	9.7660	179.815	26.0	1159.20	21.828	85.41	1.252	166.10	752.61	87.51	5.642	
		1901.07	0.7718		-0.0381	0.97152	4262.60		421.86	0.2055			53.09	0.2406		55.13	
2	30.00	0.3361	7.727	7.8105	2.286	9.7732	180.007	26.0	1160.35	21.873	85.40	0.914	166.08	751.73	87.50	5.636	CLEAR
		1901.02	0.7736		0.2232	0.97223	4263.43		422.79	0.2052			53.09	0.2403		55.07	PP TAKEN
3	30.00	0.3361	7.706	7.7897	3.219	9.7702	179.789	26.1	1160.36	21.847	85.54	0.797	166.30	752.59	87.64	5.629	CLEAR
		1900.65	0.7715		0.3162	0.97193	4262.49		422.97	0.2058			53.16	0.2406		55.06	CLEAR
4	30.00	0.3358	7.713	7.7970	4.578	9.7730	180.195	26.1	1159.32	21.876	85.65	0.622	166.07	751.61	87.75	5.652	
		1899.05	0.7722		0.4516	0.97220	4264.25		423.02	0.2058			53.09	0.2403		55.07	CLEAR
5	30.00	0.3356	7.712	7.7958	5.706	9.7708	180.135	26.1	1159.30	21.869	85.67	0.477	166.08	751.28	87.77	5.650	
		1898.04	0.7721		0.5639	0.97197	4263.99		422.81	0.2057			53.09	0.2401		55.04	CLEAR
6	30.00	0.3352	7.716	7.7994	6.520	9.7614	179.956	26.1	1159.37	21.848	85.65	0.371	166.06	750.26	87.75	5.644	
		1895.90	0.7725		0.6450	0.97103	4263.21		422.89	0.2054			53.08	0.2398		54.97	
7	30.00	0.3350	7.716	7.7993	6.883	9.7653	179.947	26.1	1159.42	21.848	85.72	0.325	166.06	749.63	87.82	5.643	
		1894.32	0.7725		0.6812	0.97142	4263.17		423.19	0.2054			53.08	0.2396		54.92	
8	30.00	0.3339	7.739	7.8221	7.277	9.7703	179.860	26.2	1159.36	21.836	85.69	0.274	165.81	746.26	87.79	5.641	
		1888.53	0.7748		0.7205	0.97191	4262.79		423.41	0.2044			53.00	0.2385		54.76	RAINING
9	30.00	0.3335	7.732	7.8140	7.666	9.7731	179.274	26.2	1159.18	21.762	85.60	0.225	165.87	745.66	87.70	5.625	
		1886.02	0.7740		0.7592	0.97218	4260.25		423.16	0.2040			53.02	0.2383		54.70	RAINING

BHEL APGENCO SE/HO

PULICHINTALA HEP Turbine Model witness Test: DAY 4 Test and Comments

Day no. 4 Date: 10/04/09

Schedule for the day	
First Half	Runner Dismantling for angle change, Setting of angle β =10°. Assembly of model.
Second Half	Performance Test at β = 10° at various guide vane openings at different speed factors: i. Ned = 34.94 corresponding to protohead = 27.68 m. ii. Ned = 37.52 corresponding to protohead = 24 m. iii. Ned = 53.07 corresponding to protohead = 12 m Cavitation Tests at blade angle β = 10° were carried out for the following conditions & Pressure Pulsations were taken near plant sigma. i. Prototype head = 27.68 m,GV opening = 31.5° for proto output~ 31.5 MW
Comments	
1.	Performance Test were conducted at β = 10° at various guide vane openings at different speed factors. Performance Test results were compared with pre-witness Test Results and they were found to be quite matching.
2.	Cavitation Test demonstrated that efficiency at sigma plant is practically same as on higher sigma values. Cavitation Characteristic curve demonstrates that sufficient margin exists in sigma plant. Pressure pulsations were taken at sigma plant and were found to be within ± 0.75 % which is well within the safe range.

BHEL/AGM (Hydro Lab)

APGENCO SE/HO & ADE I/C EE/Projects

HYDRO MACHINERY DEVELOPMENT STATION

CAVITATION TEST REPORT

PROJECT NAME PULICHINTALA HEP
RUNNER BLADE ANGLE 10°
REPORT No B-4-039

DATE 30 Apr 2020

CIRCUIT CLOSED LOOP
INITIAL LOAD 120 kg

PUMP SETUP PARALLEL

MODE TURBINE
PROTO DIA 4.6 m

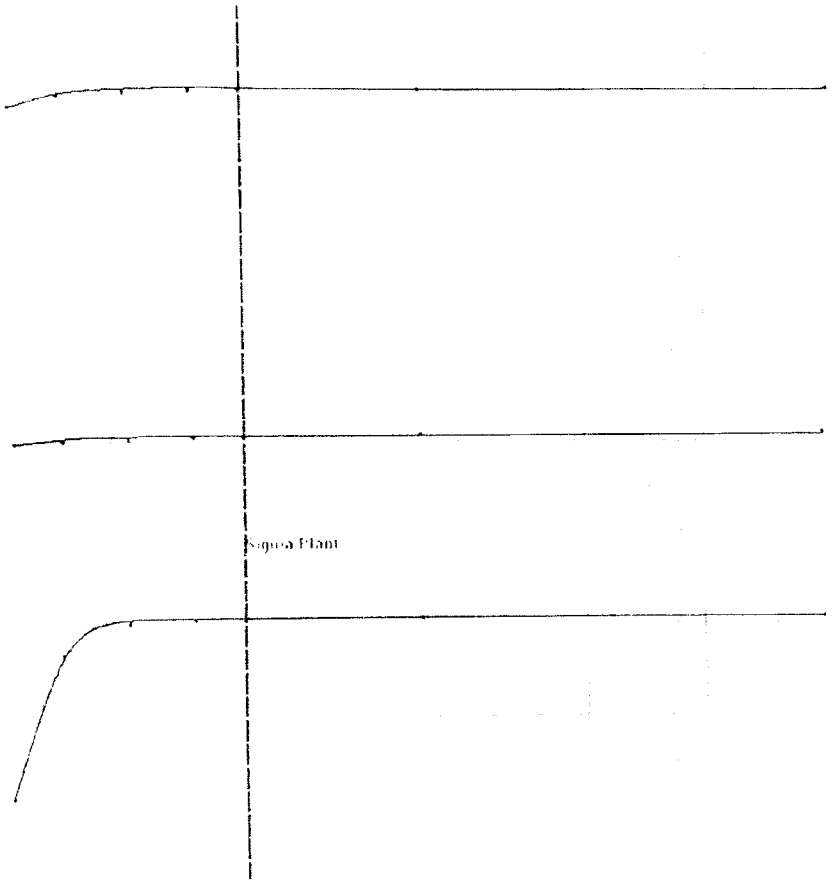
AIR TEMPERATURE 23 °C

	FLOW RATE	PRESS HEAD	NETT HEAD	SUCT HEAD	ATMOS HEAD	TOTAL TORQUE	WATER TEMP	MODEL SPEED	OUTPUT POWER	MODEL EFFI	CAVI COEFF	UNIT SPEED	UNIT DISC	TURBINE EFFI	TURBINE OUTPUT	REMARK
	DEG	m³/s	m	m	m	N-m	°C	RPM	kW	%	Sigma	RPM	l/s	%	MW	
				05	04	01		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH m³/s	
				-0.310	9.7686	613.906	25.5	899.90	57.853	92.14	0.900	109.38	1128.27	94.24	31.903	
				-0.0355	0.97189	6146.47		531.02	0.3323			34.96	0.3607		125.51	
				3.352	9.7661	613.007	25.5	899.93	57.770	92.16	0.560	109.29	1123.66	94.26	31.854	CLEAR
				0.3294	0.97162	6142.57		531.23	0.3310			34.93	0.3592		125.10	
				4.007	9.7701	609.182	25.6	900.89	57.471	92.13	0.408	109.34	1116.24	94.23	31.588	PP TAKEN
				0.4934	0.97201	6125.96		531.57	0.3287			34.95	0.3568		124.21	SLIGHT RAIN
				5.428	9.7751	608.048	25.6	900.91	57.365	92.14	0.368	109.23	1110.62	94.24	31.528	
				0.5365	0.97250	6121.05		531.35	0.3271			34.91	0.3550		123.71	
				6.013	9.7659	605.039	25.7	901.90	57.144	92.03	0.313	109.18	1102.51	94.13	31.304	RAIN
				0.5946	0.97158	6107.99		531.42	0.3243			34.90	0.3524		122.86	
				6.626	9.7808	599.749	25.7	902.77	56.699	91.39	0.258	109.18	1098.42	93.49	30.976	RAINING
				0.6551	0.97305	6085.03		531.40	0.3209			34.90	0.3511		122.41	
				7.047	9.7687	596.928	25.8	904.75	54.661	88.41	0.217	109.29	1090.72	90.51	29.690	PULSATING
				0.6976	0.97184	5985.99		531.97	0.3082			34.93	0.3486		121.43	FLOW

BHEL / AGM (Hydro Lab)

APGENCO SE/HO 2

ADE/CE(H) Projects


Sigma Plant
SIGMA

PULICHINTALA HEP Turbine Model witness Test: DAY 5 Test and Comments

Day no. 5

Date: 11/04/09

Schedule for the day	
First Half	Cavitation Tests at blade angle $\beta = 10^{\circ}$ were carried out for the following conditions & Pressure Pulsations were taken near plant sigma. i. Prototype head = 24 m,GV opening = 33° for proto output ~ 27.3 MW Runaway Test at blade angle $\beta = 10^{\circ}$ at various guide vane opening.
Second Half	Runner Dismantling for angle change, Setting of angle $\beta = 0^{\circ}$.
Comments	
1.	Cavitation Test demonstrated that efficiency at sigma plant is practically same as on higher sigma values. Cavitation Characteristic curve demonstrates that sufficient margin exists in sigma plant. Pressure pulsations were taken at sigma plant and were found to be within ± 0.86 % which is well within the safe range.
2.	From Runaway Test On CAM Runaway speed is 260.6, 247.8 RPM corresponding to protohead of 27.68mm & 24m respectively whereas maximum OFF CAM Runaway speed corresponding to 42^{0} GV opening is 301.4 RPM.

(AGM HYDRO LAB)
BHEL

(SE/HD-2)

(ADE % CEE/PROJECTS)
APGENCO

RECORD No 921

HYDRO MACHINERY DEVELOPMENT STATION

CAVITATION TEST REPORT

DATE 11 Apr 2009

PROJECT NAME: **PULICHINTALA HEP**
RUNNER BLADE ANGLE 10°
REPORT No : B-4-039

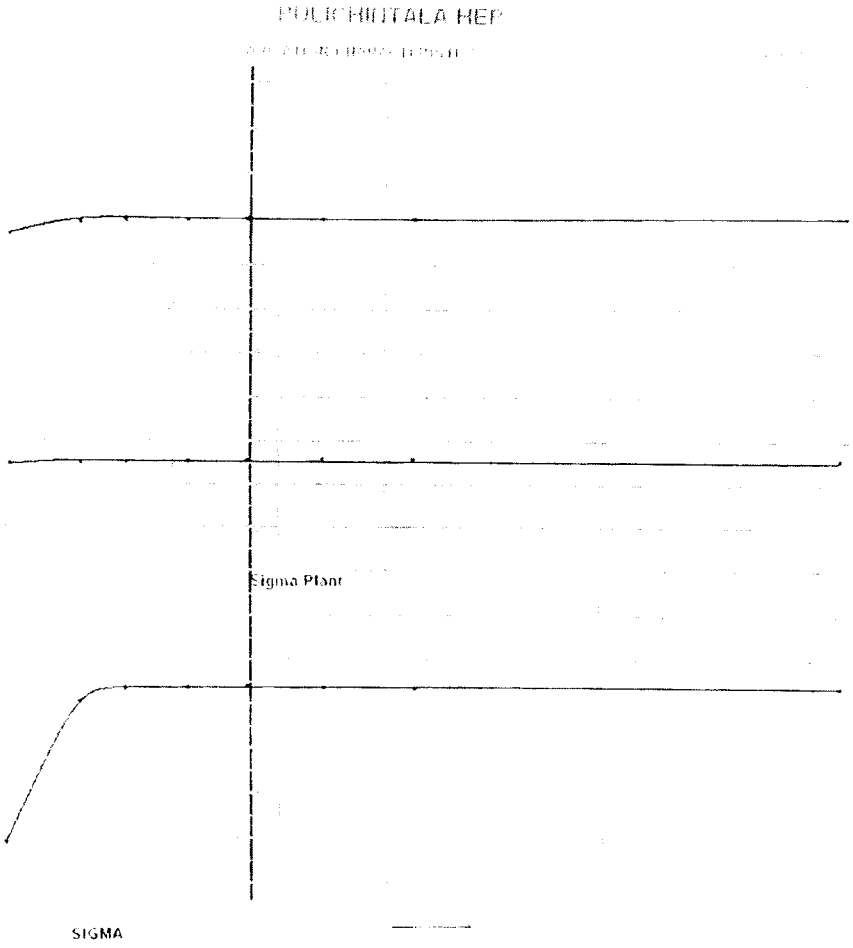
AIR TEMPERATURE 24.8°C

TEST RIG No 1 | CIRCUIT : CLOSED LOOP | PUMP SETUP : PARALLEL | MODE : TURBINE | CONST : GV
MODEL DIA 4 m | INITIAL LOAD 120 kg | | PROTO DIA 4.6 m | PROTO HEAD 24 m

SL No	GV OPEN	FLOW RATE	PRESS HEAD	NETT HEAD	SUCT HEAD	ATMOS HEAD	TOTAL TORQUE	WATER TEMP	MODEL SPEED	OUTPUT POWER	MODEL EFFI	CAVI COEFF	UNIT SPEED	UNIT DISC	TURBINE EFFI	TURBINE OUTPUT	REMARK
	DEG	m³/s	m	m	m	m	N-m	°C	RPM	kW	%	Sigma	RPM	l/s	%	MW	
		O5 Hz	O2 kg/cm²		O3 kg/cm²	O4 kg/cm²	O1 Hz		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH m³/s	
1	33.00	0.5839	9.155	9.4072	-0.167	9.8068	525.005	26.2	900.32	49.498	92.38	1.023	117.42	1189.76	94.48	27.260	
		3298.14	0.9158		-0.0213	0.97554	5760.65		501.04	0.3513			37.53	0.3803		123.29	CLEAR
2	33.00	0.5844	9.163	9.4166	3.558	9.8082	526.081	26.2	900.03	49.584	92.36	0.627	117.32	1190.21	94.46	27.333	CLEAR
		3301.01	0.9167		0.3499	0.97567	5765.32		501.52	0.3514			37.50	0.3805		123.43	
3	33.00	0.5838	9.171	9.4236	4.349	9.7972	526.026	26.2	900.11	49.583	92.38	0.541	117.29	1188.64	94.48	27.326	CLEAR
		3297.88	0.9174		0.4288	0.97457	5765.09		501.63	0.3510			37.49	0.3799		123.31	
4	33.00	0.5831	9.183	9.4346	5.030	9.8056	526.159	26.2	900.14	49.597	92.41	0.469	117.22	1186.50	94.51	27.331	PP TAKEN
		3293.81	0.9186		0.4965	0.97539	5765.66		501.59	0.3505			37.47	0.3793		123.15	SLIGHT RAIN
5	33.00	0.5822	9.202	9.4528	5.535	9.8105	525.603	26.3	901.11	49.598	92.39	0.415	117.23	1183.43	94.49	27.244	
		3288.43	0.9205		0.5469	0.97587	5763.25		501.68	0.3495			37.47	0.3783		122.82	
6	33.00	0.5801	9.218	9.4670	6.078	9.8079	523.775	26.3	902.11	49.481	92.37	0.357	117.28	1178.30	94.47	27.089	RAINING
		3276.61	0.9220		0.6009	0.97561	5755.32		501.41	0.3479			37.49	0.3766		122.24	
7	33.00	0.5789	9.242	9.4902	6.477	9.8129	521.790	26.3	903.15	49.350	92.09	0.314	117.27	1174.45	94.19	26.926	
		3269.89	0.9244		0.6407	0.97609	5746.70		501.51	0.3457			37.49	0.3754		121.85	
8	33.00	0.5765	9.246	9.4926	7.100	9.8097	501.718	26.3	904.08	47.500	88.97	0.248	117.37	1169.52	91.07	25.857	PULSATION
		3256.61	0.9249		0.7028	0.97577	5659.59		501.71	0.3326			37.52	0.3738		121.23	START

(AGM HYDRO LAB)
BHEL

(SE/HD-2) (ADE % CEE/PROJECTS)
APGENCO


PULICHINTALA HEP
Sigma Plant
SIGMA

PULICHINTALA HEP Turbine Model witness Test: DAY 6 Test and Comments

Day no. 6 Date: 13/04/09

Schedule for the day	
First Half	Cavitation Tests at blade angle β = 0° were carried out for the following conditions & Pressure Pulsations were taken near plant sigma. i. Prototype head = 24m,GV opening = 25° for proto output ~17.2 MW Performance Test at β = 0° at various guide vane openings at different speed factors: i. Ned = 34.94 corresponding to protohead = 27.68m. ii. Ned = 37.52 corresponding to protohead = 24 m.
Second Half	Performance Test at β = 0° at various guide vane openings at speed factor: i. Ned = 53.07 corresponding to protohead = 12 m. Cavitation Tests at blade angle β = 0° were carried out for the following conditions & Pressure Pulsations were taken near plant sigma. i. Prototype head = 27.68 m,GV opening = 23 °for proto output~20 MW ii.Prototype head = 12m, GV opening = 36.5° for proto output~8 MW.
Comments	
1.	Assembly of model was done on 12/04/09.
2.	Performance Test were conducted at β = 0° at various guide vane openings at different speed factors. Performance Test results were compared with pre-witness Test Results and they were found to be quite matching.
3.	Cavitation Test demonstrated that efficiency at sigma plant is practically same as on higher sigma values.Cavitation Characteristic curve demonstrates that sufficient margin exists in sigma plant. Pressure pulsations were taken at sigma plant and were found to be within ± 0.77 % which is well within the safe range.

(AGM HYDRO LAB)
BHEL

(SE/HD-2)

(ADE % GEE/PROJECTS)
APGENCO

RECORD No 036

HYDRO MACHINERY DEVELOPMENT STATION

CAVITATION TEST REPORT

PROJECT NAME: PULICHINTALA HEP
RUNNER BLADE ANGLE 0°
REPORT No.: B-4-039

DATE 13 Apr 2009

TEST RIG No 1
MODEL DIA 4 m
CIRCUIT CLOSED LOOP
INITIAL LOAD 120 kg
PUMP SETUP : PARALLEL
MODE : TURBINE
PROTO DIA 4.6 m
CONST GV
PROTO HEAD 24 m
AIR TEMPERATURE 23 °C

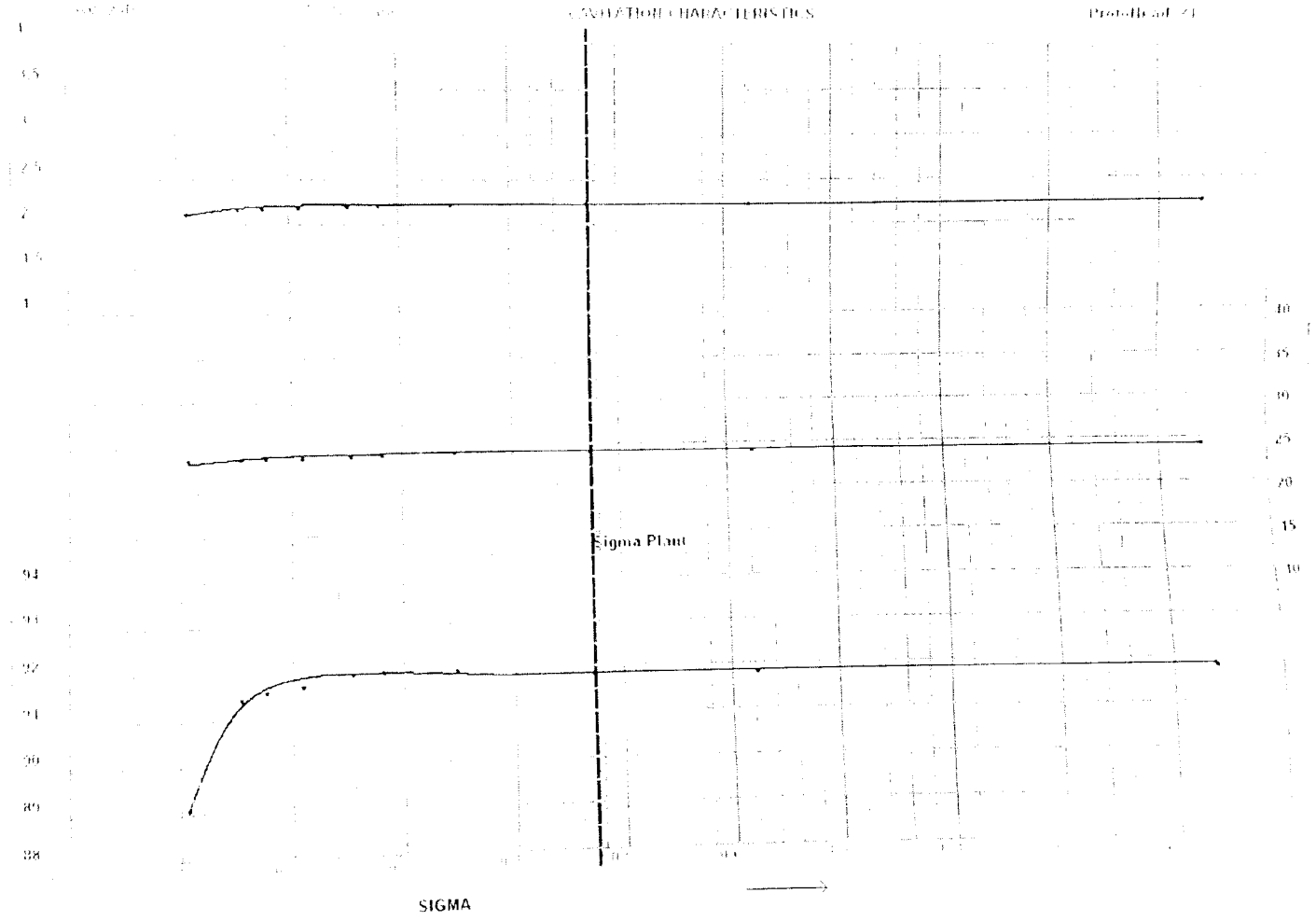
SL No	GV OPEN	FLOW RATE	PRESS HEAD	NETT HEAD	SUCT HEAD	ATMOS HEAD	TOTAL TORQUE	WATER TEMP	MODEL SPEED	OUTPUT POWER	MODEL EFFI	CAVI COEFF	UNIT SPEED	UNIT DISC	TURBINE EFFI	TURBINE OUTPUT	REMARK
	DEG	m³/s	m	m	m	m	N-m	°C	RPM	kW	%	Sigma	RPM	l/s	%	MW	
		O5 Hz	O2 kg/cm²		O3 kg/cm²	O4 kg/cm²	O1 Hz		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH. m³/s	
1	25.00	0.3734	9.309	9.4125	-0.336	9.7687	334.094	25.3	900.15	31.493	91.82	1.038	117.36	760.77	93.92	17.352	CLEAR
		2111.75	0.9314		-0.0381	0.97193	4932.14		463.91	0.2233			37.51	0.2432		78.87	
2	25.00	0.3733	9.337	9.4400	3.559	9.7719	334.957	25.4	900.07	31.571	91.81	0.623	117.18	759.42	93.91	17.401	CLEAR
		2111.05	0.9341		0.3500	0.97224	4935.89		464.01	0.2228			37.46	0.2427		78.85	
3	25.00	0.3727	9.276	9.3788	5.004	9.7655	332.279	25.4	900.08	31.319	91.83	0.472	117.56	760.57	93.93	17.261	PP TAKEN
		2107.36	0.9280		0.4940	0.97159	4924.26		464.57	0.2232			37.58	0.2431		78.71	CLEAR
4	25.00	0.3714	9.296	9.3980	6.179	9.7670	332.213	25.5	900.13	31.315	91.95	0.346	117.45	757.15	94.05	17.256	RAINING
		2100.04	0.9300		0.6112	0.97173	4923.98		464.55	0.2225			37.54	0.2420		78.44	
5	25.00	0.3699	9.313	9.4142	6.792	9.7685	331.464	25.5	900.12	31.244	91.96	0.281	117.35	753.46	94.06	17.217	
		2091.62	0.9317		0.6722	0.97187	4920.72		464.76	0.2214			37.51	0.2408		78.12	
6	25.00	0.3692	9.326	9.4266	7.048	9.7618	331.239	25.5	900.10	31.222	91.95	0.252	117.27	751.52	94.05	17.206	HEAVIER
		2087.61	0.9330		0.6977	0.97120	4919.75		464.54	0.2209			37.48	0.2402		77.97	RAIN
7	25.00	0.3677	9.332	9.4324	7.474	9.7755	329.303	25.5	900.09	31.039	91.72	0.208	117.23	748.33	93.82	17.107	HEAVY RAIN
		2079.39	0.9336		0.7402	0.97256	4911.35		464.51	0.2194			37.47	0.2392		77.67	
8	25.00	0.3669	9.325	9.4249	7.768	9.7633	327.905	25.6	900.09	30.907	91.60	0.176	117.28	747.01	93.70	17.035	HEAVY RAIN
		2074.90	0.9329		0.7695	0.97135	4905.28		464.69	0.2187			37.49	0.2388		77.50	
9	25.00	0.3676	9.345	9.4450	7.987	9.7676	328.655	25.6	899.99	30.974	91.44	0.153	117.14	747.52	93.54	17.079	
		2078.51	0.9349		0.7913	0.97177	4908.53		464.53	0.2185			37.44	0.2389		77.64	
10	25.00	0.3655	9.349	9.4484	8.414	9.7522	318.482	25.6	900.02	30.017	89.10	0.106	117.12	743.09	91.20	16.559	PULSATING
		2066.56	0.9353		0.8338	0.97023	4864.38		464.97	0.2116			37.44	0.2375		77.19	FLOW

(AGM HYDRO LAB)
BHEL

(SE/HD-2)

(ADE % CE/PROJECTS)
APGENCO

PULICHINTALA HEP



RECORD No 964

HYDRO MACHINERY DEVELOPMENT STATION

CAVITATION TEST REPORT

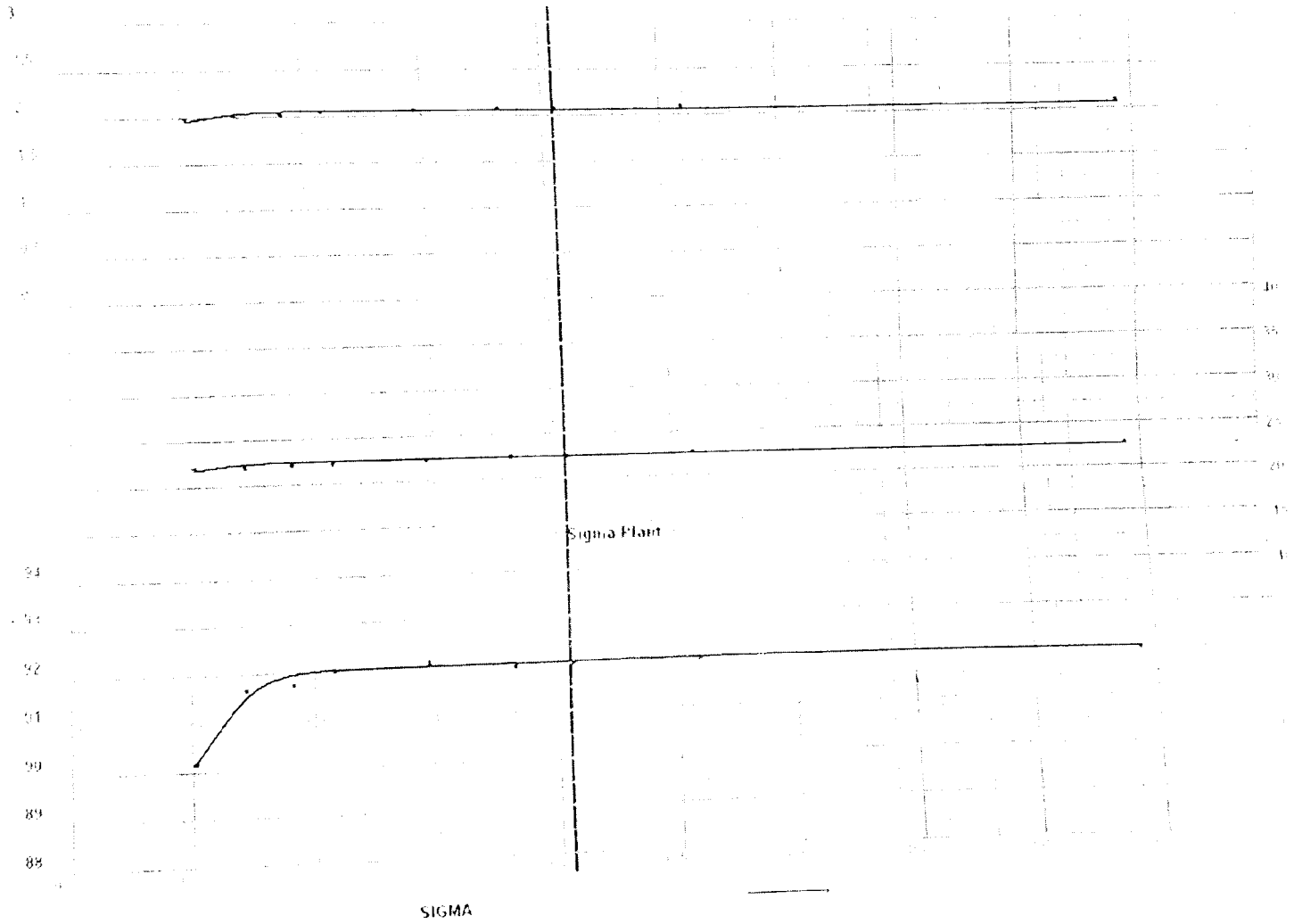
PROJECT NAME: **PULICHINTALA HEP** DATE 13 Apr 2009
RUNNER BLADE ANGLE 0°
REPORT No : B-4-039

TEST RIG No.: 1 CIRCUIT : CLOSED LOOP PUMP SETUP : PARALLEL MODE : TURBINE AIR TEMPERATURE 23°C
MODEL DIA: 4 m INITIAL LOAD 120 kg PROTO DIA 4.6 m CONST : GV
PROTO HEAD : 27.68 m

SL No.	GV OPEN	FLOW RATE	PRESS HEAD	NETT HEAD	SUCT HEAD	ATMOS HEAD	TOTAL TORQUE	WATER TEMP	MODEL SPEED	OUTPUT POWER	MODEL EFFI	CAVI COEFF	UNIT SPEED	UNIT DISC	TURBINE EFFI	TURBINE OUTPUT	REMARK
	DEG	m³/s	m	m	m	m	N-m	°C	RPM	kW	%	Sigma	RPM	l/s	%	MW	
		O5 Hz	O2 kg/cm²		O3 kg/cm²	O4 kg/cm²	O1 Hz		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH. m³/s	
1	23.00	0.3768	10.768	10.8729	-0.252	9.7396	390.202	26.2	899.95	36.774	92.02	0.887	109.17	714.14	94.12	20.279	CLEAR
		2130.08	1.0765		-0.0297	0.96884	5175.64		494.95	0.2101			34.90	0.2283		79.59	
2	23.00	0.3763	10.772	10.8772	3.745	9.7377	389.912	26.2	899.87	36.743	92.03	0.519	109.14	713.05	94.13	20.268	CLEAR
		2127.23	1.0770		0.3686	0.96864	5174.38		495.08	0.2097			34.89	0.2279		79.49	
3	23.00	0.3747	10.736	10.8397	4.909	9.7186	386.880	26.3	899.89	36.458	92.01	0.411	109.33	711.33	94.11	20.110	PP TAKEN
		2118.44	1.0733		0.4845	0.96673	5161.22		494.22	0.2092			34.95	0.2274		79.16	MILD RAIN
4	23.00	0.3738	10.739	10.8425	5.430	9.7311	385.901	26.3	899.87	36.365	91.98	0.364	109.31	709.49	94.08	20.060	RAINING
		2113.23	1.0736		0.5364	0.96796	5156.97		494.39	0.2086			34.94	0.2268		78.97	
5	23.00	0.3720	10.749	10.8518	6.197	9.7296	385.040	26.4	899.84	36.283	92.13	0.293	109.26	705.82	94.23	20.016	RAINING
		2103.20	1.0746		0.6128	0.96779	5153.23		494.90	0.2078			34.93	0.2256		78.60	
6	23.00	0.3689	10.795	10.8962	7.028	9.7303	382.956	26.4	899.78	36.084	92.02	0.216	109.03	698.49	94.12	19.911	
		2085.61	1.0792		0.6956	0.96785	5144.19		494.71	0.2055			34.85	0.2233		77.94	
7	23.00	0.3667	10.763	10.8626	7.396	9.7325	378.396	26.4	899.76	35.653	91.76	0.182	109.20	695.32	93.86	19.676	HEAVY RAIN
		2072.96	1.0760		0.7323	0.96806	5124.40		494.21	0.2040			34.91	0.2223		77.47	
8	23.00	0.3659	10.754	10.8532	7.818	9.7290	376.892	26.5	899.70	35.509	91.67	0.143	109.24	694.15	93.77	19.602	
		2068.53	1.0751		0.7743	0.96769	5117.87		493.80	0.2034			34.92	0.2219		77.31	
9	23.00	0.3644	10.746	10.8447	8.245	9.7192	368.277	26.5	901.69	34.774	90.22	0.103	109.52	691.55	92.32	19.076	PULSATING
		2059.99	1.0743		0.8168	0.96672	5080.49		493.57	0.1995			35.01	0.2211		76.82	FLOW

(AGM HYDRO LAB)
BHEL

(SE/HD-2) (ADE % CEE/PROJECTS)
APGENCO


Sigma Plant
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SIGMA

RECORD No 073

HYDRO MACHINERY DEVELOPMENT STATION

CAVITATION TEST REPORT

PROJECT NAME: PULICHINTALA HEP
RUNNER BLADE ANGLE 0°

DATE : 13 Apr 2009

REPORT No. : B-4-039

TEST RIG No 1
MODEL DIA 4 m
CIRCUIT CLOSED LOOP
INITIAL LOAD 120 kg
PUMP SETUP PARALLEL
MODE TURBINE
PROTO DIA 4.6 m
CONST GV
PROTO HEAD 12 m
AIR TEMPERATURE : 24°C

SL No	GV OPEN	FLOW RATE	PRESS HEAD	NETT HEAD	SUCT HEAD	ATMOS HEAD	TOTAL TORQUE	WATER TEMP	MODEL SPEED	OUTPUT POWER	MODEL EFFI	CAVI COEFF	UNIT SPEED	UNIT DISC	TURBINE EFFI	TURBINE OUTPUT	REMARK
	DEG	m³/s	m	m	m	m	N-m	°C	RPM	kW	%	Sigma	RPM	l/s	%	MW	
		O5 Hz	O2 kg/cm²		O3 kg/cm²	O4 kg/cm²	O1 Hz		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH m³/s	
1	36.50	0.4604	7.398	7.5548	-0.263	9.7312	249.069	26.6	1140.63	29.750	87.69	1.275	165.99	1046.85	89.79	8.067	
		2601.29	0.7406		-0.0308	0.96789	4563.15		436.78	0.2934			53.06	0.3346		76.73	CLEAR
2	36.50	0.4602	7.397	7.5543	2.287	9.7252	249.058	26.7	1140.61	29.749	87.72	0.937	166.00	1046.52	89.82	8.067	
		2600.37	0.7406		0.2233	0.96728	4563.10		436.98	0.2934			53.06	0.3345		76.71	PP TAKEN
3	36.50	0.4601	7.394	7.5511	2.627	9.7155	248.625	26.8	1140.43	29.692	87.62	0.891	166.01	1046.52	89.72	8.056	CLEAR
		2599.73	0.7403		0.2571	0.96628	4561.22		437.23	0.2931			53.06	0.3345		76.70	CLEAR
4	36.50	0.4601	7.404	7.5609	3.306	9.7172	248.661	26.8	1140.35	29.694	87.52	0.800	165.89	1045.77	89.62	8.059	
		2599.55	0.7412		0.3247	0.96644	4561.38		437.11	0.2926			53.03	0.3343		76.70	CLEAR
5	36.50	0.4599	7.396	7.5530	5.261	9.7311	248.234	26.8	1142.34	29.695	87.65	0.544	166.26	1045.88	89.75	8.017	
		2598.45	0.7405		0.5195	0.96782	4559.52		437.53	0.2930			53.15	0.3343		76.54	SLIGHT RAIN
6	36.50	0.4596	7.400	7.5566	6.283	9.7246	248.621	26.8	1142.35	29.742	87.80	0.407	166.22	1044.94	89.90	8.029	
		2596.71	0.7408		0.6213	0.96716	4561.20		438.07	0.2933			53.13	0.3340		76.49	
7	36.50	0.4592	7.420	7.5760	6.624	9.7344	248.466	26.9	1142.48	29.726	87.60	0.363	166.03	1042.75	89.70	8.023	
		2594.58	0.7428		0.6553	0.96813	4560.53		437.62	0.2920			53.07	0.3333		76.41	SLIGHT RAIN
8	36.50	0.4776	8.042	8.2106	7.135	9.7179	266.911	26.9	1190.29	33.270	86.99	0.270	166.16	1041.73	89.09	7.941	
		2698.15	0.8047		0.7062	0.96647	4640.58		455.84	0.2897			53.11	0.3330		76.28	RAINING
9	36.50	0.4794	8.055	8.2257	7.434	9.7224	267.847	26.9	1190.22	33.384	86.81	0.234	166.00	1044.61	88.91	7.970	
		2708.07	0.8061		0.7359	0.96691	4644.64		455.29	0.2899			53.06	0.3339		76.57	

(AGM HYDRO LAB)
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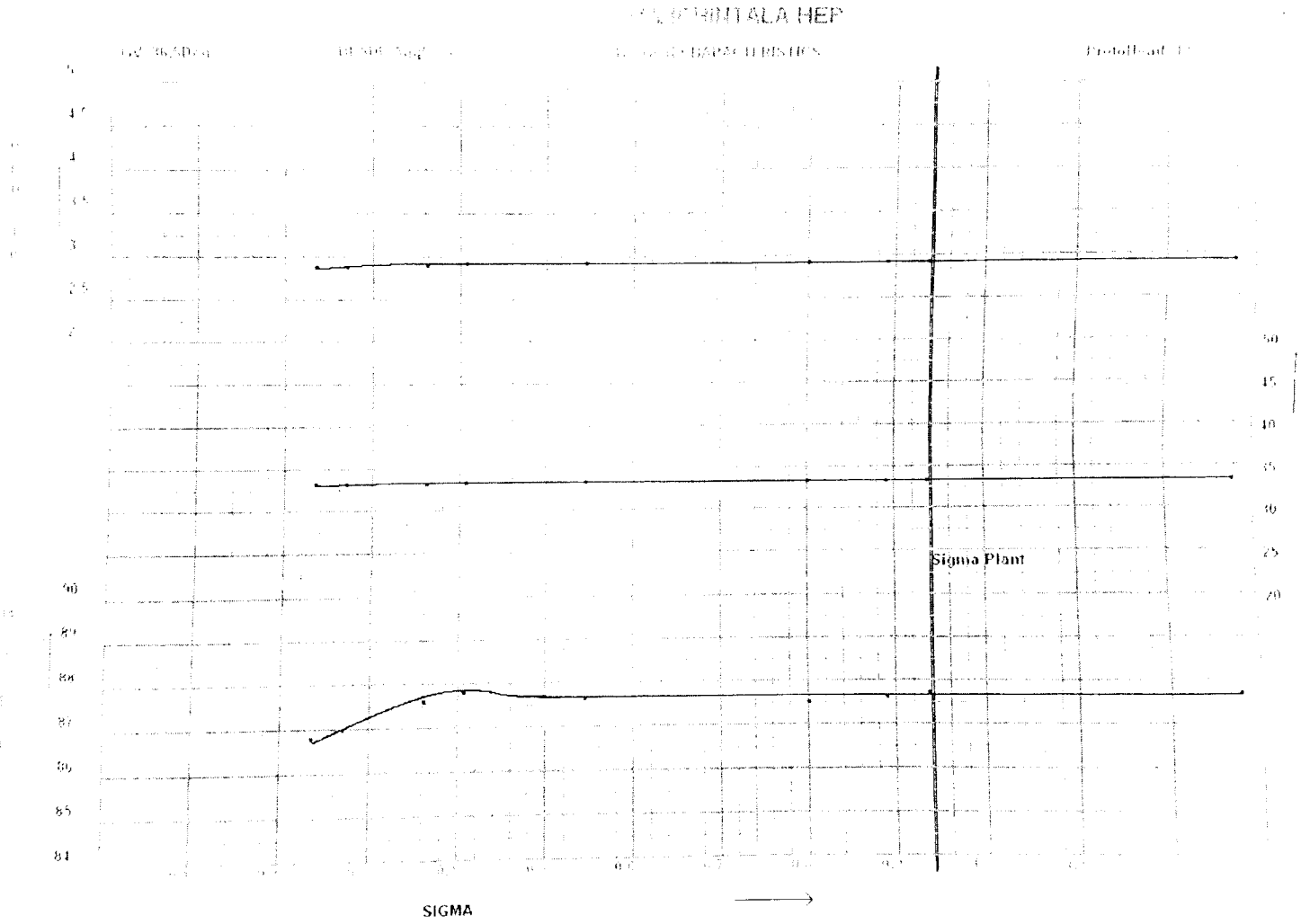
(SE/HD-2)

(ADE % CEE/PROJECTS)
APGENCO


Sigma Plant
SIGMA

RECORD No 1002

HYDRO MACHINERY DEVELOPMENT STATION

CAVITATION TEST REPORT

DATE 16 Apr 2009

PROJECT NAME: **PULICHINTALA HEP**
RUNNER BLADE ANGLE 16°
REPORT No.: B-4-039

AIR TEMPERATURE 25.1°C

TEST RIG No 1 | CIRCUIT CLOSED LOOP | PUMP SETUP PARALLEL | MODE TURBINE | CONST GV
MODEL DIA 4 m | INITIAL LOAD 120 kg | | PROTO DIA 4.6 m | PROTO HEAD 27.68 m

SL No	GV OPEN	FLOW RATE	PRESS HEAD	NETT HEAD	SUCT HEAD	ATMOS HEAD	TOTAL TORQUE	WATER TEMP	MODEL SPEED	OUTPUT POWER	MODEL EFFI	CAVI COEFF	UNIT SPEED	UNIT DISC	TURBINE EFFI	TURBINE OUTPUT	REMARK
	DEG	m³/s	m	m	m	m	N-m	°C	RPM	kW	%	Sigma	RPM	l/s	%	MW	
		O5 Hz	O2 kg/cm²		O3 kg/cm²	O4 kg/cm²	O1 Hz		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH. m³/s	
1	38.50	0.7545	10.408	10.8413	-0.178	9.7467	774.491	26.8	899.69	72.969	90.26	0.882	109.30	1451.13	92.36	40.298	
		4316.11	1.0405		-0.0223	0.96938	6843.37		567.97	0.4187			34.94	0.4639		161.54	
2	38.50	0.7588	10.488	10.9148	3.390	9.7498	773.023	26.9	902.64	73.069	90.46	0.549	109.29	1435.44	92.56	39.959	START OF
		4283.78	1.0484		0.3331	0.96966	6837.00		569.02	0.4150			34.93	0.4588		159.81	RAIN
3	38.50	0.7497	10.576	10.9925	4.919	9.7433	768.310	27.0	905.61	72.863	90.65	0.406	109.26	1413.23	92.75	39.455	PP TAKEN
		4232.36	1.0572		0.4854	0.96897	6816.55		568.01	0.4095			34.92	0.4517		157.38	START OF UNSTABLE ROPE
4	38.50	0.7484	10.599	11.0144	5.414	9.7404	768.565	27.1	905.56	72.883	90.65	0.359	109.14	1409.40	92.75	39.473	START OF
		4225.04	1.0595		0.5347	0.96867	6817.65		568.88	0.4084			34.89	0.4505		157.12	WEAK ROPE
5	38.50	0.7427	10.573	10.9816	5.771	9.7451	740.016	27.2	904.58	70.100	88.13	0.328	109.19	1400.71	90.23	38.115	
		4192.64	1.0568		0.5702	0.96910	6693.76		566.52	0.3946			34.90	0.4477		156.08	
6	38.50	0.7445	10.532	10.9428	5.601	9.7411	749.180	27.2	904.55	70.965	89.32	0.344	109.38	1406.58	91.42	38.578	
		4202.69	1.0527		0.5533	0.96869	6733.53		565.89	0.4016			34.96	0.4496		156.47	
7	38.50	0.7387	10.560	10.9644	6.027	9.7350	722.201	27.3	904.54	68.409	86.61	0.304	109.27	1394.28	88.71	37.218	PULSATING
		4169.97	1.0555		0.5957	0.96806	6616.45		566.58	0.3860			34.93	0.4457		155.25	FLOW

(AGM HYDRO LAB)
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(SE/HD-2) % CEE/PROJECTS)
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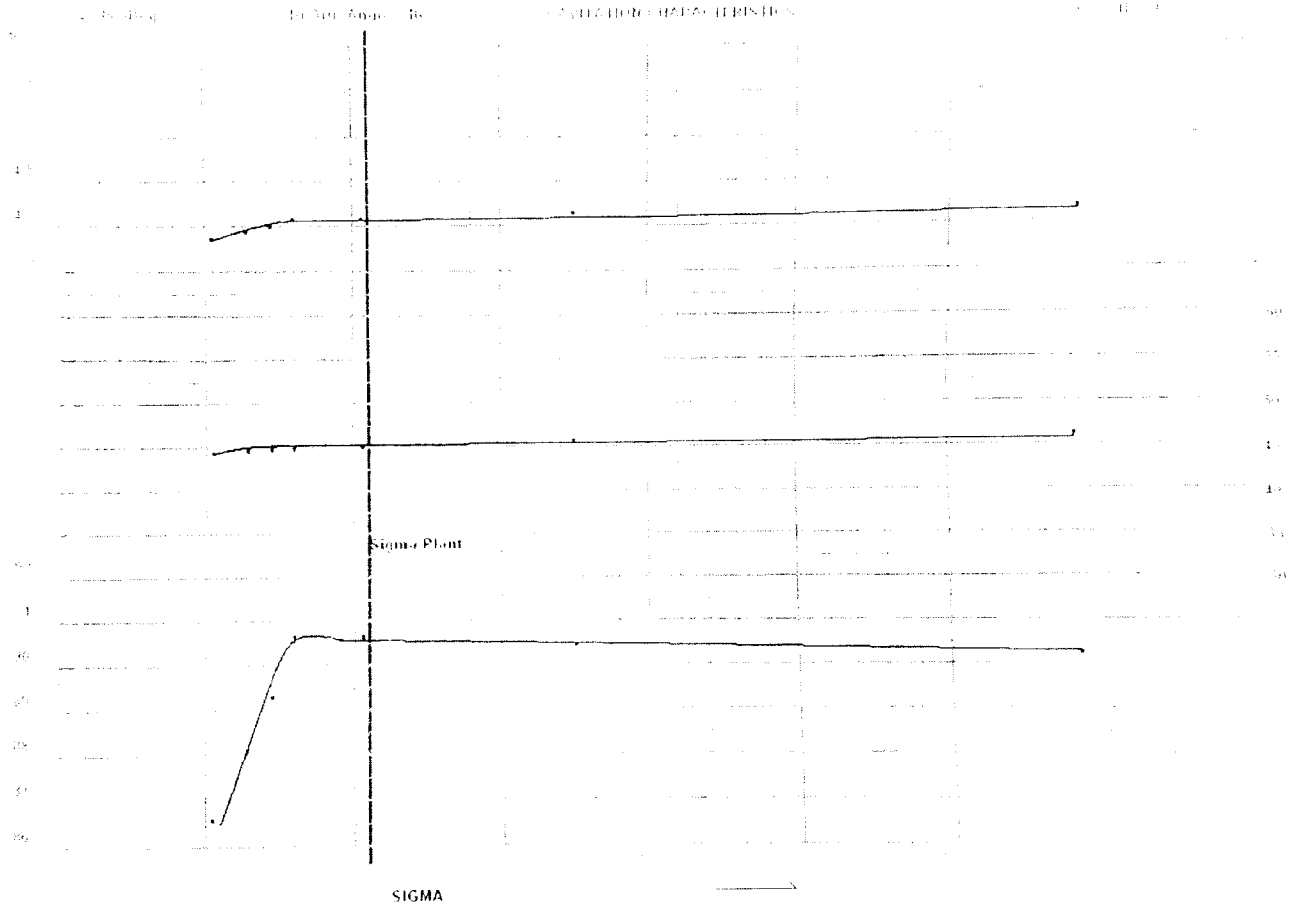
PULICHINTALA HEP



Minutes of meeting on completion of Turbine Model Witness Test from 07/04/08 to 18/04/09 of Pulichintala HEP held at Hydro Lab, BHEL Bhopal on 18/04/2009.

Members Present:
S/Shri

APGENCO
I.H.T. Ramesh Babu, SE/HD-II
N. Venugopal, ADE %CEE /Projects /Vidyut Soudha

BHEL, BHOPAL
M.Mangla, AGM (Hydro Lab)
V.S.Rao, Manager (Hydro Lab)
Nitin Khodre, Dy. Manager(Hydro Lab)
Sangeeta Kerketta,Dy.Manager (Hydro Lab)
Kundan Maheshwari,Engineer Trainee

Turbine Model Witness Test were carried out as per following Log of events:

Schedule for the day	Description of Tests
07/04/09	Opening Meeting for briefing about model testing techniques and procedure Familiarization with test bed Presentation of Pre- witness test results. Calibration of Head Transducer, Cavitation Transducer, Torque Transducer, Checking of speed pick up **Performance Test** at $\beta = 5°$ at various guide vanes at different speed factors Ned = 34.94, 37.52 & 53.07 corresponding to protohead = 27.68m, 24 m (rated) & 12 m respectively.
08/04/09	**Cavitation Tests** at blade angle $\beta = 5°$ at different speed factors corresponding to prototype head = 27.68 m, 24 m and 12 m. **Runaway Test** at blade angle $\beta = 5°$ at various guide vane opening. Runner Dismantling for angle change, Setting of angle $\beta = -5°$.
09/04/09	**Performance Test** at $\beta = -5°$ at various guide vanes at different speed factors Ned = 34.94, 37.52 & 53.07 corresponding to protohead = 27.68m, 24 m(rated) & 12 m respectively. **Cavitation Tests** at blade angle $\beta = -5°$ at different speed factors corresponding to prototype head = 27.68 m, 24 m and 12 m. **Runaway Test** at blade angle $\beta = -5°$ at various guide vane opening
10/04/09	Runner Dismantling for angle change, Setting of angle $\beta = 10°$. Assembly of model. **Performance Test** at $\beta = 10°$ at various guide vanes at different speed factors Ned = 34.94, 37.52 & 53.07 corresponding to protohead = 27.68 m, 24 m and 12 m respectively. **Cavitation Tests** at blade angle $\beta = 10°$ for prototype head = 27.68 m
11/04/09	Cavitation Tests at blade angle $\beta = 10°$ at different speed factors corresponding to prototype head = 24 m. Runaway Test at blade angle $\beta = 10°$ at various guide vane opening. Runner Dismantling for angle change, Setting of angle $\beta = 0°$.

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(SE/HD-2)

(ADE)

(% CEE/PROJECTS)
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Page 1of 2

13/04/09	**Performance Test** at $\beta = 0°$ at various guide vanes at different speed factors Ned = 34.94, 37.52 & 53.07 corresponding to protohead =27.68 m, 24 m and 12 m respectively. **Cavitation Tests** at blade angle $\beta = 0°$ at different speed factors corresponding to prototype head = 27.68 m, 24 m and 12 m.
15/04/09	**Runaway Test** at blade angle $\beta = 0°$ at various guide vane opening Runner Dismantling for angle change Setting of angle $\beta = 16°$ Assembly of model.
16/04/09	**Performance Test** at $\beta = 16°$ at various guide vanes at different speed factors Ned = 34.94 & 37.52 corresponding to protohead = 27.68 m & 24 m respectively. **Cavitation Tests** at blade angle $\beta = 16°$ at speed factor corresponding to prototype head = 27.68 m.
17/04/09	Dismantling of model Calibration of Temperature Atmospheric Head Calibration Dimensional checking of model components started Measurement of Torque armlength. Connection of test loop for flow calibration
18/04/09	Dimensional Checking continued Flow calibration. Closing Meeting on completion of Model Witness Test. Handing over of Witness Test Data.

1. Weighted Average Efficiency at 24 m Rated Head was computed from witness Test data as 93.21% against Guaranteed Weighted Average Efficiency of **92.927 %.**
2. Runaway Test demonstrated that Prototype ON CAM Runaway Speed = 273.9 RPM against guaranteed value of 275 rpm and OFF CAM Runaway speed = 350.4 RPM against guaranteed value of 357 rpm.
3. Calibration of various parameters were carried out and were found to be same as done before Witness Test.
4. Dimensional Check of model components were carried out on completion of test and were found to be within tolerances as specified in IEC 60193;1999.
5. Weighted Average Efficiency, Power Output, Runaway Speed, Cavitation, Pressure Pulsation Tests have successfully been completed as per the contract. All the tests have been performed in the presence of customer and the test results obtained confirms that all the guarantees are fulfilled.
6. It has been agreed that BHEL is allowed to proceed with design/ manufacturing of prototype turbines based on theoretical design of model.
7. Witness Test Data is enclosed and Final Model Test Report will be delivered within 4 to 5 weeks

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Page 2 of 2

16.0 DISCUSSION OF TEST RESULTS

Turbine Performance & output test

Pre Witness Tests were carried out as per chapter 7.4.1 and witness test carried out as chapter 7.4.2. The prototype results are derived at chapter 10,11 &15 .

It may be noted that performance parameters which are specified in offer are based on available model with guarantee on weighted average efficiency only. Later on receipt of order new model design is carried out suiting to exact site condition and to meet requirement of weighted average efficiency. Hence efficiencies achieved may differ slightly from specified efficiency in the offer.

Guaranteed output at all the operating heads have been met. Weighted average efficiency on basis of model test works out to be 93.21% which is slightly higher than guaranteed value of 92.927%.

Therefore guarantees with respect to efficiency and output are met.

Cavitation test and pressure pulsation test

It is clear from chapter 11.2 that sufficient margin exists at σplant for specified output range. Pressure pulsations amplitude and visual observation in draft tube cone for entire specified range demonstrate smooth operation.

Maximum Runaway Speed

Refer Chapter 11.3 maximum Runaway Speed for prototype corresponding to maximum head of 27.68m works out to be 273.9/350.4 rpm (ON CAM/OFF CAM) which is lower than guaranteed values of 275/357 rpm (ON CAM/OFF CAM) and is therefore safe.

Calibration of Equipment / Instrument

Refer chapter 14 & 15. Calibration were carried out before pre witness test and during witness test, they are within specified uncertainty.

Dimensional Checking of Model

Refer chapter 13, Dimensional checking of model proves that the model has been manufactured within the tolerances as specified by IEC 60193.

Axial Hydraulic Thrust

Refer chapter 10 & 11, according to model test Maximum Prototype axial hydraulic thrust for off cam condition works out to be 4539.458 KN (462.926 Ton) which will be at -5° blade opening and 27.68m head against specified value of 470 Ton.

Guide Vane Torque

Refer chapter 10 & 11, Prototype guide vane servo motor is designed to take care of maximum torque as per model test.

With this the all the contractual obligations regarding model testing are fulfilled.

RECORD No 870

HYDRO MACHINERY DEVELOPMENT STATION

CAVITATION TEST REPORT

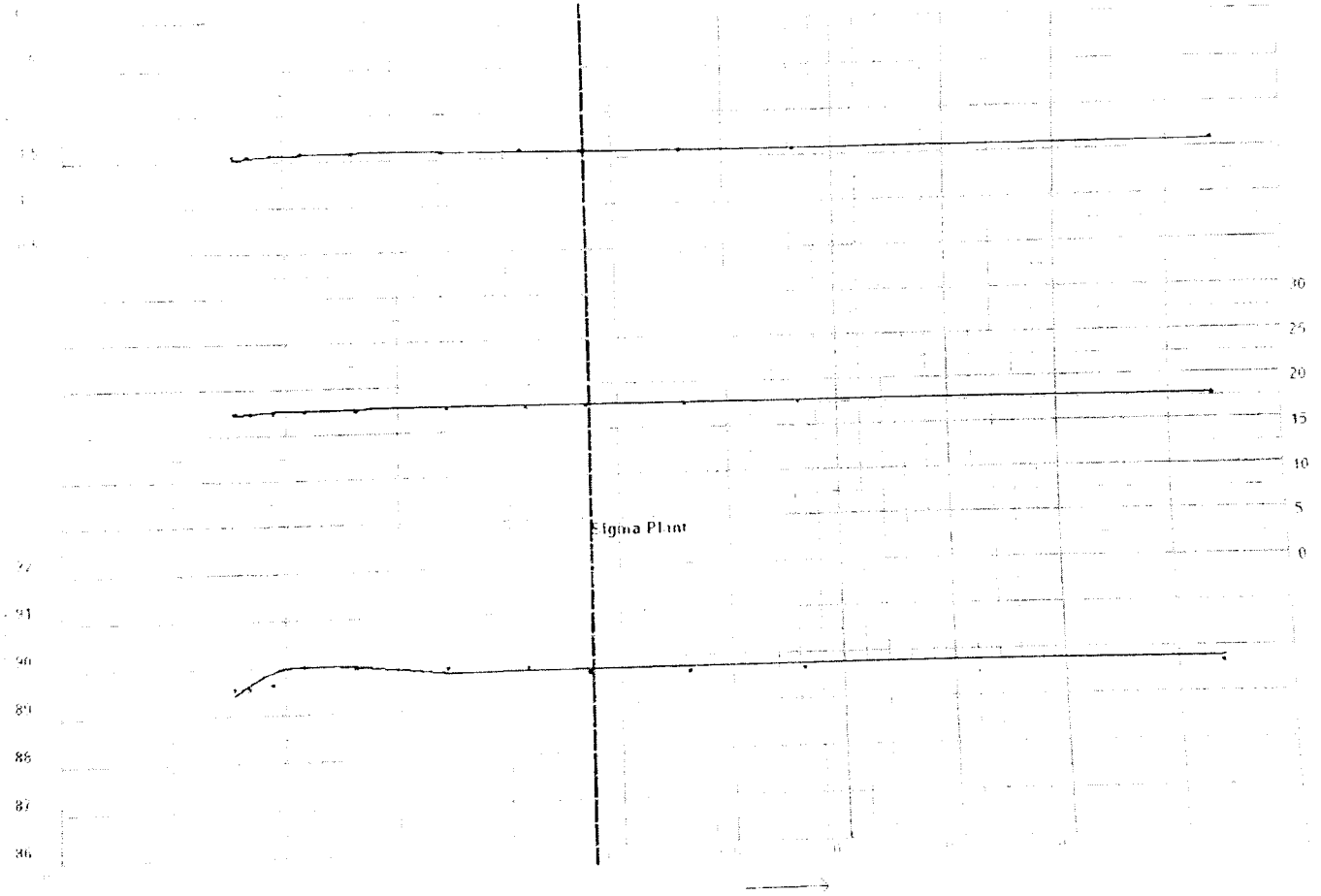
PROJECT NAME: PULICHINTALA HEP
RUNNER BLADE ANGLE -5°
REPORT No.: B-4-039

DATE 09 Apr 2009

TEST RIG No 1
MODEL DIA 4 m
CIRCUIT CLOSED LOOP
INITIAL LOAD 120 kg
PUMP SETUP PARALLEL
MODE TURBINE
PROTO DIA 4.6 m
AIR TEMPERATURE 25°C
CONST GV
PROTO HEAD 24 m

SL No.	GV OPEN	FLOW RATE	PRESS HEAD	NETT HEAD	SUCT HEAD	ATMOS HEAD	TOTAL TORQUE	WATER TEMP	MODEL SPEED	OUTPUT POWER	MODEL EFFI	CAVI COEFF	UNIT SPEED	UNIT DISC	TURBINE EFFI	TURBINE OUTPUT	REMARK
	DEG	m³/s	m	m	m	m	N-m	°C	RPM	kW	%	Sigma	RPM	l/s	%	MW	
		O5 Hz	O2 kg/cm²		O3 kg/cm²	O4 kg/cm²	O1 Hz		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH m³/s	
1	20.50	0.2732	9.352	9.4078	-0.336	9.7681	238.538	25.7	900.14	22.485	89.67	1.038	117.39	556.68	91.77	12.397	CLEAR
		1546.07	0.9356		-0.0381	0.97179	4517.44		448.85	0.1595			37.52	0.1779		57.70	
2	20.50	0.2731	9.363	9.4184	3.177	9.7732	238.756	25.7	900.12	22.505	89.69	0.664	117.32	556.10	91.79	12.409	CLEAR
		1545.33	0.9367		0.3119	0.97230	4518.39		449.77	0.1595			37.50	0.1778		57.67	
3	20.50	0.2729	9.361	9.4164	4.153	9.7670	238.580	25.8	900.08	22.488	89.68	0.560	117.33	555.89	91.78	12.401	CLEAR
		1544.59	0.9365		0.4092	0.97167	4517.63		449.93	0.1594			37.50	0.1777		57.65	
4	20.50	0.2729	9.367	9.4222	5.003	9.7723	238.815	25.8	899.88	22.505	89.71	0.470	117.27	555.64	91.81	12.419	PP TAKEN
		1544.36	0.9371		0.4940	0.97220	4518.65		449.80	0.1593			37.48	0.1776		57.65	CLEAR
5	20.50	0.2726	9.358	9.4129	5.513	9.7598	238.662	25.8	899.96	22.492	89.83	0.415	117.33	555.39	91.93	12.408	
		1542.89	0.9361		0.5448	0.97095	4517.98		449.65	0.1594			37.51	0.1775		57.59	
6	20.50	0.2722	9.349	9.4036	6.195	9.7643	238.175	25.8	900.06	22.449	89.89	0.343	117.40	554.82	91.99	12.380	CLEAR
		1540.55	0.9352		0.6127	0.97140	4515.87		450.01	0.1594			37.53	0.1773		57.50	
7	20.50	0.2712	9.350	9.4041	6.962	9.7692	237.503	25.8	900.01	22.384	89.97	0.262	117.39	552.66	92.07	12.347	SLIGHT RAIN
		1534.61	0.9353		0.6891	0.97188	4512.95		449.82	0.1590			37.52	0.1767		57.28	
8	20.50	0.2701	9.347	9.4013	7.394	9.7639	236.597	25.9	900.05	22.300	90.02	0.216	117.42	550.52	92.12	12.298	LIGHT RAIN
		1528.45	0.9351		0.7321	0.97135	4509.02		449.46	0.1584			37.53	0.1760		57.05	
9	20.50	0.2695	9.372	9.4256	7.644	9.7613	235.433	25.9	900.94	22.212	89.64	0.188	117.38	548.53	91.74	12.215	
		1524.90	0.9375		0.7571	0.97108	4503.97		449.59	0.1571			37.52	0.1753		56.86	
10	20.50	0.2688	9.384	9.4372	7.831	9.7570	235.026	25.9	900.92	22.173	89.59	0.168	117.31	546.92	91.69	12.194	
		1521.36	0.9387		0.7757	0.97064	4502.20		449.47	0.1566			37.50	0.1748		56.73	
11	20.50	0.2686	9.367	9.4205	7.959	9.7555	234.414	25.9	900.92	22.116	89.58	0.134	117.41	546.99	91.68	12.163	HEAVY RAIN
		1520.20	0.9370		0.7884	0.97049	4499.55		449.50	0.1566			37.53	0.1748		56.68	

BHEL [illegible] APGT NCO [illegible]


Sigma Plot
SIGMA

RECORD No : 831

HYDRO MACHINERY DEVELOPMENT STATION

CAVITATION TEST REPORT

PROJECT NAME: **PULICHINTALA HEP**
RUNNER BLADE ANGLE -5°
REPORT No.: B-4-039

DATE 09 Apr 2009

TEST RIG No 1
MODEL DIA 4 m

CIRCUIT CLOSED LOOP
INITIAL LOAD 120 kg

PUMP SETUP PARALLEL

MODE TURBINE
PROTO DIA 4.6 m

CONST : GV
PROTO HEAD 12 m

AIR TEMPERATURE : 23°C

SL No	GV OPEN	FLOW RATE	PRESS HEAD	NETT HEAD	SUCT HEAD	ATMOS HEAD	TOTAL TORQUE	WATER TEMP	MODEL SPEED	OUTPUT POWER	MODEL EFFI	CAVI COEFF	UNIT SPEED	UNIT DISC	TURBINE EFFI	TURBINE OUTPUT	REMARK
	DEG	m³/s	m	m	m	m	N-m	°C	RPM	kW	%	Sigma	RPM	l/s	%	MW	
		O5 Hz	O2 kg/cm²		O3 kg/cm²	O4 kg/cm²	O1 Hz		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH. m³/s	
1	30.00	0.3362	7.709	7.7928	-0.336	9.7660	179.815	26.0	1159.20	21.828	85.41	1.252	166.10	752.61	87.51	5.642	CLEAR
		1901.07	0.7718		-0.0381	0.97152	4262.60		421.86	0.2055			53.09	0.2406		55.13	
2	30.00	0.3361	7.727	7.8105	2.286	9.7732	180.007	26.0	1160.35	21.873	85.40	0.914	166.08	751.73	87.50	5.636	PP TAKEN
		1901.02	0.7736		0.2232	0.97223	4263.43		422.79	0.2052			53.09	0.2403		55.07	CLEAR
3	30.00	0.3361	7.706	7.7897	3.219	9.7702	179.789	26.1	1160.36	21.847	85.54	0.797	166.30	752.59	87.64	5.629	CLEAR
		1900.65	0.7715		0.3162	0.97193	4262.49		422.97	0.2058			53.16	0.2406		55.06	
4	30.00	0.3358	7.713	7.7970	4.578	9.7730	180.195	26.1	1159.32	21.876	85.65	0.622	166.07	751.61	87.75	5.652	CLEAR
		899.05	0.7722		0.4516	0.97220	4264.25		423.02	0.2058			53.09	0.2403		55.07	
5	30.00	0.3356	7.712	7.7958	5.706	9.7708	180.135	26.1	1159.30	21.869	85.67	0.477	166.08	751.28	87.77	5.650	CLEAR
		1898.04	0.7721		0.5639	0.97197	4263.99		422.81	0.2057			53.09	0.2401		55.04	
6	30.00	0.3352	7.716	7.7994	6.520	9.7614	179.956	26.1	1159.37	21.848	85.65	0.371	166.06	750.26	87.75	5.644	
		1895.90	0.7725		0.6450	0.97103	4263.21		422.89	0.2054			53.08	0.2398		54.97	
7	30.00	0.3350	7.716	7.7993	6.883	9.7653	179.947	26.1	1159.42	21.848	85.72	0.325	166.06	749.63	87.82	5.643	
		894.32	0.7725		0.6812	0.97142	4263.17		423.19	0.2054			53.08	0.2396		54.92	
8	30.00	0.3339	7.739	7.8221	7.277	9.7703	179.860	26.2	1159.36	21.836	85.69	0.274	165.81	746.26	87.79	5.641	RAINING
		1888.53	0.7748		0.7205	0.97191	4262.79		423.41	0.2044			53.00	0.2385		54.76	
9	30.00	0.3335	7.732	7.8140	7.666	9.7731	179.274	26.2	1159.18	21.762	85.60	0.225	165.87	745.66	87.70	5.625	RAINING
		886.02	0.7740		0.7592	0.97218	4260.25		423.16	0.2040			53.02	0.2383		54.70	

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PULICHINTALA HEP Turbine Model witness Test: DAY 4 Test and Comments

Day no. 4 Date: 10/04/09

Schedule for the day	
First Half	Runner Dismantling for angle change, Setting of angle β =10°. Assembly of model.
Second Half	Performance Test at β = 10° at various guide vane openings at different speed factors: i. Ned = 34.94 corresponding to protohead = 27.68 m. ii. Ned = 37.52 corresponding to protohead = 24 m. iii. Ned = 53.07 corresponding to protohead = 12 m Cavitation Tests at blade angle β = 10° were carried out for the following conditions & Pressure Pulsations were taken near plant sigma. i. Prototype head = 27.68 m,GV opening = 31.5° for proto output~ 31.5 MW
Comments	
1.	Performance Test were conducted at β = 10° at various guide vane openings at different speed factors. Performance Test results were compared with pre-witness Test Results and they were found to be quite matching.
2.	Cavitation Test demonstrated that efficiency at sigma plant is practically same as on higher sigma values. Cavitation Characteristic curve demonstrates that sufficient margin exists in sigma plant. Pressure pulsations were taken at sigma plant and were found to be within ± 0.75 % which is well within the safe range.

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ADE I/C EE/Projects

HYDRO MACHINERY DEVELOPMENT STATION

CAVITATION TEST REPORT

PROJECT NAME PULICHINTALA HEP
RUNNER BLADE ANGLE 10°
REPORT No B-4-039

DATE 10 Apr 2009

[illegible]
MODEL DIA [illegible] m

CIRCUIT CLOSED LOOP
INITIAL LOAD 120 kg

PUMP SETUP PARALLEL

MODE TURBINE
PROTO DIA 4.6 m

CONST [illegible]
PROTO HEAD 27.68 m

AIR TEMPERATURE 23.4°C

[illegible]	[illegible]	FLOW RATE	PRESS HEAD	NETT HEAD	SUCT HEAD	ATMOS HEAD	TOTAL TORQUE	WATER TEMP	MODEL SPEED	OUTPUT POWER	MODEL EFFI	CAVI COEFF	UNIT SPEED	UNIT DISC	TURBINE EFFI	TURBINE OUTPUT	REMARK
	DEG	m³/s	m	m	m	m	N-m	°C	RPM	kW	%	Sigma	RPM	l/s	%	MW	
		[illegible]	[illegible]		05	04	01		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH	
		[illegible]	[illegible]		[illegible] cm²	[illegible]	Hz									m³/s	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9.7686	613.906	25.5	899.90	57.853	92.14	0.900	109.38	1128.27	94.24	31.903	
		[illegible]	[illegible]		[illegible]	0.97189	6146.47		531.02	0.3323			34.96	0.3607		125.51	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.352	9.7661	613.007	25.5	899.93	57.770	92.16	0.560	109.29	1123.66	94.26	31.854	CLEAR
		[illegible]	[illegible]		[illegible]	0.97162	6142.57		531.23	0.3310			34.93	0.3592		125.10	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9.7701	609.182	25.6	900.89	57.471	92.13	0.408	109.34	1116.24	94.23	31.588	PP TAKEN
		[illegible]	[illegible]		[illegible]	0.97201	6125.96		531.57	0.3287			34.95	0.3568		124.21	SLIGHT RAIN
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9.7751	608.048	25.6	900.91	57.365	92.14	0.368	109.23	1110.62	94.24	31.528	
		[illegible]	[illegible]		[illegible]	0.97250	6121.05		531.35	0.3271			34.91	0.3550		123.71	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9.7659	605.039	25.7	901.90	57.144	92.03	0.313	109.18	1102.51	94.13	31.304	RAIN
		[illegible]	[illegible]		[illegible]	0.97158	6107.99		531.42	0.3243			34.90	0.3524		122.86	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9.7808	599.749	25.7	902.77	56.699	91.39	0.258	109.18	1098.42	93.49	30.976	RAINING
		[illegible]	[illegible]		[illegible]	0.97308	6085.03		531.40	0.3209			34.90	0.3511		122.41	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9.7683	576.928	25.8	904.75	54.661	88.41	0.217	109.29	1090.72	90.51	29.690	PULSATING
		[illegible]	[illegible]		[illegible]	0.97184	5985.99		531.97	0.3082			34.93	0.3486		121.43	FLOW

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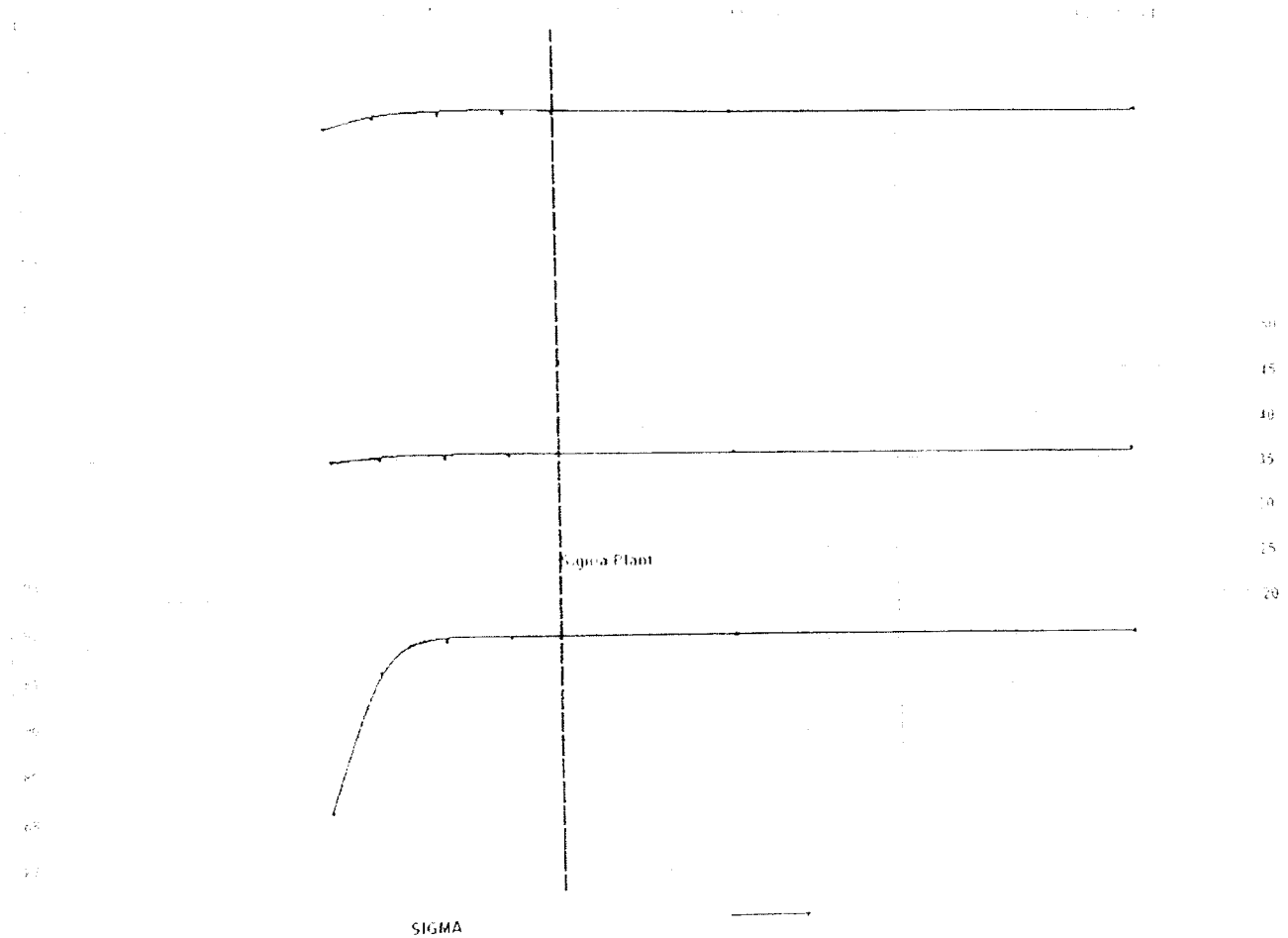
ADE/O/o CE Projects


Kapica Plant
SIGMA

PULICHINTALA HEP Turbine Model witness Test: DAY 5 Test and Comments

Day no. 5

Date: 11/04/09

Schedule for the day	
First Half	Cavitation Tests at blade angle $\beta = 10^{\circ}$ were carried out for the following conditions & Pressure Pulsations were taken near plant sigma. i. Prototype head = 24 m,GV opening = 33° for proto output ~ 27.3 MW Runaway Test at blade angle $\beta = 10^{\circ}$ at various guide vane opening.
Second Half	Runner Dismantling for angle change, Setting of angle $\beta = 0^{\circ}$.
Comments	
1.	Cavitation Test demonstrated that efficiency at sigma plant is practically same as on higher sigma values. Cavitation Characteristic curve demonstrates that sufficient margin exists in sigma plant. Pressure pulsations were taken at sigma plant and were found to be within ± 0.86 % which is well within the safe range.
2.	From Runaway Test On CAM Runaway speed is 260.6, 247.8 RPM corresponding to protohead of 27.68mm & 24m respectively whereas maximum OFF CAM Runaway speed corresponding to 42^{0} GV opening is 301.4 RPM.

(AGM HYDRO LAB)
BHEL

(SE/HD-2)

(ADE % CEE/PROJECTS)
APGENCO

RECORD No 921

HYDRO MACHINERY DEVELOPMENT STATION

CAVITATION TEST REPORT

DATE 11 Apr 2009

PROJECT NAME PULICHINTALA HEP
RUNNER BLADE ANGLE 10°
REPORT No.: B-4-039

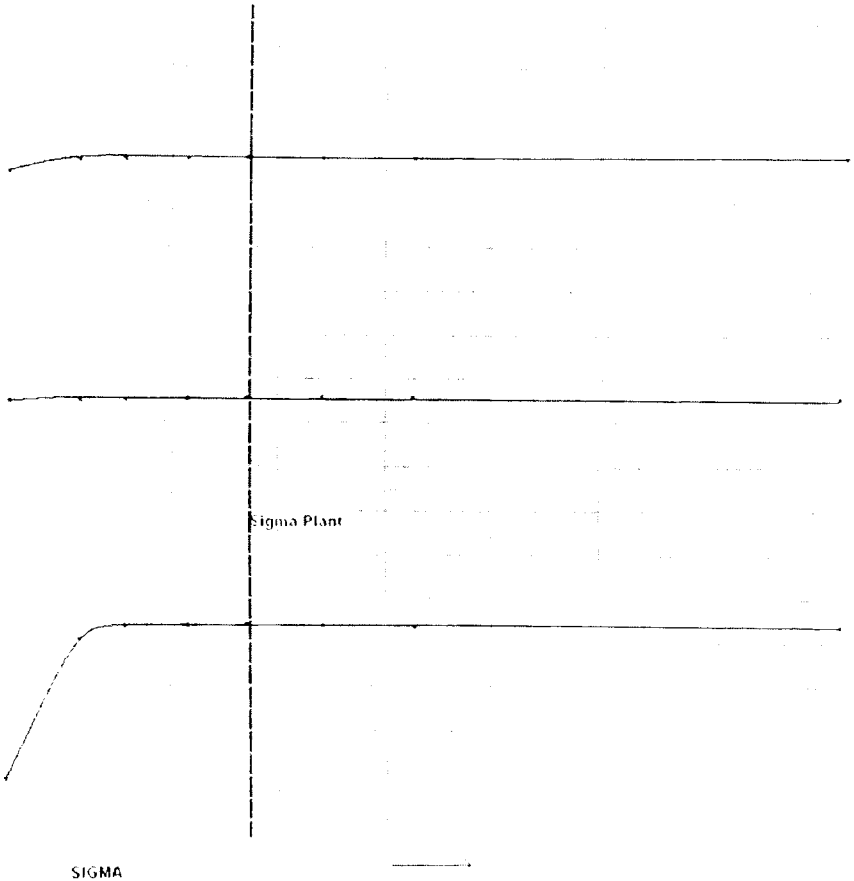
AIR TEMPERATURE 24.8°C

TEST RIG No 1 | CIRCUIT CLOSED LOOP | PUMP SETUP PARALLEL | MODE TURBINE | CONST GV
MODEL DIA 4 m | INITIAL LOAD 120 kg | | PROTO DIA 4.6 m | PROTO HEAD 24 m

SL No	GV OPEN	FLOW RATE	PRESS HEAD	NETT HEAD	SUCT HEAD	ATMOS HEAD	TOTAL TORQUE	WATER TEMP	MODEL SPEED	OUTPUT POWER	MODEL EFFI	CAVI COEFF	UNIT SPEED	UNIT DISC	TURBINE EFFI	TURBINE OUTPUT	REMARK
	DEG	m³/s	m	m	m	m	N-m	°C	RPM	kW	%	Sigma	RPM	l/s	%	MW	
		O5 Hz	O2 kg/cm²		O3 kg/cm²	O4 kg/cm²	O1 Hz		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH. m³/s	
1	33.00	0.5839	9.155	9.4072	-0.167	9.8068	525.005	26.2	900.32	49.498	92.38	1.023	117.42	1189.76	94.48	27.260	
		3298.14	0.9158		-0.0213	0.97554	5760.65		501.04	0.3513			37.53	0.3803		123.29	CLEAR
2	33.00	0.5844	9.163	9.4166	3.558	9.8082	526.081	26.2	900.03	49.584	92.36	0.627	117.32	1190.21	94.46	27.333	CLEAR
		3301.01	0.9167		0.3499	0.97567	5765.32		501.52	0.3514			37.50	0.3805		123.43	
3	33.00	0.5838	9.171	9.4236	4.349	9.7972	526.026	26.2	900.11	49.583	92.38	0.541	117.29	1188.64	94.48	27.326	CLEAR
		3297.88	0.9174		0.4288	0.97457	5765.09		501.63	0.3510			37.49	0.3799		123.31	
4	33.00	0.5831	9.183	9.4346	5.030	9.8056	526.159	26.2	900.14	49.597	92.41	0.469	117.22	1186.50	94.51	27.331	PP TAKEN
		3293.81	0.9185		0.4965	0.97539	5765.66		501.59	0.3505			37.47	0.3793		123.15	SLIGHT RAIN
5	33.00	0.5822	9.202	9.4528	5.535	9.8105	525.603	26.3	901.11	49.598	92.39	0.415	117.23	1183.43	94.49	27.244	
		3288.43	0.9205		0.5469	0.97587	5763.25		501.68	0.3495			37.47	0.3783		122.82	
6	33.00	0.5801	9.218	9.4670	6.078	9.8079	523.775	26.3	902.11	49.481	92.37	0.357	117.28	1178.30	94.47	27.089	RAINING
		3276.61	0.9220		0.6009	0.97561	5755.32		501.41	0.3479			37.49	0.3766		122.24	
7	33.00	0.5789	9.242	9.4902	6.477	9.8129	521.790	26.3	903.15	49.350	92.09	0.314	117.27	1174.45	94.19	26.926	
		3269.89	0.9244		0.6407	0.97609	5746.70		501.51	0.3457			37.49	0.3754		121.85	
8	33.00	0.5765	9.246	9.4926	7.100	9.8097	501.718	26.3	904.08	47.500	88.97	0.248	117.37	1169.52	91.07	25.857	PULSATION
		3256.61	0.9249		0.7028	0.97577	5659.59		501.71	0.3326			37.52	0.3738		121.23	START

(AGM HYDRO LAB)
BHEL

(SE/HD-2) (ADE % CEE/PROJECTS)
APGENCO


Sigma Plant
SIGMA

PULICHINTALA HEP Turbine Model witness Test: DAY 6 Test and Comments

Day no. 6 Date: 13/04/09

Schedule for the day	
First Half	Cavitation Tests at blade angle β = 0° were carried out for the following conditions & Pressure Pulsations were taken near plant sigma. i. Prototype head = 24m,GV opening = 25° for proto output ~17.2 MW Performance Test at β = 0° at various guide vane openings at different speed factors: i. Ned = 34.94 corresponding to protohead = 27.68m. ii. Ned = 37.52 corresponding to protohead = 24 m.
Second Half	Performance Test at β = 0° at various guide vane openings at speed factor: i. Ned = 53.07 corresponding to protohead = 12 m. Cavitation Tests at blade angle β = 0° were carried out for the following conditions & Pressure Pulsations were taken near plant sigma. i. Prototype head = 27.68 m,GV opening = 23 °for proto output~20 MW ii.Prototype head = 12m, GV opening = 36.5° for proto output~8 MW.
Comments	
1.	Assembly of model was done on 12/04/09.
2.	Performance Test were conducted at β = 0° at various guide vane openings at different speed factors. Performance Test results were compared with pre-witness Test Results and they were found to be quite matching.
3.	Cavitation Test demonstrated that efficiency at sigma plant is practically same as on higher sigma values.Cavitation Characteristic curve demonstrates that sufficient margin exists in sigma plant. Pressure pulsations were taken at sigma plant and were found to be within ± 0.77 % which is well within the safe range.

(AGM HYDRO LAB)
BHEL

(SE/HD-2)

(ADE % VEE/PROJECTS)
APGENCO

RECORD No 936

HYDRO MACHINERY DEVELOPMENT STATION

CAVITATION TEST REPORT

PROJECT NAME: PULICHINTALA HEP
RUNNER BLADE ANGLE 0°
REPORT No.: B-4-039

DATE 13 Apr 2009

TEST RIG No 1
MODEL DIA 4 m
CIRCUIT CLOSED LOOP
INITIAL LOAD 120 kg
PUMP SETUP PARALLEL
MODE TURBINE
PROTO DIA 4.6 m
CONST GV
PROTO HEAD 24 m
AIR TEMPERATURE 23°C

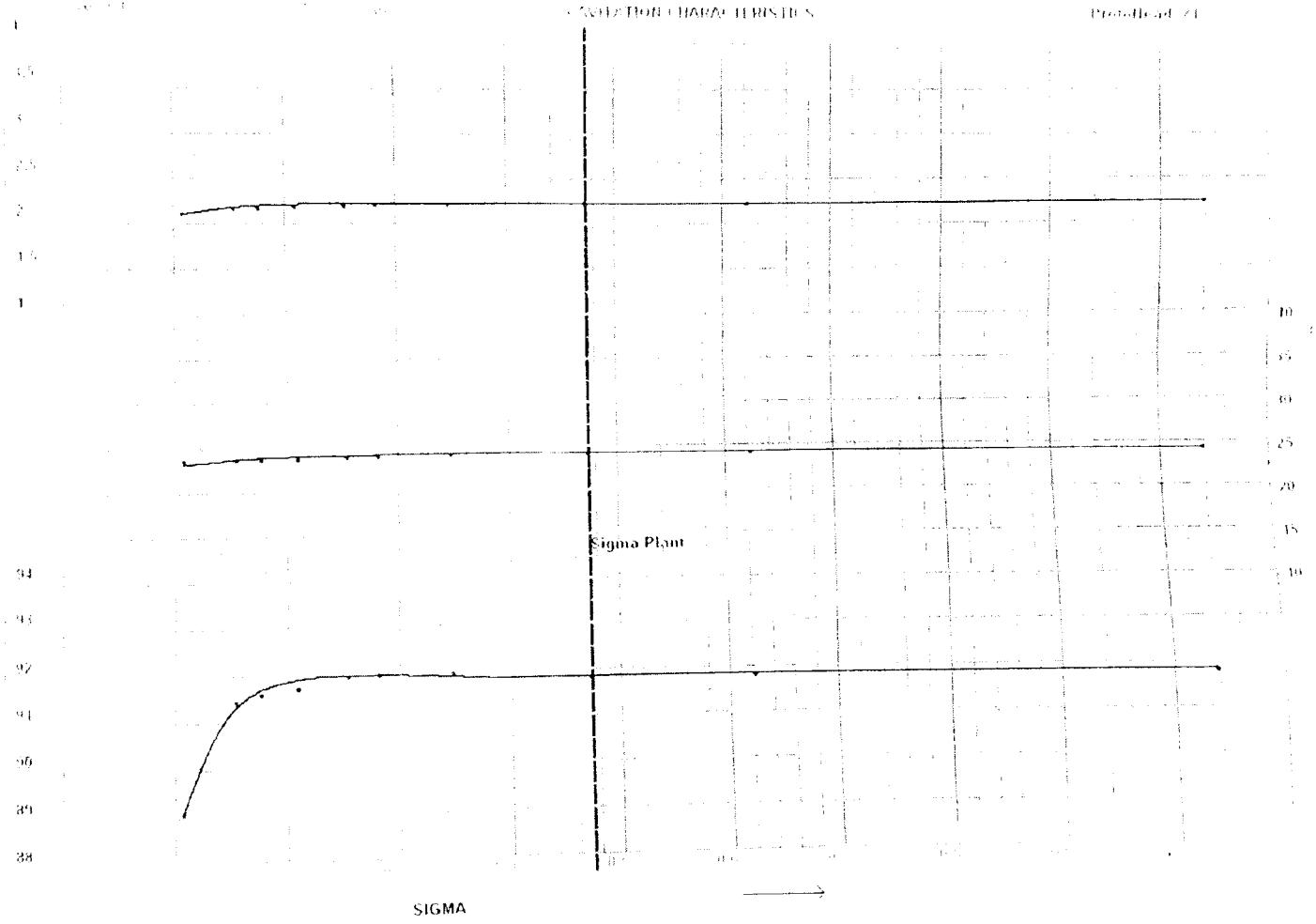
SL No	GV OPEN	FLOW RATE	PRESS HEAD	NETT HEAD	SUCT HEAD	ATMOS HEAD	TOTAL TORQUE	WATER TEMP	MODEL SPEED	OUTPUT POWER	MODEL EFFI	CAVI COEFF	UNIT SPEED	UNIT DISC	TURBINE EFFI	TURBINE OUTPUT	REMARK
	DEG	m³/s	m	m	m	m	N-m	°C	RPM	kW	%	Sigma	RPM	l/s	%	MW	
		Q5 Hz	Q2 kg/cm²		O3 kg/cm²	O4 kg/cm²	O1 Hz		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH. m³/s	
1	25.00	0.3734	9.309	9.4125	-0.336	9.7687	334.094	25.3	900.15	31.493	91.82	1.038	117.36	760.77	93.92	17.352	CLEAR
		2111.75	0.9314		-0.0381	0.97193	4932.14		463.91	0.2233			37.51	0.2432		78.87	
2	25.00	0.3733	9.337	9.4400	3.559	9.7719	334.957	25.4	900.07	31.571	91.81	0.623	117.18	759.42	93.91	17.401	CLEAR
		2111.05	0.9341		0.3500	0.97224	4935.89		464.01	0.2228			37.46	0.2427		78.85	
3	25.00	0.3727	9.276	9.3788	5.004	9.7655	332.279	25.4	900.08	31.319	91.83	0.472	117.56	760.57	93.93	17.261	PP TAKEN
		2107.36	0.9280		0.4940	0.97159	4924.26		464.57	0.2232			37.58	0.2431		78.71	CLEAR
4	25.00	0.3714	9.296	9.3980	6.179	9.7670	332.213	25.5	900.13	31.315	91.95	0.346	117.45	757.15	94.05	17.256	RAINING
		2100.04	0.9300		0.6112	0.97173	4923.98		464.55	0.2225			37.54	0.2420		78.44	
5	25.00	0.3699	9.313	9.4142	6.792	9.7685	331.464	25.5	900.12	31.244	91.96	0.281	117.35	753.46	94.06	17.217	
		2091.62	0.9317		0.6722	0.97187	4920.72		464.76	0.2214			37.51	0.2408		78.12	
6	25.00	0.3692	9.326	9.4266	7.048	9.7618	331.239	25.5	900.10	31.222	91.95	0.252	117.27	751.52	94.05	17.206	HEAVIER
		2087.61	0.9330		0.6977	0.97120	4919.75		464.54	0.2209			37.48	0.2402		77.97	RAIN
7	25.00	0.3677	9.332	9.4324	7.474	9.7755	329.303	25.5	900.09	31.039	91.72	0.208	117.23	748.33	93.82	17.107	HEAVY RAIN
		2079.39	0.9336		0.7402	0.97256	4911.35		464.51	0.2194			37.47	0.2392		77.67	
8	25.00	0.3669	9.325	9.4249	7.768	9.7633	327.905	25.6	900.09	30.907	91.60	0.176	117.28	747.01	93.70	17.035	HEAVY RAIN
		2074.90	0.9329		0.7695	0.97135	4905.28		464.69	0.2187			37.49	0.2388		77.50	
9	25.00	0.3676	9.345	9.4450	7.987	9.7676	328.655	25.6	899.99	30.974	91.44	0.153	117.14	747.52	93.54	17.079	
		2078.51	0.9349		0.7913	0.97177	4908.53		464.53	0.2185			37.44	0.2389		77.64	
10	25.00	0.3655	9.349	9.4484	8.414	9.7522	318.482	25.6	900.02	30.017	89.10	0.106	117.12	743.09	91.20	16.559	PULSATING
		2066.56	0.9353		0.8338	0.97023	4864.38		464.97	0.2116			37.44	0.2375		77.19	FLOW

(AGM HYDRO LAB)
BHEL

(SE/HD-2)

(ADE % CE/PROJECTS)
APGENCO

PULICHINTALA HEP



RECORD No 964

HYDRO MACHINERY DEVELOPMENT STATION

CAVITATION TEST REPORT

PROJECT NAME: **PULICHINTALA HEP**
RUNNER BLADE ANGLE 0°
REPORT No : B-4-039

DATE 13 Apr 2009

TEST RIG No. 1
MODEL DIA: 4 m

CIRCUIT : CLOSED LOOP
INITIAL LOAD: 120 kg

PUMP SETUP : PARALLEL

MODE : TURBINE
PROTO DIA : 4.6 m

CONST : GV
PROTO HEAD : 27.68 m

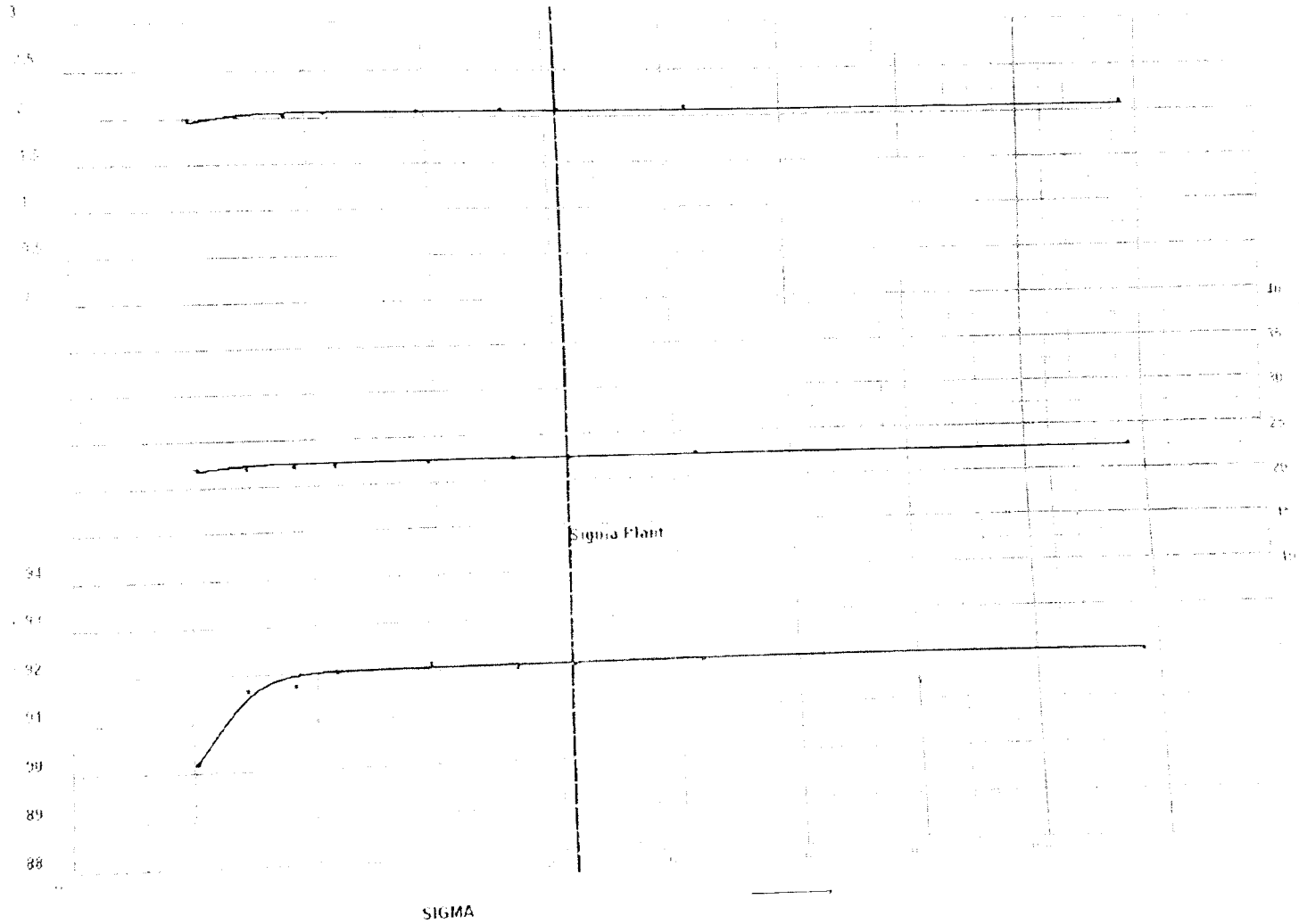
AIR TEMPERATURE : 23°C

SL. No.	GV OPEN	FLOW RATE	PRESS HEAD	NETT HEAD	SUCT HEAD	ATMOS HEAD	TOTAL TORQUE	WATER TEMP	MODEL SPEED	OUTPUT POWER	MODEL EFFI	CAVI COEFF	UNIT SPEED	UNIT DISC	TURBINE EFFI	TURBINE OUTPUT	REMARK
	DEG	m³/s	m	m	m	m	N-m	°C	RPM	kW	%	Sigma	RPM	l/s	%	MW	
		O5 Hz	O2 kg/cm²		O3 kg/cm²	O4 kg/cm²	O1 Hz		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH. m³/s	
1	23.00	0.3768	10.768	10.8729	-0.252	9.7396	390.202	26.2	899.95	36.774	92.02	0.887	109.17	714.14	94.12	20.279	CLEAR
		2130.08	1.0765		-0.0297	0.96884	5175.64		494.95	0.2101			34.90	0.2283		79.59	
2	23.00	0.3763	10.772	10.8772	3.745	9.7377	389.912	26.2	899.87	36.743	92.03	0.519	109.14	713.05	94.13	20.268	CLEAR
		2127.23	1.0770		0.3686	0.96864	5174.38		495.08	0.2097			34.89	0.2279		79.49	
3	23.00	0.3747	10.736	10.8397	4.909	9.7186	386.880	26.3	899.89	36.458	92.01	0.411	109.33	711.33	94.11	20.110	PP TAKEN
		2118.44	1.0733		0.4845	0.96673	5161.22		494.22	0.2092			34.95	0.2274		79.16	MILD RAIN
4	23.00	0.3738	10.739	10.8425	5.430	9.7311	385.901	26.3	899.87	36.365	91.98	0.364	109.31	709.49	94.08	20.060	RAINING
		2113.23	1.0736		0.5364	0.96796	5156.97		494.39	0.2086			34.94	0.2268		78.97	
5	23.00	0.3720	10.749	10.8518	6.197	9.7296	385.040	26.4	899.84	36.283	92.13	0.293	109.26	705.82	94.23	20.016	RAINING
		2103.20	1.0746		0.6128	0.96779	5153.23		494.90	0.2078			34.93	0.2256		78.60	
6	23.00	0.3689	10.795	10.8962	7.028	9.7303	382.956	26.4	899.78	36.084	92.02	0.216	109.03	698.49	94.12	19.911	
		2085.61	1.0792		0.6956	0.96785	5144.19		494.71	0.2055			34.85	0.2233		77.94	
7	23.00	0.3667	10.763	10.8626	7.396	9.7325	378.396	26.4	899.76	35.653	91.76	0.182	109.20	695.32	93.86	19.676	HEAVY RAIN
		2072.96	1.0760		0.7323	0.96806	5124.40		494.21	0.2040			34.91	0.2223		77.47	
8	23.00	0.3659	10.754	10.8532	7.818	9.7290	376.892	26.5	899.70	35.509	91.67	0.143	109.24	694.15	93.77	19.602	
		2068.53	1.0751		0.7743	0.96769	5117.87		493.80	0.2034			34.92	0.2219		77.31	
9	23.00	0.3644	10.746	10.8447	8.245	9.7192	368.277	26.5	901.69	34.774	90.22	0.103	109.52	691.55	92.32	19.076	PULSATING
		2059.99	1.0743		0.8168	0.96672	5080.49		493.57	0.1995			35.01	0.2211		76.82	FLOW

(AGM HYDRO LAB)
BHEL

(SE/HD-2)

(ADE % CE/PROJECTS)
APGENCO


Sigma Plant
SIGMA

RECORD No 073

HYDRO MACHINERY DEVELOPMENT STATION

CAVITATION TEST REPORT

PROJECT NAME: PULICHINTALA HEP
RUNNER BLADE ANGLE 0°

DATE 13 Apr 2009

REPORT No. B-4-039

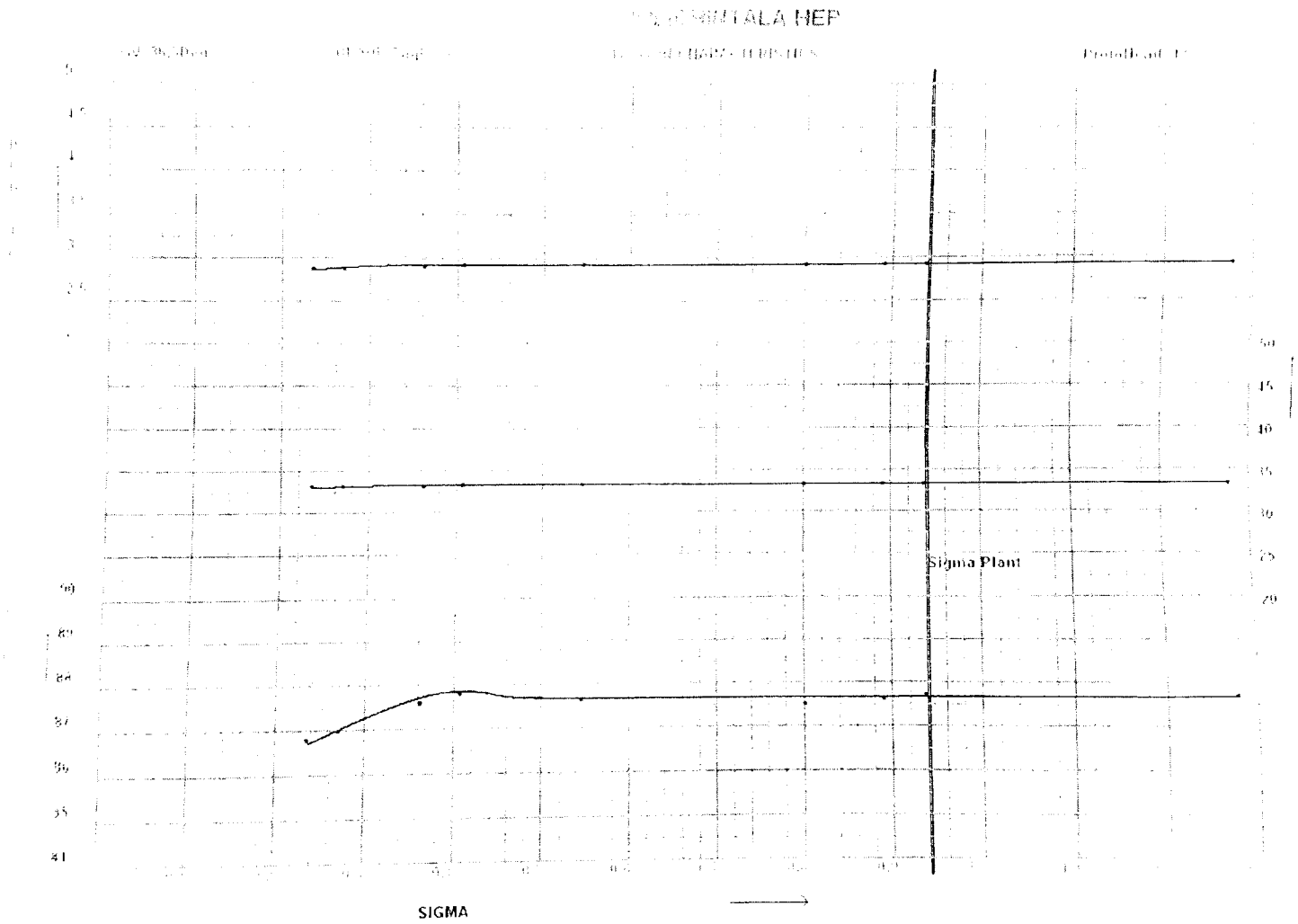
TEST RIG No 1 | CIRCUIT CLOSED LOOP | PUMP SETUP PARALLEL | MODE TURBINE | CONST GV | AIR TEMPERATURE 24°C
MODEL DIA 4 m | INITIAL LOAD 120 kg | PROTO DIA 4.6 m | PROTO HEAD 12 m

SL No	GV OPEN	FLOW RATE	PRESS HEAD	NETT HEAD	SUCT HEAD	ATMOS HEAD	TOTAL TORQUE	WATER TEMP	MODEL SPEED	OUTPUT POWER	MODEL EFFI	CAVI COEFF	UNIT SPEED	UNIT DISC	TURBINE EFFI	TURBINE OUTPUT	REMARK
	DEG	m³/s	m	m	m	m	N-m	°C	RPM	kW	%	Sigma	RPM	l/s	%	MW	
		O5 Hz	O2 kg/cm²		O3 kg/cm²	O4 kg/cm²	O1 Hz		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH m³/s	
1	36.50	0.4604	7.398	7.5548	-0.263	9.7312	249.069	26.6	1140.63	29.750	87.69	1.275	165.99	1046.85	89.79	8.067	
		2601.29	0.7406		-0.0308	0.96789	4563.15		436.78	0.2934			53.06	0.3346		76.73	CLEAR
2	36.50	0.4602	7.397	7.5543	2.287	9.7252	249.058	26.7	1140.61	29.749	87.72	0.937	166.00	1046.52	89.82	8.067	
		2600.37	0.7406		0.2233	0.96728	4563.10		436.98	0.2934			53.06	0.3345		76.71	PP TAKEN
3	36.50	0.4601	7.394	7.5511	2.627	9.7155	248.625	26.8	1140.43	29.692	87.62	0.891	166.01	1046.52	89.72	8.056	CLEAR
		2599.73	0.7403		0.2571	0.96628	4561.22		437.23	0.2931			53.06	0.3345		76.70	CLEAR
4	36.50	0.460	7.404	7.5609	3.306	9.7172	248.661	26.8	1140.35	29.694	87.52	0.800	165.89	1045.77	89.62	8.059	
		2599.53	0.7412		0.3247	0.96644	4561.38		437.11	0.2926			53.03	0.3343		76.70	CLEAR
5	36.50	0.4599	7.396	7.5530	5.261	9.7311	248.234	26.8	1142.34	29.695	87.65	0.544	166.26	1045.88	89.75	8.017	
		2598.45	0.7405		0.5195	0.96782	4559.52		437.53	0.2930			53.15	0.3343		76.54	SLIGHT RAIN
6	36.50	0.4596	7.400	7.5566	6.283	9.7246	248.621	26.8	1142.35	29.742	87.80	0.407	166.22	1044.94	89.90	8.029	
		2596.71	0.7408		0.6213	0.96716	4561.20		438.07	0.2933			53.13	0.3340		76.49	
7	36.50	0.4592	7.420	7.5760	6.624	9.7344	248.466	26.9	1142.48	29.726	87.60	0.363	166.03	1042.75	89.70	8.023	SLIGHT RAIN
		2594.58	0.7428		0.6553	0.96813	4560.53		437.62	0.2920			53.07	0.3333		76.41	
8	36.50	0.4776	8.042	8.2106	7.135	9.7179	266.911	26.9	1190.29	33.270	86.99	0.270	166.16	1041.73	89.09	7.941	RAINING
		2698.15	0.8047		0.7062	0.96647	4640.58		455.84	0.2897			53.11	0.3330		76.28	
9	36.50	0.4794	8.055	8.2257	7.434	9.7224	267.847	26.9	1190.22	33.384	86.81	0.234	166.00	1044.61	88.91	7.970	
		2708.07	0.8061		0.7359	0.96691	4644.64		455.29	0.2899			53.06	0.3339		76.57	

(AGM HYDRO LAB)
BHEL

(SE/HD-2)
APGENCO

(ADE % CEE/PROJECTS)


Sigma Plant
SIGMA

RECORD No 1002

HYDRO MACHINERY DEVELOPMENT STATION

CAVITATION TEST REPORT

DATE : 16 Apr 2009

PROJECT NAME: **PULICHINTALA HEP**
RUNNER BLADE ANGLE 16°
REPORT No.: B-4-039

AIR TEMPERATURE : 25.1°C

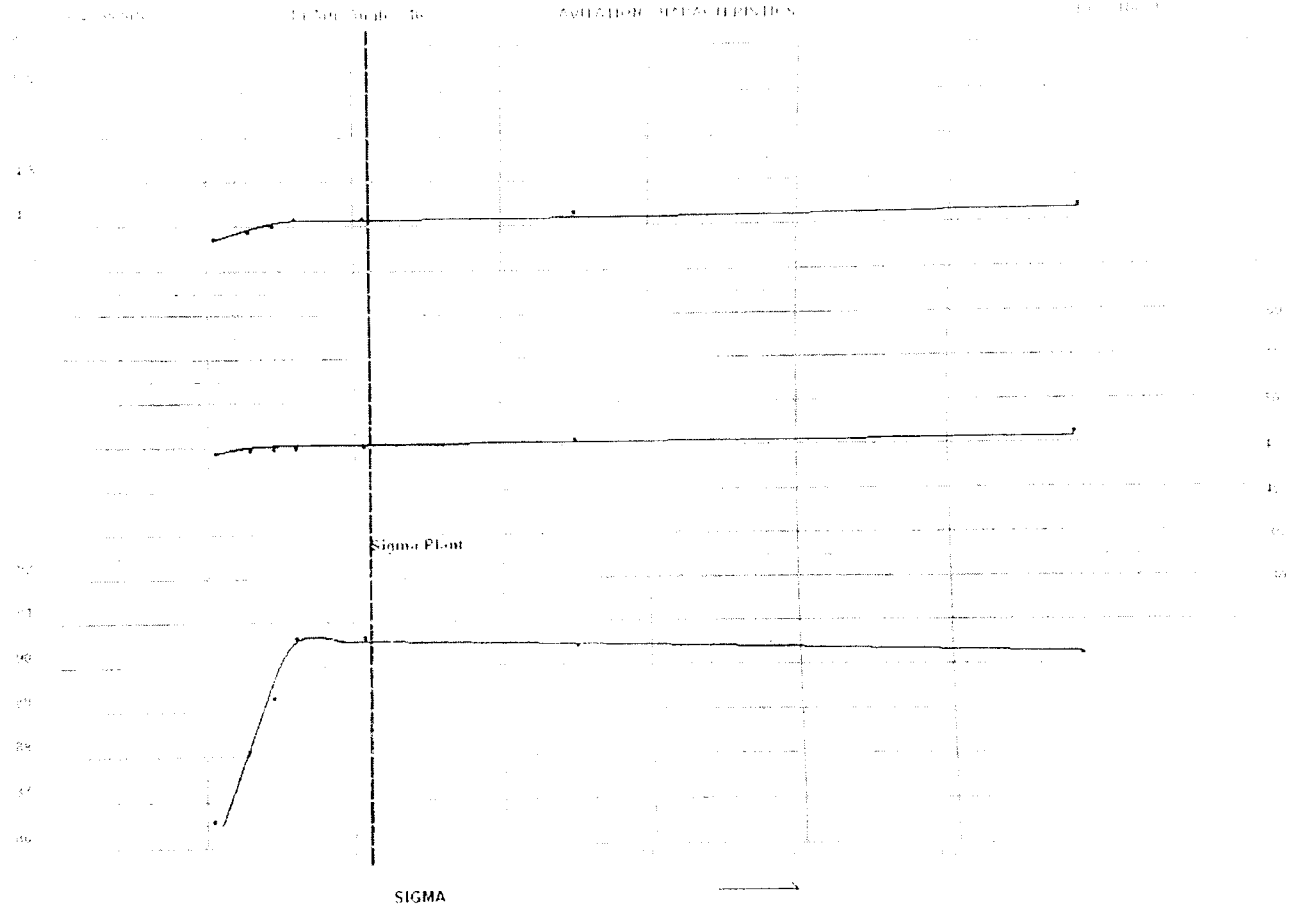
TEST RIG No : 1 | CIRCUIT : CLOSED LOOP | PUMP SETUP : PARALLEL | MODE : TURBINE | CONST : GV
MODEL DIA : 4 m | INITIAL LOAD 120 kg | PROTO DIA 4.6 m | PROTO HEAD 27.68 m

SL No	GV OPEN	FLOW RATE	PRESS HEAD	NETT HEAD	SUCT HEAD	ATMOS HEAD	TOTAL TORQUE	WATER TEMP	MODEL SPEED	OUTPUT POWER	MODEL EFFI	CAVI COEFF	UNIT SPEED	UNIT DISC	TURBINE EFFI	TURBINE OUTPUT	REMARK
	DEG	m³/s	m	m	m	m	N-m	°C	RPM	kW	%	Sigma	RPM	l/s	%	MW	
		O5 Hz	O2 kg/cm²		O3 kg/cm²	O4 kg/cm²	O1 Hz		PUMP SPEED	POWER FACTOR			SPEED FACTOR	DISC FACTOR		DISCH m³/s	
1	38.50	0.7645	10.408	10.8413	-0.178	9.7467	774.491	26.8	899.69	72.969	90.26	0.882	109.30	1451.13	92.36	40.298	
		4316.11	1.0405		-0.0223	0.96938	6843.37		567.97	0.4187			34.94	0.4639		161.54	
2	38.50	0.7588	10.488	10.9148	3.390	9.7498	773.023	26.9	902.64	73.069	90.46	0.549	109.29	1435.44	92.56	39.959	START OF
		4283.78	1.0484		0.3331	0.96966	6837.00		569.02	0.4150			34.93	0.4588		159.81	RAIN
3	38.50	0.7497	10.576	10.9925	4.919	9.7433	768.310	27.0	905.61	72.863	90.65	0.406	109.26	1413.23	92.75	39.455	PP TAKEN
		4232.36	1.0572		0.4854	0.96897	6816.55		568.01	0.4095			34.92	0.4517		157.38	START OF UNSTABLE ROPE
4	38.50	0.7484	10.599	11.0144	5.414	9.7404	768.565	27.1	905.56	72.883	90.65	0.359	109.14	1409.40	92.75	39.473	START OF
		4225.04	1.0595		0.5347	0.96867	6817.65		568.88	0.4084			34.89	0.4505		157.12	WEAK ROPE
5	38.50	0.7427	10.573	10.9816	5.771	9.7451	740.016	27.2	904.58	70.100	88.13	0.328	109.19	1400.71	90.23	38.115	
		4192.54	1.0568		0.5702	0.96910	6693.76		566.52	0.3946			34.90	0.4477		156.08	
6	38.50	0.7445	10.532	10.9428	5.601	9.7411	749.180	27.2	904.55	70.965	89.32	0.344	109.38	1406.58	91.42	38.578	
		4202.59	1.0527		0.5533	0.96869	6733.53		565.89	0.4016			34.96	0.4496		156.47	
7	38.50	0.7387	10.560	10.9644	6.027	9.7350	722.201	27.3	904.54	68.409	86.61	0.304	109.27	1394.28	88.71	37.218	PULSATING
		4169.97	1.0555		0.5957	0.96806	6616.45		566.58	0.3860			34.93	0.4457		155.25	FLOW

(AGM HYDRO LAB)
BHEL

(SE/HD-2) % CEE/PROJECTS)
APGENCO

PULICHINTALA HEP



Minutes of meeting on completion of Turbine Model Witness Test from 07/04/08 to 18/04/09 of Pulichintala HEP held at Hydro Lab, BHEL Bhopal on 18/04/2009.

Members Present:
S/Shri

APGENCO
I.H.T. Ramesh Babu, SE/HD-II
N. Venugopal, ADE %CEE /Projects
/Vidyut Soudha

BHEL, BHOPAL
M.Mangla, AGM (Hydro Lab)
V.S.Rao, Manager (Hydro Lab)
Nitin Khodre, Dy. Manager(Hydro Lab)
Sangeeta Kerketta,Dy.Manager (Hydro Lab)
Kundan Maheshwari,Engineer Trainee

Turbine Model Witness Test were carried out as per following Log of events:

Schedule for the day	Description of Tests
07/04/09	Opening Meeting for briefing about model testing techniques and procedure Familiarization with test bed Presentation of Pre- witness test results. Calibration of Head Transducer, Cavitation Transducer, Torque Transducer, Checking of speed pick up **Performance Test** at β = 5° at various guide vanes at different speed factors Ned = 34.94, 37.52 & 53.07 corresponding to protohead = 27.68m, 24 m (rated) & 12 m respectively.
08/04/09	**Cavitation Tests** at blade angle β = 5° at different speed factors corresponding to prototype head = 27.68 m, 24 m and 12 m. **Runaway Test** at blade angle β = 5° at various guide vane opening. Runner Dismantling for angle change, Setting of angle β = -5 °.
09/04/09	**Performance Test** at β = -5° at various guide vanes at different speed factors Ned = 34.94, 37.52 & 53.07 corresponding to protohead = 27.68m, 24 m(rated) & 12 m respectively. **Cavitation Tests** at blade angle β = -5° at different speed factors corresponding to prototype head = 27.68 m, 24 m and 12 m. **Runaway Test** at blade angle β = -5° at various guide vane opening
10/04/09	Runner Dismantling for angle change, Setting of angle β =10°. Assembly of model. **Performance Test** at β = 10° at various guide vanes at different speed factors Ned = 34.94, 37.52 & 53.07 corresponding to protohead = 27.68 m, 24 m and 12 m respectively. **Cavitation Tests** at blade angle β = 10° for prototype head = 27.68 m
11/04/09	Cavitation Tests at blade angle β = 10° at different speed factors corresponding to prototype head = 24 m. Runaway Test at blade angle β = 10° at various guide vane opening. Runner Dismantling for angle change, Setting of angle β = 0°.

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13/04/09	**Performance Test** at $\beta = 0°$ at various guide vanes at different speed factors Ned = 34.94, 37.52 & 53.07 corresponding to protohead =27.68 m, 24 m and 12 m respectively. **Cavitation Tests** at blade angle $\beta = 0°$ at different speed factors corresponding to prototype head = 27.68 m, 24 m and 12 m.
15/04/09	**Runaway Test** at blade angle $\beta = 0°$ at various guide vane opening Runner Dismantling for angle change Setting of angle $\beta = 16°$ Assembly of model.
16/04/09	**Performance Test** at $\beta = 16°$ at various guide vanes at different speed factors Ned = 34.94 & 37.52 corresponding to protohead = 27.68 m & 24 m respectively. **Cavitation Tests** at blade angle $\beta = 16°$ at speed factor corresponding to prototype head = 27.68 m.
17/04/09	Dismantling of model Calibration of Temperature Atmospheric Head Calibration Dimensional checking of model components started Measurement of Torque armlength. Connection of test loop for flow calibration
18/04/09	Dimensional Checking continued Flow calibration. Closing Meeting on completion of Model Witness Test. Handing over of Witness Test Data.

1. Weighted Average Efficiency at 24 m Rated Head was computed from witness Test data as **93.21%** against Guaranteed Weighted Average Efficiency of **92.927 %.**
2. Runaway Test demonstrated that Prototype ON CAM Runaway Speed = 273.9 RPM against guaranteed value of 275 rpm and OFF CAM Runaway speed = 350.4 RPM against guaranteed value of 357 rpm.
3. Calibration of various parameters were carried out and were found to be same as done before Witness Test.
4. Dimensional Check of model components were carried out on completion of test and were found to be within tolerances as specified in IEC 60193;1999.
5. Weighted Average Efficiency, Power Output, Runaway Speed, Cavitation, Pressure Pulsation Tests have successfully been completed as per the contract. All the tests have been performed in the presence of customer and the test results obtained confirms that all the guarantees are fulfilled.
6. It has been agreed that BHEL is allowed to proceed with design/ manufacturing of prototype turbines based on theoretical design of model.
7. Witness Test Data is enclosed and Final Model Test Report will be delivered within 4 to 5 weeks.

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16.0 DISCUSSION OF TEST RESULTS

Turbine Performance & output test

Pre Witness Tests were carried out as per chapter 7.4.1 and witness test carried out as chapter 7.4.2. The prototype results are derived at chapter 10,11 &15 .

It may be noted that performance parameters which are specified in offer are based on available model with guarantee on weighted average efficiency only. Later on receipt of order new model design is carried out suiting to exact site condition and to meet requirement of weighted average efficiency. Hence efficiencies achieved may differ slightly from specified efficiency in the offer.

Guaranteed output at all the operating heads have been met. Weighted average efficiency on basis of model test works out to be 93.21% which is slightly higher than guaranteed value of 92.927%.

Therefore guarantees with respect to efficiency and output are met.

Cavitation test and pressure pulsation test

It is clear from chapter 11.2 that sufficient margin exists at σplant for specified output range. Pressure pulsations amplitude and visual observation in draft tube cone for entire specified range demonstrate smooth operation.

Maximum Runaway Speed

Refer Chapter 11.3 maximum Runaway Speed for prototype corresponding to maximum head of 27.68m works out to be 273.9/350.4 rpm (ON CAM/OFF CAM) which is lower than guaranteed values of 275/357 rpm (ON CAM/OFF CAM) and is therefore safe.

Calibration of Equipment / Instrument

Refer chapter 14 & 15. Calibration were carried out before pre witness test and during witness test, they are within specified uncertainty.

Dimensional Checking of Model

Refer chapter 13, Dimensional checking of model proves that the model has been manufactured within the tolerances as specified by IEC 60193.

Axial Hydraulic Thrust

Refer chapter 10 & 11, according to model test Maximum Prototype axial hydraulic thrust for off cam condition works out to be 4539.458 KN (462.926 Ton) which will be at -5° blade opening and 27.68m head against specified value of 470 Ton.

Guide Vane Torque

Refer chapter 10 & 11, Prototype guide vane servo motor is designed to take care of maximum torque as per model test.

With this the all the contractual obligations regarding model testing are fulfilled.

Telangana State Power Generation Corporation Limited

Vidyut Soudha,Hyderabad

DETAILED PROJECT REPORT

FOR R&M of Air Pre heaters (APH) in

Unit- 10 (1x250MW) of

Kothagudem Thermal Power Station-V stage.

INDEX

1. Introduction

Telangana State Power Generation Corporation Limited (TSGENCO) is a pivotal power generating organization in Telangana. Apart from Operation & Maintenance (O&M) of the power plants, TSGENCO is taking up Renovation & Modernization (R&M) works of the old power stations.

1.1. Kothagudem Thermal Power Station (KTPS)-V stage has 2 units with a total capacity of 500MW(2X250) and the details are as follows:

S.No	Station	Unit	Capacity (MW)	Date of commissioning	Age
1	KTPS-V stage	Unit-9	250	27-03-1997	25
2		Unit-10	250	28-02-1998	24

The above Units i.e., Unit-9 & Unit-10 have been operating for about 25 years & 24 years respectively.

Each boiler of KTPS-V Stage is equipped with 02 nos. LJUNGSTORM Regenerative Air Preheaters. These air preheaters absorb waste heat from flue gas and transfer this heat to incoming cold air by means of continuously rotating heat transfer elements of specially formed metal sheets with the primary objective of increasing the thermal efficiency of the process.

In unit-09, the air pre heaters were modified with double sealing arrangement during the capital overhaul 2020-21.

The existing Air pre-heaters(APH) with single sealing arrangement in Unit-10 are in continuous service for the last 24 years. The present performance of Air pre heaters is reportedly observed to be deteriorating, affecting the overall performance of the Unit. The

energy audit conducted by M/s National Productivity Council (NPC), Hyderabad in August-September 2018 has identified and reported the underperformance of Air pre heaters at KTPS-V stage. The NPC in its report stated that the existing air leakage across APH of Unit-10 is 60% which is higher when compared to the design value of 8%. Due to higher air ingress in both units, the ID fans, PA fans, FD fans & Mills are being run at higher capacities drawing more power thus resulting in increased auxiliary power consumption.

The energy audit conducted by M/s NPC proposed to arrest leakages across APH or **to replace APH**. By doing so, flue gas outlet temperature will reduce from 187^{0}C to 150^{0}C and improve the boiler efficiency by 1.73% and annual coal savings worth of Rs.663.70 Lakhs.

Hence, to improve the performance of air pre-heaters of Unit-10, it is proposed for modification of the existing single sealing (12 Sectors) Air pre heaters with double sealing arrangement (24 Sectors) to achieve the improvement in performance parameters.

2. Objective of R&M in Thermal Units :

In general, the R&M of a thermal power plant will be implemented based on the following:

i. The units, which require Renovation & Modernization, are identified based on key performance parameters such as Plant Load Factor (PLF), Efficiency, Auxiliary Power Consumption, Fuel Consumption and Emissions etc.

ii. During the R&M project assessment, R&M project scope is defined keeping in view available data, conducting specialized testing and analysis, RLA/LE studies and cost-benefit analysis. Thermal power

plant equipments are designed for about 25 years of operation as these are working under high Temperature and Pressure, which leads to metallurgical deterioration of the metals after prolonged operation. Apart from this, there may be early failures due to deviations in operation practices. As such, before undertaking any preparation of R&M project, assessment of the extent of equipment ageing/deterioration/residual life etc., needs to be made for which following studies/tests are conducted.

a. RLA (Residual Life Assessment).

b. LE (Life Extension).

c. Energy Audit.

d. Condition Assessment.

e. Past History of the Plant.

Based on above studies, scope for R&M project for Boiler, Turbine, and Generator is prepared.

Based on RLA/LE study recommendations, discussions and negotiations, R&M and LE activities will be finalized for achieving the targets of rated capacity generation, Boiler Efficiency, Turbine Heat Rate, plant availability, etc.

Improvement in the operational performance can be gauged from the performance parameters achieved after execution of R&M works.

In KTPS V stage:

The total R&M of the Units-09 & 10 have to be taken up as they have completed their useful service of 25 years and 24 years respectively. Hence for conducting the Remnant Life Assessment (RLA) of Boilers and its auxiliaries, RLA & Condition Assessment (CA) of Turbine & Critical Piping, Power Transformers and Ash Handling System in Units-09 & 10 of KTPS-V Stage, a Purchase Order No.4900027002, Dt:14.09.2018 was placed on M/s. TUV SUD SOUTH ASIA Pvt. Ltd., Noida.

Accordingly, RLA study of Unit-10 was carried out by M/s.TUV SUD SOUTH ASIA PRIVATE LIMITED, Noida during the Annual Overhaul from 25.01.2019 to 07.02.2019.

Based on the RLA study recommendations, the comprehensive R&M proposals for Boiler, Turbine and Generator will be taken up in the near future for which it takes considerable time.

Further, Energy Audit study of KTPS-V Stage was carried out by Energy Management Department, National Productivity Council (NPC), Hyderabad during 2018-19.

In view of the observations and recommendations of the Energy Audit of NPC, the R&M of APH of unit-10 is being taken up to replace the existing APH with the technologically advanced system i.e., Double Sealing Air Pre-heater exclusively to address the following acute problems:

1. High seal leakages.
2. Deterioration of heat absorbing characteristics.
3. Loading of the PA, FD & ID Fans.

4. High Auxiliary Power Consumption.

2.1 Objective of R&M of Air Pre heater in Thermal Units:

The R&M of Air Pre-heaters is necessitated for the following specific reasons:

i. Many existing coal-based power plants with installed capacities of 200/210/270 MW are now equipped with double sealing arrangement for better boiler efficiency and low generation cost.

ii. The crucial role of Air Pre heaters in thermal units is to maximize heat recovery from the flue gas, which is achieved by minimum leakages. Double sealing Air pre-heaters arrest these leakages thus reduces auxiliary power consumption, lowers outlet flue gas temperature.

iii. The new installation being capital intensive, it is considered prudent to maximize the generation from the existing power stations to ensure optimal utilization of resources. This would involve replacement of the existing obsolete items of equipment in operation with those with more efficient and of latest designs incorporating the state-of-the-art technologies and improved metallurgy.

iv. The environmental regulations are becoming stringent day by day. The units which were designed earlier were provided with less effective environmental systems which do not meet the present day standards, requiring either refurbishing the systems or complete replacement.

v. The R&M Program is primarily aimed at improving the plant performance and efficiency enhancement, overcoming problems

such as rise in Heat Rate, Specific Coal Consumption & Auxiliary Power Consumption and reduced Gross Generation & PLF etc.

3. Detailed Justification for R&M of APH in Unit-10

3.1. The details of the existing APH and its present status is summarized as below:

The Air Pre heaters with Single Sealing arrangement was commissioned on 28-02-1998 for Unit-10 and is in operation since then. The present performance of Air pre heaters is reportedly observed to be deteriorating which is affecting the overall performance of the Unit. The energy audit conducted by National Productivity Council (NPC), Hyderabad reported the underperformance of Air pre-heaters at KTPS-V stage. The audit report furnished by the NPC regarding the operation of boilers of Unit-10 is detailed below:

a) **Boiler Load:** The boiler was generating as per the design conditions.

b) **Fuel:** The plant was using better quality of coal as per the design conditions. (The actual GCV is 3545.80 kCal/kg against the design GCV 3000 kCal/kg).

c) **Flue Gas Temperature:** The flue gas exit temperature of the boiler is lower than the design temperature mainly due to huge ingress of air across APH.

d) **Cold Air Ingress:** The flue gas analysis shows that the air ingress across air pre-heater of unit-10 is 60% when compared to design value of 8%.

3.2. **Technical Details of existing Air pre-heaters are as follows:**

Make:BHEL,

Model No :**27.5 VITM 2000**

Heating Surface Area :19000m^2.

Total weight :283 Tons.

Number of Sectors :12

Sealing System : Single Sealing

S.No	Type of Baskets	Quantity (No's)
i	Hot End Baskets	120
ii	Hot Intermediate Baskets	120
iii	Cold End Baskets	168
iv	Total	**408**

3.3. **Performance Parameters of Air Pre-heaters of Unit-10 of KTPS-V Stageas per the NPC Audit Report:**

S.No	Parameter	Units	Design	Actual
1	Inlet GasTemperature	°c	356	335
2	Outlet Gas Temperature	°c	150	134
3	Gas Flow rate	TPH	1103	1035.0
4	Oxygen at inlet	%	3.57	5.40
5	Oxygen at outlet	%	5.5	11.6
6	Air inlet temperature	°c	40	43
7	Air outlet temperature	°c	330	272
8	Mass flow rate of air	TPH	1014	944

9	Air temperature rise	°C	290	229
10	Flue gas temperature drop	°C	206	201
11	APH effectiveness	%	92	78
12	Heat recovered from FG	M kCals	68.2	62.4
13	Heat Pickup by Air	M kCals	73.5	54.0
14	Air Heater Leakage	%	8	60.0
15	Calculated FGT leaving APH (corrected for no air leakage)	°C	158.59	187.30
16	X-Ratio		0.68	0.64
17	AH Gas side efficiency	%	62.47	50.58

Observations and conclusions made by M/s National Productivity Council, Energy Management Department in the Energy Audit report are as follows:

- **Flue Gas Temperature:** The calculated flue gas temperature was much higher than the design temperature of flue gas, which shows that there is cold air ingress across APH. The quantum of cold air leakage in to the APH is calculated for unit-10 i.e., 60% which is very high when compared to design value of 8%. The plant has to take serious steps to reduce the air leakages either by taking appropriate measures such as arresting port holes, leakages in ducts, replacing worn out ducts and expansion joints or it is worthwhile to replace APH if it is damaged completely.
- **Cold Air Ingress:** The performance of ID fans in unit-10 is not satisfactory when compared to design. This is mainly due to

air ingress across APH and in turn additional load on ID fans. Air leaking from the combustion air to the flue gas stream is not participating in the combustion process and it represents an additional burden on the Forced Draft (FD) fans, Induced Draft (ID) fans. As air leakage increases,the FD fan needs to handle an additional volume of air to supply combustion air to the boiler. Additionally, the ID fan power increases, because the fan has to handle leakage air in addition to the combustion products (flue gas). As a result, station service power increases, causing an undesirable increase in net unit heat rate. Hence, the additional load on ID fans in turn affects the loading on PA and FD fans.

- The temperature rise of the combustion air is lower than the design temperature rise of the boiler i.e., 60°C less for unit-10.
- The gas side efficiency (50.58%) of the Air Pre-heater is lesser than the design value (62.47%).
- On overall, the performance of the APH is not satisfactory and the performance may be improved by adopting measures like by arresting the air leakages across APH.
- As KTPS stage-V is under Perform Achieve and Trade (PAT) scheme of Bureau of Energy Efficiency (BEE) under National mission, it is worthwhile to mention here that by reducing or arresting the above loss, KTPS can reduce their Auxiliary Power Consumption (APC) drastically which in turn helps the PAT Target.

3.4 To meet the PAT Targets:

Perform Achieve and Trade (PAT), an insight of Ministry of Power (MoP) and Bureau of Energy Efficiency (BEE) which is a market based mechanism to enhance energy efficiency in energy intensive industries through ESCerts, PAT targets are notified to each designated consumer (DC) thus enabling the designated consumer to operate the plant at design plant performance parameters in the subsequent PAT cycles else huge penalties are attracted for deviation in targets and operating heat rates.

The improvement achieved in the performance parameters after R&M of Air Pre-heaters of Unit-10 certainly aids to meet the PAT targets.

3.5 Adopting the Latest Technology i.e., Double Sealing of Air Pre - heaters:

In present power scenario, in order to compete with other power plants across the country, the generation cost of units must be on lower side and it is possible only by implementing the latest state of art technology. Many thermal power plants initially with Single sealing Air Pre-heaters with installed capacities of 200/210/270 MW are now equipped with double sealing Air Pre-heaters arrangement.

The following advantages shall be achieved by Modification of the existing Air Pre heaters of Unit-10 with double sealing arrangement:

a) Reduction in Air Preheater Leakages up to 6% .

b) Reduction in % Auxiliary Power Consumption as Fan loading reduces significantly due to reduced air leakages.

c) Better heat recovery from flue gas to Primary and Secondary air.

d) Significant improvement in Boiler efficiency.

e) Improvement in Station Gross heat rate.

f) Reduction in particulate matter emission due to better ESP performance with lesser Gas handling.

g) Reduction in Coal Consumption & Mill loading.

h) Reduced Maintenance cost.

3.6 **To get more benefits with relatively less investment:**

The cost implications for carrying out Air pre heater modification of Unit-10 of KTPS-V Stage from existing single seal arrangement to double seal arrangement against regular Overhaul is mentioned below:

Sl. No.	Description	Basic Cost in crores (Rs.)
a.	Investment for carrying out Unit-10 APH overhaul (including replacement of damaged modules, Heating elements, sector plates, Hot end center section and Axial seal plates etc.)	8.0
b.	Investment for modification of Air preheaters from single seal arrangement to double seal arrangement.	10.0

Therefore, modification of Air Pre-Heaters (APH) is more advantageous than carrying out regular overhaul works by investing additional Rs. 2 crores to get the above said more benefits.

3.7**Present Status:** The Air Pre heaters of Unit-10 are almost completing its useful life, the present performance of the equipment is as follows.

PARAMETER		CURRENT STATUS
i) % AUXILIARY POWER		10.17%
ii)% AIR LEAKAGES (APH		56.84/70.78
iii) LOADING OF FANS		
	ID Fan Channel Currents(HT side)	105/103/99/101 Amperes
	FD Fan Current	22/21 Amperes
	PA Fan Current	112/109 Amperes
iv) STATION HEAT		2348 KCal/Kwh

In view of the above, the Renovation & Modernization (R&M) of 2no.s of Air Pre-heaters of Unit-10 is recommended to improve its performance parameters.

4. **Complete Scope of work under R&M:**

Name of the work:

"Modification of 02 Nos Air Pre-heaters (Size 27.5 VIMT 2000) single sealing arrangement with double sealing arrangement by Design, Engineering, Manufacturing, Supply and Erection &Commissioning of Double sealing material duly dismantling the existing single seal air pre-heaters in Unit- 10 (1x250MW) of KTPS-V stage" and the detailed scope is as follows.

4.1. **SCOPE OF SUPPLY:**

SN	Description	Quantity
1	Design,Fabrication and Supply of Modular Rotor with 24 Sectors	2 sets
2	Cold End Heating Elements Baskets for all 24 sectors (material: Corten steel, Advanced Profile with approval of in-charge Engineer)	2 Sets

3	Hot Intermediate Heating Elements Baskets for all 24 sectors (material: Carbon steel, Advanced Profile with approval of in-charge Engineer)	2 Sets
4	Hot End Heating Elements Baskets for all 24 sectors (material: Carbon steel, Advanced Profile with approval of in-charge Engineer)	2 Sets
5	Pin Rack Assembly, 37Teeth pinion and Taper lock Bush.	2 sets.
6	Radial seals, Axial seals, Bypass seals with holding strips and fasteners for hot end & cold end for all 24 sectors.	2 sets
7	T bars , Rotor angles & Bypass seal fixing angles(Air & Flue gas side)	2 sets
8	Rotor post seal for hot end & cold end	2 sets
9	Cold End Spool with air seal assembly for support bearing	2 sets
10	Hot End spool, spool seal ring & Tracking rods with Aluminium air seal assembly for Guide bearing & Kawool retainer box	2 sets
11	Radial sector plate adjustor blocks assembly with shim and fasteners for Hot and Cold ends along with guide pins.	2 sets
12	Axial seal plate adjustor block assembly with shim and fasteners.	2 sets
13	Static seal assembly for Sector plates (Both Hot and Cold ends) and Axial seal plates.	2 sets
14	Axial seal plate to Sector plate seals with door & Frame assembly for Hot End and Cold end.	2 sets
15	Support bracing pipes at Hot end & Cold end including duct bracings	2 sets

16	Connecting plates(Both at Hot End & Cold End) Flue gas side	2sets
17	Side panels for APH	2 sets
18	Radial Sector plates Assembly for both hot and cold end	2 sets
19	Axial seal plates.	2 sets
20	Hot end centre section	2 Nos
21	Insulation fixing materials required for laying wool mattresses for the entire for Two Air Pre Heater and where ever required for the work . Material: Insulation Fixing material such as rod, square plate, round plate & Wire mesh - Mild steel Cladding sheet- Aluminium , Holding strip (Retaining strip), Screw & Binding wire SWG-18 - G.I.	L.S.
22	Lightly resin bonded wool mattress of 60mm thickness confirming to IS 8183/ 93 with density of 150 kg / m^3 with GI. Hexagonal wire netting stitched on both sides of size ¾" x 22 G machine laid & machine stitched in standard sizes for covering the entire Two Air Pre Heater and where ever required for work.	L.S.
23	Expansion joints (RCEJ#4, 5000X3100X561, RCEJ#4, 4100X3700X561 RCEJ#1, 4560X3530X186, RCEJ#1, 3440X2800X186, RCEJ#6, 3100X7200X919PCD,) (1 Set = 5 Nos)	2sets(2APHs)
24	Soot blower pipe, Barco swivel joint, elbows and nozzles	2sets(2APHs)
25	Water wash and Deluge pipes	2sets(2APHS)
26	Cold End gratings	2sets(2APHS)

27 Bearings for the Main Gear box 2sets(2APHS)

***Note** : The materials given in the above list are only approximate. Further materials, if any required for erection and modification of single sealing arrangement to double sealing arrangement shall be provided by the contractor.

Erection and Commissioning.

All the above works should be completed in all respects within 25days from the date of tripping of Unit/date of handing over of site. The works should be carried out round the clock by engaging sufficient number of skilled workmen, so as to complete the above said work within the above period.

All other existing APH components including the following at customer site will be used as such:

1) Rotor post
2) Drive assembly, Guide and Support bearings
3) Lubrication oil systems.
4) Water wash and deluge line strainers and pressure gauges.
5) Cleaning device drive assembly and dial thermometer.

4.2 SCOPE OF WORK:

The following works are to be carried out for providing double sealing arrangement by modifying the existing 12 sectors into 24 sectors in Air pre heaters A & B of Unit-10 of type 27.5 VIMT2000.

1 Dismantling the existing 12 modules including hot, hot intermediate & cold end baskets , axial ,bypass , radial seals& rotor post seals with holding strips ,T bars & Rotor angle, bypass seal fixing angle, pin rack assembly, cold end gratings & cold end doors to suitable for the modification of APH with 24modules..

2 Providing new modular rotor with 24 sector consist of 3 layer (hot end, hot intermediate & cold end) baskets.

3 Providing new T Bar, rotor angles, bypass seal fixing angles & pin rack assembly. Leveling of pin rack assembly.

4 Providing new rotor post seals, radial seals, axial seal & bypass seals with new holding strips for the 24 sector at hot end & cold end.

5 Replacement of all cold end gratings & cold end doors duly removing old one.

6 Replacement of all the Sector plates with new static seals at Hot End & Cold End duly removing old one.

7 Replacement of all the Axial seal plates with new static seals duly removing old one.

8 Replacement of Cold End Spool, Air seal assembly for support bearing duly removing old one.

9 Replacement of Hot End spool with spool seal ring and Air seal assembly for Guide bearing duly removing old one.

10 Renewal of Support bracing pipes at Hot end & Cold end including duct bracings.

11 Renewal of Connecting plates (Both at Hot End & Cold End) & side panels for Two Air pre heaters.

12 Renewal of Axial seal plate to Sector plate seals with Door and Frame assembly.

13 After Providing new rotor, rotor alignment have to be carried out, sector plate should be levelled at hot & cold end and set the radial , axial seal & bypass seals at hot end & cold end according to the original design.

14 Guide bearing and support bearing overhaul should be carried out and if necessary the respective bearing should be renewed (Bearing will be

supplied by TSGENCO) and alignment has to be done.

15 Providing Barco swivel joint, twin nozzle cleaning device as originally fitted in both Air pre heaters.

16 Providing necessary APH duct supports, deluge pipe as per the original design after the completion of work.

17 Removal of insulation in the entire flue gas side/PA Side/SA side (From Cold end connecting plate to hot end connecting plate) of both Air pre heaters (where ever required for work) and relaying the insulation after erection of new modules should be carried out.

18 Renewal of support bracing pipes in Hot End and Cold end of Flue gas side in both Air pre heaters.

19 Replacement of Expansion joints (RCEJ#4- 5000X3100X561, RCEJ#4-4100X3700X561

RCEJ#1- 4560X3530X186, RCEJ#1- 3440X2800X186,RCEJ#6-

20 3100X7200X919PCD). (Total 10 Nos for 2 APHs)

Replacement of the duct wall unit side (UCB) above and below of the Air pre heater (From GD1 & GD2 to APH Hoppers) and Bracings for supporting the ducts above and below the APH (From GD1 & GD2 to

21 APH Hoppers). Patch welding to the APH (From GD1 & GD2 to APH

22 Hoppers) including Hoppers.

23 Replacement of Deluge and Water washing pipes with nozzles.

24 Replacement of pinion and Taper lock Bush with new one.

Overhauling of Oil Circulating units.

25 Replacement of Lube oil in gear boxes, Guide bearings, support bearings,

26 Fluid coupling & soot blower gear reducers.

Replacement of Hot end centre sections.

Replacement of Main gear box bearings and servicing.

*Note: Further works, if any required for erection and modification of single sealing arrangement to double sealing arrangement is under the scope of contractor only.

5. **Estimated life extension of the Asset:**

The life of APH will increase by more than 10 years duly attending the recommended maintenance works.

6. **Improvement in performance parameters:-**

The similar work was carried out in Unit-09 during the Capital overhaul in the FY 2020-21, and the achieved leakage percentage across air pre heaters and flue gas exit temperature are tabulated below.

a. **Leakage Calculation(%)**

	APH-A	APH-B
First set average	4.31	3.59
Second set average	4.61	5.75
Average of two sets	4.46	4.67
Combined Actual Leakage %	**4.57**	
Guaranteed leakage %	**6**	

b. **Flue gas exit temperature(°C):**

	Design	Set-1	Set-2	Average
Flue gas exit temp in Deg.C	**135+3**	135.34	125.82	**130.58**

Performance comparison of U-09 of KTPS-V Stage before and after modification of Air Pre Heaters

❖ **Station Heat Rate:**

	Month	PLF(%)	Heat Rate (Kcal/Kwh)
Before	May-2020	79.53	2457
After	Dec-2020	94.81	2236

❖ **Power Savings:**

	Before	After	Deviation in Power
ID Fan Channel Currents (HT side)	105/103/99/101	72/77/79/75	255.059 KW*2 = 510.118 KW
ID Fan Power (Avg)	991.085 KW	736.026 KW	
FD fan Current	22/21	32/30	-92.307 KW*2 = -184.614 KW
FD Fan Power (Avg)	208.905 KW	301.212KW	
PA fan Current	112/109	75/75	344.936 KW *2 =689.872 KW
PA Fan Power	1073.675 KW	728.739 KW	
Reduction in power Consumption			**1015.376 KW**

❖ **Auxiliary Power Consumption(APC)(%)**

Savings in power (PA,FD &ID fans)	1015.376KW
Power savings per day	0.0245 MU
Power savings per annum (considering85% PLF)	7.560 MU
Achieved Improvement in % APC	**0.41 %**

❖ **Fuel savings due to improvement in boiler Efficiency:**

U-9 Corrected Flue gas Temperature (average)-After	140.33^{0}C
U-9 Corrected Flue gas Temperature (average)-Before	194.95^{0}C
Reduction in Exit Flue gas temperature after APH R&M	54.62 ^{0}C
Improvement in Boiler Efficiency	2.73%
Fuel savings per day (Considering 173 TPH at present condition)	**114.48 TPH**

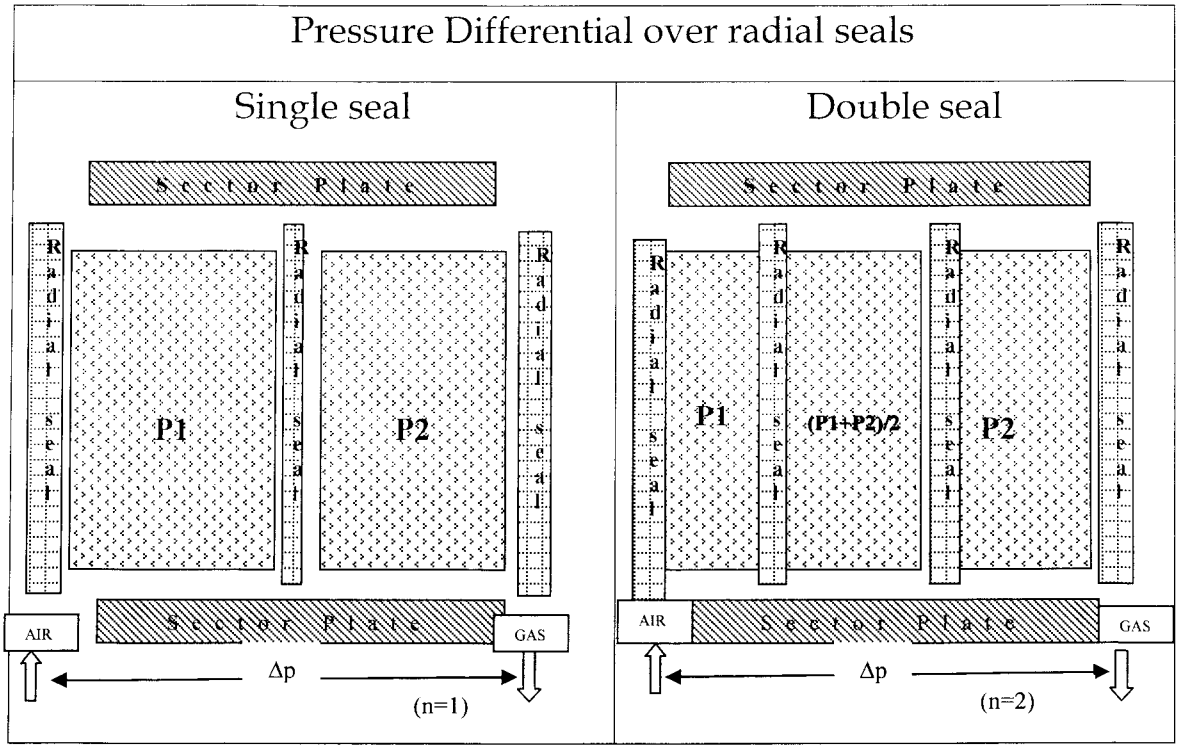
❖ **Achieved Cost savings of Unit-09 after R&M of Air Pre Heater:**

Fuel Savings per annum @85% PLF	**35,517.42 MT**
Power savings per Annum @85% PLF	**7.560MU**
Monetary savings per annum-Fuel (Considering cost of coal/MT;Rs.2900/-)	**Rs.10.300 Crores**
Monetary savings per annum-Power (Considering cost of Generation :Rs.3/- per KWh)	**Rs.2.268 Crores**
Total savings per annum	**Rs.12.568 Crores**

Benefits of Double Sealing Air Preheaters of Unit-10 are as follows:

In Double sealing arrangement the direct leakage is reduced by introducing an additional diaphragm plate between each sector of 12 sector rotor, converting the rotor into 24 sectors which creates hot end differential pressure between gas and air sector leading to lesser leakage. Further, radial seals and axial seals will also be fitted to the rotor. This will enable at least two sectors of rotor covered by the sector plates resulting in reduced leakage.

The principle of double sealing arrangement is explained below:



Leakage α (Gap Length x Gap size x $\sqrt{\Delta p/n}$)

Δp = pressure difference between air and flue gas.

n= Number of Radial walls under Radial seal plate.

In the above diagram, it is observed that by introducing one more diaphragm plate (with radial Seal) between sector plates, the differential pressure between air and flue gases is reduced and as the value of n is increased from 1 to 2, the leakages will be reduced.

7. Cost Benefit Analysis:

The following Cost benefits can be achieved with double sealing arrangement with a payback period of less than 9 months:

FUEL SAVINGS PER ANNUM @ 85% PLF	**37,642.63 MT**
POWER SAVINGS PER ANNUM @ 85% PLF	**7.777 MU**
MONETARY SAVINGS PER ANNUM - FUEL (considering Cost of coal/MT: Rs.2900/-)	**Rs.10.916 CRORES**
MONETARY SAVINGS PER ANNUM - POWER (Considering Cost of Generation: Rs.3.00/- per KWh)	**Rs.2.333 CRORES**
TOTAL SAVINGS	**Rs.13.249 CRORES**
INVESTMENT TO BE MADE	**RS.10 CRORES (APPROX.)**
PAY BACK PERIOD	**~ 09 MONTHS**

The detailed justification for overall cost benefit analysis is as follows:

i) **Anticipated reduction in Power Consumption:**

	U#09	U#10	Deviation in Power
ID Fan Amperages (HT side)	72/77/79/75	100/100/95/95	
ID Fan Power (Average)	736.03 KW	947.36 kW	211.33 KW *2 = 422.66 KW
FD Fan Amperages	32/30	22/24	
FD Fan Power (Average)	301.21 KW	223.48 KW	-77.73 KW *2 = -155.46 KW
PA Fan Amperages	75/75	115/115	
PA Fan Power (Average)	728.74 KW	1117.40 KW	388.66 KW *2 =777.32
Total power reduction after APH R&M (anticipated)			**1044.52KW**

An anticipated power reduction after successful accomplishment of Air preheaters with double sealing arrangement is **1044.52 KW.**

ii) **Anticipated reduction in Auxiliary Power Consumption (APC)(%)**

Savings in Power (PA,FD&ID)	1044.52 KW
Power savings per day	0.025 MU
Power savings per annum (considering 85% PLF)	7.777 MU
Achieved Improvement in % APC	**0.42** %

iii) **Anticipated Fuel savings due to improvement in Boiler Efficiency**

U#10 Corrected Flue gas Temperature (average) - After	135.0 °C
U#10 Corrected Flue gas Temperature (average) - Before	190.91 °C
Anticipated reduction in Exit Flue Gas Temperature after APH R&M	55.91 °C
Anticipated Improvement in Boiler Efficiency	2.79 %
Fuel savings per day (considering 180 TPH at present condition)	121.733 Tons

An anticipated fuel savings after successful accomplishment of Air pre heaters with double sealing arrangement is **121.733 Tons per day.**

8. **Phasing of expenditure: (Anticipated)**

Supply:

Design, Engineering, Manufacturing, Supply of materials required for Modification of 02 Nos Air pre heaters: Rs.8,40,00,000/-.

Services:

Dismantling, Erection & Commissioning of 02 Nos Air pre heaters Rs:1,60,00,000/-.

GST component Rs:1,80,00,000/-.

9. **Schedule of Completion with Milestones:**

A. PRE-SHUTDOWN WORKS:

1. Pre-overhaul test shall be carried out to measure the parameters related to Air pre heater performance and should be recorded. Boiler load, coal type & data, boiler operating parameters shall also be recorded.

2. The contractor should mobilize their working force, tools and plants, sufficient number of winches, high boom capacity cranes etc well in advance before the date of tripping of unit and make all preliminary arrangements required for the above work before the commencement of work.
3. All the scaffolding materials required for this work should be brought by the contractor well in advance before the commencement of overhaul.
4. Preliminary arrangements such as providing temporary scaffolding and the transportation of required materials to the working area should be carried out well in advance before overhaul.
5. All the materials in the scope of supply should be made available at site and all its dimensions should be checked before erection.
6. PERT Chart for the work of Providing double sealing arrangement by modifying the existing 12 sectors into 24 sectors in Air pre heaters A & B of Unit-X of type 27.5 VIMT2000 from the date of commencement of work to the date completion of work should be handed over to the field engineers well in advance before commencement of work.

B. SHUTDOWN WORKS:

a) **DISMANTLING :-**

1. Removal of insulation for the required portion to be opened up for the dismantling work of the existing Air pre heater rotor.
2. Removal of insulation in the entire Air pre heater.
3. Dismantling the existing Air pre heater rotor with all hot end, intermediate & cold end baskets and all existing T bars & Rotor angle, bypass seal fixing angle, radial, bypass, axial, rotor post seals and pin rack assembly.

4. Dismantling the Sector plates both at Hot end and cold end, Axial seal plates, Cold end spool, Hot End Spool, Air seal assembly both Hot End & Cold end, Air pre heater side panels and Connecting plates both Hot End & Cold end in both Air pre heaters.
5. Dismantling the APH gearbox pinion from the APH rotor (ie)from the pin rack.
6. Dismantling the APH support bracing pipes, deluge pipe assembly and twin nozzle cleaning device.
7. Drain the dirty oil from guide bearing & support bearing.
8. Devolution of dismantled Air pre heater materials to central stores then and there.

b) <u>ERECTION WORKS:</u>

1. Overhauling of Guide bearing and support bearing should be carried out and bearings should be renewed wherever necessary (Bearings will be supplied by board).
2. Erection of sector plates at Hot end and Cold end.
3. Erection of Axial seal plates .
4. Erection of Cold end Bracing pipes and connecting plates at Cold end.
5. Hot end spool with spool seal ring and Air seal assembly for Guide bearing should be replaced with new ones.
6. Erection of new modular rotor with 24 sectors consists of 3 layer (hot end, hot intermediate, cold end) baskets.
7. Cold end spool and Air seal assembly for support bearing should be replaced with new ones.
8. Erection of new pin rack Assembly and leveling.

9. Providing new T Bar angles, rotor angles, bypass seal fixing angles.
10. Providing new rotor post seals, radial , axial seals & bypass seals with new holding strips for the 24 sector at Hot End and Cold End.
11. Static seals should be provided in all Sector plates for both Hot End and Cold End with new ones.
12. Static seals should be provided in all Axial Seal Plates with new ones.
13. Axial seal plate to Sector plate seals with Door & Frame should be replaced with new ones in both Hot end and Cold end in Both Air pre heaters.
14. After Providing new rotor, rotor alignment have to be carried out, sector plate should be leveled at hot & cold end and set the radial , axial seals & bypass seals at hot end & cold end .
15. Properly refilling the new oil supplied by board in guide bearing, support bearing & Air pre heater gearbox after proper cleaning and draining of the all lub oil lines.
16. Fixing the gear box with the newly erected rotor pin rack and new pinions.
17. Erection of Hot end Bracing pipes and connecting plates at Hot end.
18. Side panels for flue gas side should be replaced by new ones.
19. All the welding works related to Airpreheater should be carried out by the contractor at their cost as instructed by the site engineer.
20. Replacement of twin nozzle cleaning device as originally fitted in both Air preheaters.
21. Providing necessary APH duct supports after the completion of work.

22. Lube oil pump and APH trial run should be carried out after completing all the works and its smooth operation should be ensured by the site engineer.

23. Removal and relaying of insulation in the entire Air pre heater from Cold end connecting plate up to Hot end connecting plate should be carried out.

24. After completion of all the works, the insulation in the removed area should be relayed.

25. The structures, pipelines and platforms dismantled during the erection work are to be re erected as originally provided.

26. Dismantling the temporary platform and cleaning the area has to be done and the working area to be cleared and cleaned.

27. Replacement of Deluge pipes and Water wash pipes.

28. Support bracings at Hot end and cold end including duct.

29. Replacement of Cold End gratings for both the Air Pre Heaters with new one.

30. Replacement of Hot End Centre section of both the Air Pre Heaters.

31. Replacement of Main gear box bearings and servicing.

32. *Any other work related to the smooth running of Air pre heater not mentioned in the scope of work should be carried out by the contractor at their cost.

33. Replacement of the duct wall unit side (UCB) above and below of the Air pre heater (From GD1 & GD2 to APH Hoppers) and Bracings for supporting the ducts above and below the APH (From GD1 & GD2 to

APH Hoppers). Patch welding to the APH (From GD1 & GD2 to APH Hoppers) including Hoppers.

C. COMMISSIONING WORKS:-

After completion of all the works as specified in the scope of work, lub oil pump, Twin nozzle device and APH trial run should be carried out after completing all the works and its smooth operation should be ensured by the site engineer and attend defects if any.

D. POST SHUTDOWN WORKS:

1. All the drawings related to the newly erected Air pre heater with dimensions should be handed over to the site engineers.
2. After the completion of overhaul, post-overhaul test shall be carried out and similar set of parameters related to Air pre heater taken before overhaul shall be measured and compared to ensure the improvement in the performance of Air pre heater

Erection & Commissioning schedule for Air pre heaters R&M work in Unit-10		
Sl.No	**Activity**	**No of Days**
A	**Pre-Shut Down Activities**	**15days**
A-1	Mobilisation of Tools & tackles	
A-2	Obataining of gate pass labour licence etc for work men	
A-3	Obataining power supply point for welding & fabrication of trolleys for movement of modules	
A-4	position of lifting tackles/winches/cranes	
B	**Dismantling of APH-10A & 10B**	**10days**
B-1	Cutting & dismantling of APH Inltet & Outlet ducts, expansion joints to the extent required	
B-2	Removal of water washing / fire fighting manifolds from Hot End & Cold End, Lub oil connections & instruments	

B-3	Removal of side panels, heating elements, sector plates, seals	
B-4	Removal of Hot End center section by locking main pedestals	
B-5	Removal of rotor section and housing	
C	**Erection & Commissioning of APH-A&B**	**35days**
C-1	Inspection of Support Bearing and Guide Bearings	
C-2	Erection of Hot End center section	
C-3	Erection of Cold End sector plate	
C-4	Erection of Axial seal plates	
C-5	Erection of rotor segments along with heating elements and its alignment	
C-6	Erection of Hot End sector plate and leveling	
C-7	Erection of side panels and pedestals,Connecting plates	
C-8	Erection of Expansion joints	
C-9	Alignment of sector plates and axial seal plates	
C-10	Main Gear box inspection	
C-11	Installation of Rotor angle, T-Bar and By pass angle	
C-12	Erection of Pin rack assembly and pinions	
C-13	Seal setting	
C-14	Erection of water washing / fire fighting manifolds from Hot End & Cold End, Lub oil connections etc	
C-15	Soot blower pipe assembly replacement	
C-16	Replacement of Flue gas duct one side wall	
C-17	Commissioning of APH & Trail run on no load	
C-18	Insulation over APH and ducts	
D	**Post shut down works**	**30days**
	Devolution of scrap	

Dismantling of existing system, erection & commissioning of new APH shall be completed within 45 days from the date of handing over of site.

10. **Reference Price Levels:**

The similar work was carried out in Unit-09 of KTPS- V Stage in the FY 2020-21 and the reference price levels are taken from unit-9 R&M work Contract No: 3000000025, Dt:13-12-2019.

S.No.	Description of the work in Unit-09	Amount
1.	Supply for 02 Nos Air pre heaters	Rs.8,40,00,000/-
2.	Erection and Commissioning of 02 Nos Air Pre heaters	Rs.1,60,00,000/-
Freight, Insurance, GST for materials & GST for Services		Rs.2,19,64,800/-
	Total Contract Price	**Rs.12,19,64,800/-**

11. **Estimated Completion cost including foreign exchange component, if any:**

Sl. No.	Description	Price(Rs.)
1	Supply for 02 Nos. Air Preheaters	8,40,00,000/-
2 h	Erection and Commissioning of 02 Nos. Air Preheaters	1,60,00,000/-
	Total Basic Price (Rs.):	**10,00,00,000/-**
3	GST @18%	1,80,00,000/-
4	**Total**	**11,80,00,000/-**

No Foreign exchange component required.

12. Proposal of Schedule works with expenditure:

S.No.	Description	Schedule details with tentative date	Expenditure in Rs.
1.	Modification of 02 Nos Air pre heaters in Unit-10	During the capital overhaul in the year 2023-24	Rs. 11,80,00,000/-

12.1 Scheduled Supplies & Service Particulars:

S. No.	Description	Unit rate (Rs.)	Total Basic Price (Rs.)
1	Supply for 2 Nos. Air Pre heaters	8,40,00,000/-	8,40,00,000/-
2	Erection and Commissioning of 2 Nos. Air Pre heaters	1,60,00,000/-	1,60,00,000/-
	Total Basic Price (Rs.):		**10,00,00,000/-**
	GST @18%		1,80,00,000/-
	Total		**11,80,00,000/-**

13. Other relevant aspects:

a) The thermal units which had taken up R&M of APH are detailed below:

S. No.	Project	Executed by	Period
1	Tuticorin Thermal Power Station (TANGEDCO) 5x210MW	M/s BHEL & 02 units by M/s GEECO Enercon Pvt.Ltd.	Jan-2014

2	Korba West (Hasdeo) Thermal Power Station (CSPGC)U1&2(2x210) MW	M/s BHEL	Oct 2010 & Nov-2010
3	Satpura Thermal Power Station (MPPGCL) U-6(200MW) &U-8(210MW)	M/s BHEL	Aug-2014 & Oct-2014
4	Guru Gobind Singh Super Thermal Power Plant, Ropar (PSPCL) U-2 (210MW)	M/s BHEL	Mar-2015
5	Ukai Thermal Power Station (GSECL) U-4 (200MW)	M/s BHEL	June-2017
6	Wanakhori Thermal Power Station (GSECL) U-3(210MW)	M/s BHEL	Nov-2017
7	Raichur Thermal Power Station (KPCL) U1&2(2x210)	M/s BHEL	Oct-2017& Jan-2018
8	Koradi Thermal Power Station (MAHAGENCO) U-6 (210MW)	M/s BHEL	Jan-2018
9	Kothagudem Thermal Power Station - V Stage(Unit-09)	M/s BHEL	Jun-2020

b) <u>About National Productivity Council</u>:

M/s National Productivity Council, Hyderabad is a tripartite autonomous not-for-profit organization under Ministry of Commerce & Industry, Govt. of India and is a pioneer national level organization promoting productivity culture in the country. NPC as an apex body has been providing consultancy and training in various fields including Energy Management, over the past five decades and has undertaken research in the areas of productivity, besides implementing the productivity promotion programs of the Government of India and also for the Tokyo based Asian Productivity Organization (APO).

CHIEF ENGINEER
GENERATION

TELANGANA STATE POWER GENERATION CORPORATION LIMITED
(A Govt. of Telangana State Undertaking)
Vidyut Soudha, Hyderabad - 500082. www.tsgenco.co.in
Phone: 040 - 23499321 Fax: 040-23499323

From:
The Executive Director,
Thermal Projects Construction,
TSGENCO, Vidyut Soudha,
Khairatabad, Hyderabad-500 082.
Email ID: edtpctgenco@gmail.com

To:
M/s Bharat Heavy Electricals Limited,
Power Sector - Marketing,
BHEL House, Siri Fort,
NEW DELHI-110049.
Fax: 011-26493561

Attention: Sri S.C.Varma, DGM/Mktg

LOI.No:ED/CE/TPC/SE1/EME7/KTPS-VII(1X800MW)/F:FGD/D.No:22/18, Dtd:29.05.2018.

Sir,

Sub: TSGENCO - Kothagudem Thermal Power Station Stage-VII (1X800 MW) - Design, Engineering, Manufacture, Supply, transportation to site, insurance, erection, testing & commissioning of Flue Gas Desulphurisation (FGD) System including Civil works and Mandatory Spares - Issue of Letter of Intent - Reg.

Ref:

1. M/s BHEL Lr.No:MS-1-14-0009, Dtd:20.05.2016.
2. Lr.No:CE/TPC/SE-1/EME1/KTPS-VII(1x800MW)/BHEL/D.No:306/16,Dt:27.10.2016.
3. M/s BHEL Lr.No: MS-1-14-0009/A, Dt:08.03.2017: Technical Proposal for FGD.
4. M/s BHEL Lr.No: MS-1-14-0009, Dt:20.07.2017: Price offer and revised Technical proposal for FGD System.
5. Meeting between TSGENCO and M/s BHEL held on 31.07.2017 regarding Sulphur content to be considered for design of FGD.
6. Lr.No:ED/TPC/SE-1/EME-3/KTPS-VII(1X800MW)/F.FGD/D.No:190/17,Dt:01.08.2017.
7. M/s BHEL Lr.No:MS-1-14-0009, Dt:01.09.2017: Revised Price offer for FGD.
8. Lr No:ED/TPC/SE-1/EME-3/KTPS-VII(1X800MW)/F.FGD/D.No.247/17,Dt:22.09.2017.
9. Lr.No:ED/TPC/SE-1/EME-3/KTPS-VII(1X800MW)/F.FGD/D.No.258/17,Dt:04.10.2017.
10. MOM between TSGENCO and M/s BHEL held on 05.10.2017 regarding technical issues and exclusions/deviations raised in BHEL offer for FGD Dt:20.07.2017.
11. Lr.No:ED/TPC/SE-1/EME-3/KTPS-VII(1X800MW)/F.FGD/D.No.262/17,Dt:06.10.2017.
12. MOM between TSGENCO and M/s BHEL held on 13.11.2017 regarding technical issues and exclusions/deviations raised in BHEL offer for FGD Dt:20.07.2017.
13. M/s BHEL Lr.No:MS-1-14-0007, Dt:17.11.2017.
14. Lr.No:ED/TPC/SE-1/EME-3/KTPS-VII(1X800MW)/F.FGD/D.No.306/17,Dt:17.11.2017.
15. MOM between TSGENCO and M/s BHEL held on 23.11.2017 regarding price negotiation on BHEL revised Price offer Dt:01.09.2017.
16. M/s BHEL Lr.No:MS-1-14-0007, Dt:05.12.2017.
17. Lr No:ED/TPC/SE-1/EME-3/KTPS-VII(1X800MW)/F.FGD/D.No.329/17,Dt:08.12.2017.
18. MOM between TSGENCO and M/s BHEL held on 12.12.2017 regarding inclusion of GST and Mandatory Spares in the BHEL revised price offer Dt:01.09.2017.
19. M/s BHEL Lr.No:MS-1-14-0009, Dt:02.01.2018: Price Break-up and list Mandatory Spares for FGD System.
20. Lr No:ED/TPC/SE-1/EME-3/KTPS-VII(1X800MW)/F.FGD/D.No.361/17,Dt:24.01.2018.
21. M/s BHEL Lr.No:MS-1-14-0009, Dt:25.01.2018: Revised Commercial Terms and Conditions for FGD System.
22. M/s BHEL Lr.No:MS-1-14-0009, Dt:03.03.2018: Revised ERV and CDV Formula, which is in line with YTPS.

23. M/s BHEL Lr.No.:MS-1-14-0009, Dt:22.05.2018: Revised Performance Guarantees for FGD System.

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Telangana State Power Generation Corporation Limited (hereinafter referred to as "Purchaser") is pleased to inform M/s Bharat Heavy Electricals Limited, New Delhi, (hereinafter referred to as "Contractor") that the Purchaser accepts the contractor's techno-commercial offer cited above, read with specification, related discussions, correspondence/clarifications on deviations and negotiations for Flue Gas Desulphurisation (FGD) System an additional Scope of work pertaining to (1X800 MW) Kothagudem Thermal Power Station, Stage-VII, Unit#12, subject to the following terms & conditions.

1.0 SCOPE OF WORK:

It is not the intent to list out complete scope of work hereunder. However, the broad scope of the work shall include but not be limited to the following:

Single EPC contract for Additional Scope of work including basic & detailed design, engineering, manufacture, procurement, assembly, pre-assembly, inspection and testing, packing & forwarding, loading, supply, transportation to site and transit insurance, unloading at site, storage, comprehensive insurance, inter-site & intra-site transportation & handling, Civil works, erection, testing & commissioning of Flue Gas Desulphurisation System and mandatory spares including warranty period for 365 days from the date of completion of commissioning of the above System for 1X800MW Kothagudem Thermal Power Station, Stage-VII, Unit#12.

2.0 PRICE:

2.1 The Prices for Single EPC contract for Flue Gas Desulphurisation System pertaining to 1x800 MW, Unit No. 12 at Kothagudem TPS shall be as follows.

S.No.	Description	FGD System Price in Rupees
A	**Supply Contract**	
A.1	Supply of main equipment and mandatory spares (Ex-BHEL works/BHEL's sub-contractors works/Port of Entry in India basis) excluding all kinds of Taxes /Duties	2,03,70,00,000.00
A.2	GST on A.1 @18%.	36,66,60,000.00
A.3	**Sub-Total (Supplies)**	**2,40,36,60,000.00**
B	**E&C Contract**	
B.1	Unloading at site, handling, inter-site & intra-site transportation, erection, testing and commissioning, completion of trial operation and handing over including insurance excluding ALOP (Advance Loss Of Profit) (covering transit & erection, testing and commissioning) excluding all kinds of taxes/duties.	21,00,00,000.00
B.2	GST on B.1 @ 18%	3,78,00,000.00
B.3	Local Freight	2,48,64,400.00
B.4	GST on B.3 @ 18%	44,75,600.00
B.5	**Sub-Total E&C**	

C	**Civil works Contract**	
C.1	Civil works (Excluding all taxes & duties and Royalty Charges) & inclusive of BOCW @ 1%	44,00,00,000.00
C.2	GST on C.1@18%	7,92,00,000.00
C.3	**Sub-Total (Civil Works)**	**51,92,00,000.00**
D	**Grand Total (A3 +B5 + C3)**	**3,20,00,00,000.00**
(Rupees Three Hundred and Twenty Crore Only)		

2.2 (i) Prices indicated above at Para 2.1 are firm till the entire completion of the project.

(ii) The price break-up of FGD mandatory spares shall be indicated separately during BBU submission stage.

(iii) The zero date for the contract will be reckoned with effect from the date of issue of this LOI.

3.0 TAXES AND DUTIES:

3.1 The GST on various items shall be billed as per the HSN codes and applicable GST rates and the same shall be paid by TSGENCO at actual within contract period.

3.2 Any increase in rates of GST on supplies/work executed beyond contract period shall be to BHEL account. However, in case of decrease in rates of GST on supplies/work executed beyond contract period, the GST shall be claimed by BHEL at reduced rates only.

3.3 Other than GST if any other government/local body taxes become applicable, such taxes/duties/levies etc shall be paid by TSGENCO extra at actuals.

3.4 Basic concessional customs duty of 5% and applicable educational cess of 3% is included in the prices at 2.1(A.1) above towards the import of raw materials and components.

3.5 The Essentiality certificate issued by Government of Telangana State will be arranged by TSGENCO. The concessional customs duty of 5% along with Educational cess of 3% is considered on CIF component of Rs. 55 Crore (Rupees Fifty Five Crores Only) and the same is included in the Contract Price at item 2.1(A.1).

3.6 The CIF component of Rs.55 Crores (Rupees Fifty Five Crores Only), is worked out at State Bank of India exchange rates as applicable on 01.09.2017. Any variation in Customs duty due to increase in the rate of customs duty and/ or introduction of any new import levy shall be payable extra as per formula enclosed at Annexure-1. Exchange rate variation/ Custom Duty Variation shall be limited to CIF value indicated above. BHEL shall not claim any Exchange Rate Variation, Customs duty and Customs duty variation for imports beyond Rs.55 Crores.

3.7 TDS will be deducted as per the rules made there under.

4.0 TERMS OF PAYMENT:

The terms of payment will be as follows:

A) Supply Contract:

i) No initial advance.

ii) 80% of Contract Price indicated at 2.1(A.1) towards supplies of FGD System, along with 100% taxes and duties on pro-rata dispatch of material to site.

iii) 15% on pro-rata receipt of material at site.

iv) 5% on trial operation of FGD System.

B) Erection and Commissioning Contract:

i) No initial advance.

ii) 95% of Contract Price indicated at 2.1(B.1) towards Erection & Commissioning of FGD System, along with 100% taxes and duties, against progressive erection on pro-rata basis.

iii) 5% on trial operation of FGD System.

C) Freight:

100% of Contract Price mentioned at 2.1(B.3) towards FGD System along with corresponding taxes & duties against receipt of material at site on pro-rata basis.

D) Civil Works Contract:

i) No initial advance.

ii) 95% of Contract price indicated at 1.C.1 towards Civil Works, along with 100% taxes & duties on pro-rata basis against Civil & Structural steel bills.

iii) 5% on trial operation of FGD System.

5.0 MODE OF PAYMENT:

The payment by TSGENCO will be released within 30 days of receipt of Invoices provided such invoices are submitted in accordance with the terms and conditions of the contract.

6.0 COMPLETION PERIOD:

The dispatches from BHEL works and the erection activities will be planned to achieve a commissioning schedule (Trail operation) of 30 months from the Date of Issue of L.O.I.

7.0 LIQUIDATED DAMAGES:

a) For Delays in commissioning (Trial operation) of FGD System:

Any delay in the commissioning of the FGD System beyond the contractual commissioning schedule of 30 months reckoned from the date of receipt of order, due to delays solely attributable to the Contractor shall be subject to levy of liquidated damages at the rate of 0.5% of the contract price per week of delay subject to a maximum ceiling of 5% of the Contract price 2.1 (A.1 + B.1 + C.1) (Excluding Prices of Mandatory spares).

b) For Delays in supply of Mandatory Spares of FGD System:

In case of delay in supply of mandatory spares beyond 30 months, due to reasons attributable to the BHEL, LD shall be levied @ 0.5% of the contract price of undelivered mandatory spares (excluding taxes and duties) per week of delay or part thereof, subject to a ceiling of 5% of the contract price of undelivered mandatory spares (excluding taxes and duties).

c) For Guaranteed Performance Parameters:

BHEL Guarantees the following parameters in respect of performance of the FGD System, which shall be established by conducting Performance Guarantee Tests. In case of any shortfall in achieving these guarantee parameters, liquidated damages as per the rates indicated in the following table will be levied:

S.No.	Performance Parameters	Unit	Guaranteed Value	Liquidated Damages
1	SOx emission at the FGD Outlet	mg/NM3 @6% O2 dry	≤100	--
2	Auxiliary Power Consumption	KW	9200	Rs. 2,00,000/- per KW increase
3	Limestone Consumption rate at 100% of FGD load at Unit MCR	Kg/hr	9485	Rs. 1,50,000/- for every one kg/hr increase in limestone consumption from the guaranteed value.

The maximum ceiling for liquidated damages for auxiliary power performance of FGD system shall be 5% of the Contract price. Contract Price for the purpose of liquidated damages for performance will be considered as 2.1 (A.1 + B.1 + C.1) excluding prices of mandatory spares.

d) The total liability of the contractor on account of liquidated damages for delay in commissioning and performance of FGD system is limited to 10% of the contract value. Contract Price for the purpose of liquidated damages for performance will be considered as 2.1 (A.1 + B.1 + C.1).

8.0 CONTRACT PERFORMANCE GUARANTEE:

BHEL shall submit Bank Guarantees for 10% of Supply price, Erection price and Civil price towards contract performance separately within 15 days of issue of LOI. Performance BGs will be valid till completion of the warranty of FGD System, with Claim period of BGs over and above the six months of validity period. Proforma of performance Bank guarantee is enclosed.

9.0 TRIAL OPERATION:

a) Trial operation shall be defined as continuous operation of the FGD System for 14 days, at any unit load, up to maximum capacity of 800 MW, as mutually agreed between Contractor and TSGENCO. Trial operation will also include 72 hours of continuous operation on full load for the FGD System with guaranteed value of SOx emissions at FGD outlet during complete period of trial operation. Any interruption caused by the Contractor up to 24 hours will not affect the period of 14 days trail operation indicated above. In case of such interruption occurring for more than 24 hours, the above period shall be extended correspondingly.

b) **The completion of trial operation of FGD System is subject to successful operation of unit at full load with FGD with guaranteed SOx emissions at FGD outlet.**

c) The readiness of the FGD System for the trial operation shall be intimated by written notice to TSGENCO. After receipt of such notice and a consent within 15 days from TSGENCO, if the trial operation could not be performed or could not be completed due to any reasons not attributable to the Contractor, then Contractor shall be absolved of the responsibility for the delay and the FGD System shall be deemed to have been taken over by the TSGENCO at the end of 15 days after the Contractor's notifications of readiness of the same. In case TSGENCO does not reply within 15 days from Contractor's notification of readiness of Trial Operation, the responsibility of insurance of FGD plant and equipment shall pass on to TSGENCO. In such case, the payments related to trial operation shall be released to Contractor on

10.0 COMMISSIONING AND TAKEN OVER:

The FGD System shall be taken over by the TSGENCO after successful completion of trial operation of FGD System as per clause 9.0 above.

11.0 WARRANTY:

Warranty for the FGD System shall be 12 months from the date of completion of Trial Operation.

12.0 INSURANCE:

The material and equipment shall be supplied duly covered under transit insurance including Marine Insurance and Insurance related to High Sea Sales, if any. The material so received shall be insured during storage at site till completion of equipment commissioning in full shape. The insurance of FGD System shall be the responsibility of BHEL till successful completion of trial operation.

13.0 INSPECTION AND TEST CERTIFICATES:

The quality assurance plans, test certificates, type test certificates if any, wherever necessary will be submitted for review and approval of TSGENCO. The SHOP INSPECTIONS WHEREVER necessary will be intimated well in advance for enabling TSGENCO for arranging to carry out the inspection.

14.0 JURISDICTION:

All the disputes arising out of or in connection with this contract shall be settled in the courts of Hyderabad and Secunderabad in the State of Telangana only.

15.0 ACKNOWLEDGEMENT:

This letter shall be treated as "Letter Of Intent" (LOI). This LOI is not exhaustive and is not intended to cover all the terms and conditions of the contract. This LOI is being issued in duplicate. BHEL shall return the duplicate copy duly signed and stamped on each page by the authorized signatory of the company in token of acceptance of the same. Detailed Purchase Order(s) will be issued separately.

Yours faithfully,

EXECUTIVE DIRECTOR/TPC,
(For and on behalf of TSGENCO)

We accept the terms and conditions of this Letter of Intent.

Seal of the company **M/s BHEL**

Copy Communicated to:

1. Executive Director/Civil/Thermal/TSGENCO/VS/Hyderabad.
2. Chief Engineer/Telecom/TPC/Vidyut Soudha/Hyderabad.
3. Chief Engineer/O&M/KTPS/TSGENCO/Paloncha/Bhadradri-Kothagudem Dist.-507115.
4. Chief Engineer(Gen)/TSGENCO/VS/Hyderabad.
5. Chief Engineer/O&M/KTPS Stage-V&VI/Paloncha/Bhadradri-Kothagudem Dist-507115.
6. Chief Engineer(Civil)/Hydel & General Services/TSGENCO/VS/Hyderabad.
7. Chief Engineer/Coal & Commercial/TSGENCO/VS/Hyderabad.
8. FA & CCA (Resources & CFO)/TSGENCO/VS/Hyderabad.
9. FA & CCA(Accounts)/TSGENCO/VS/Hyderabad.
10. FA & CCA(Audit)/TSGENCO/VS/Hyderabad.
11. Superintending Engineer(TPC-I/III/IV)/TSGENCO/VS/Hyderabad-500 082.
12. Superintending Engineer(E&M)/KTPS Stage-VII/Paloncha/Bhadradri-Kothagudem(Dist)
13. Superintending Engineer(Civil)/Thermal/TSGENCO/VS/Hyderabad.
14. Superintending Engineer/Adm/KTPS(O&M)/Paloncha/Bhadradri-Kothagudem (Dist.)
15. Superintending Engineer/Civil/KTPS Stage–VII/Paloncha/Bhadradri-Kothagudem (Dist.)
16. SE (Tech) to CMD/TSGENCO/VS/Hyderabad.
17. DYCCA to Director(Finance)/TSGENCO/VS/Hyderabad.
18. DE (Tech) to Director(Projects)/ TSGENCO/VS/Hyderabad.
19. DE (T) to Director(Thermal)/TSGENCO/VS/Hyderabad.
20. DE (T) to Director(Hydel)/TSGENCO/VS/Hyderabad.
21. PO to Director(HR)/TSGENCO/VS/Hyderabad.
22. DE(Tech) to CE/TPC/TSGENCO/VS/Hyderabad.
23. SAO-II/KTPS (O&M)/Paloncha/Bhadradri-Kothagudem Dist.-507115.
24. SAO/Pay & Accounts/TSGENCO/VS/Hyderabad-500 082.
25. Resident Audit Officer, EBRA, Vidyut Soudha, Hyderabad-500082.
26. GM (PMG)/BHEL PMG Office/VS/ Hyderabad-500 082.
27. Stock file.

ANNEXURE-1

FLUE GAS DESULPHARIZATION SYSTEM AT 1X800 MW KTPS STAGE-VII

FORMULA FOR CALCULATION OF VARIATION ON ACCOUNT OF FOREIGN EXCHANGE RATE AND CUSTOM DUTY VARIATION

$$P1 = P0\left[\frac{ER1x\{100 + CD1\}}{100} - \frac{ER0x\{100 + CD0\}}{100}\right]$$

Where

P1 = Variation in Price on account of variation in Foreign Exchange Rate and Custom Duty Rate.

P0 = Value of imported Raw Material/Component (CIF content) in foreign currency as mentioned in BOE.

ER1 = Exchange rate as mention in BOE.

ER0 = Bill selling exchange rate as on 01.09.2017.

CD1 = Custom duty rates expressed in percentage as mentioned in BOE.

CD0 = Custom duty rates expressed in percentage as on 01.09.2017.

Following documents shall be submitted by BHEL for claiming ERV/CDV.

1. BOE (Bill of Entry)
2. Undertaking by BHEL units certifying that the material is procured by BHEL for Kothagudem (1X800MW) TPS project.

ERV/CDV Payment:

- On the basis of actual procurement of imported material, BHEL units will raise the ERV/CDV invoices on quarterly basis, starting at 12th month onwards (from zero date) till completion of all the imports required for the project or till the value of imported material reaches to a limit of Rs. 55 Crore calculated at base exchange rates of 01.09.2017.
- 100% payment towards ERV/CDV claim along with applicable GST shall be released by TSGENCO on submission of the quarterly bills by BHEL units. The payment towards the ERV/CDV claims shall be released within 30 days of receipt on invoices by TSGENCO provided such invoices are submitted in accordance with the terms and conditions of the contract.

Executive Director
Thermal Projects Construction
TSGENCO, Vidyut Soudha,
Khairatabad, Hyderabad-500 082.

(This Bank Guarantee applicable for Supply, Services & Civil portions of the contract and shall be suitably modified)

TELANGANA STATE POWER GENERATION CORPORATION LIMITED

PROFORMA FOR PERFORMANCE BANK GUARANTEE

(This Bank Guarantee has to be executed on Non-Judicial stamped Paper worth Rs.100/-)

In consideration of the Telangana State Power Generation Corporation Limited (hereinafter called 'the Corporation') having at our request agreed to accept this Bank Guarantee No. _____ in lieu of Cash Deposit required from M/s..... , (hereinafter called "the Contractor") for due fulfillments of the terms and conditions of the Purchase Order No. ..... made by the Corporation for ..... (hereinafter called "the said Agreement") during the period, if any, to indemnify and keep indemnified the Corporation to the extent of Rs. ..... (Rupees ..... only) representing Ten percent (10%) of the value of the said Agreement against all the losses, damages, claims and costs caused to or suffered by the Corporation by reason of breach by the said Contractor of any of the terms and conditions contained in the said agreement.

We, ... Bank Ltd., further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said agreement and that it shall continue to be enforceable till all the dues of the Corporation, under or by virtue of the said agreement, have been fully paid and its claims satisfied or discharged, or till the Executive Director/TPC, certifies that the terms and conditions of the agreement have been fully and properly carried out by the said Contractor; and accordingly discharges the guarantee, subject to however, that the Corporation shall have no right under this bond, unless the period is extended as aforesaid, after the expiry of .....

We the guarantor Bank undertake to pay the amount guaranteed hereunder, or such part thereof as required within one week of the same being demanded by the Corporation without referring to the Contractor, and without questioning the right of the Corporation to make such demand or the propriety or legality of the demand.

Not-withstanding anything contained in the foregoing our liability under this guarantee is restricted to Rs. ..... (Rupees ..... only). Our guarantee shall remain in force until the ..... Day of ..... 20... Unless a claim on the guarantee is made against us within 6 months from the date, all the rights of the Corporation under this guarantee shall be forfeited and we shall be relieved and discharged from all liabilities hereunder.

We, ... Bank Ltd., undertake not to revoke this guarantee during its currency except with the prior consent of the Corporation, in writing.

We , (Bank Name, Branch and address) lastly agree that this Bank Guarantee is

i. Unconditional and absolute, and
ii. Without any delay or demur if claim arises.

Dated the ..... Day of ..... , 2018

For .....Bank

Signature :----------

Witness:

Designation:----------

1.

Address: ----------

2.

Seal: ----------

Executive Director
Thermal Projects Construction
TSGENCO, Vidyut Soudha,
Khairatabad, Hyderabad-500 082.

4.0 TECHNICAL WRITE UP ON FGD

4.1 INTRODUCTION

There is a growing concern among wider section of population and among power plant owners about the effects of SO2 emission on human health and environment, caused in the atmosphere due to operation of a number of power plants. In order to control the SO2 emission certain measures are adopted worldwide. Wet Limestone FGD has been a widely established technology for control of SO2 emissions from power plants.

The absorption of sulphur dioxide in wet desulfurization units is realized in absorption towers. The absorption of sulphur dioxide in wet desulfurization units is realized in absorption towers. The flue gas generated from power station is de-dusted in electrostatic precipitator. The de-dusted flue gas is pressurized in Boost Up Fan (BUF) to compensate for the pressure drop in FGD system. The toxic flue gas is scrubbed in SO2 absorption towers with the aid of limestone slurry and is discharged through the stack. Simultaneously, the slurry rich in SO32- ions is oxidized to SO4-2 in oxidization tank (integrated with the absorber module) and ultimately results in the formation of gypsum, which crystallizes out when given sufficient resident time.

4.2 PROCESS CHEMISTRY

SO2 in the flue gas comes in contact with the CaCO3 in the limestone slurry producing CaSO3. The diluted CaCO3 is converted to CaSO4 which is finally crystallized to gypsum. The chemistry of the overall SO2 absorption from the flue gas and conversion to sulphate ion is as follows:

4.2.1 Limestone Dissolution

Limestone is soluble in aqueous solution and this is a major step in a wet FGD system. Dissolution of limestone takes place by the following equation

$$CaCO_3 + 2H^+ \rightarrow Ca^{2+} + CO_2 + H_2O$$

4.2.2 Absorption of SO2

Absorption of SO2 takes place in the scrubbing zone. Sulphur dioxide in the gas phase is first dissolved into the aqueous phase.

$$SO_{2(g)} \rightarrow SO_{2(aq)}$$

The dissolved SO2 dissociates by the following expressions:

$$SO_2 + H_2O \leftrightarrow H^+ + HSO_3^-$$

$$HSO_3^- \leftrightarrow H^+ + SO_3^{2-}$$

The products of HSO3- are neutralized by calcium carbonate to producing CaSO3 and Ca (HSO3)2. The pH of the medium decides which among the above products are formed predominantly. In the pH range of 5 to 6, CaSO3 is the main product

$$CaCO_3 + SO_3^{2-} \rightarrow CaSO_3 + CO_3^{2-}$$

While in the pH range of 4.5 to 5, the following reaction proceeds:

$$CaCO_3 + 2HSO_3^- \rightarrow Ca(HSO_3)_2 + HCO_3^-$$

4.2.3 Oxidation of SO3- To SO42-

CaSO3 and Ca (HSO3)2 are first dissolved and are then converted to CaSO4 by oxidation.

$$SO_3^{2-} + \frac{1}{2}O_2 \rightarrow SO_4^{2-}$$

$$2HSO_3^- + \frac{1}{2}O_2 \rightarrow SO_4^{2-} + SO_2 + H_2O$$

4.2.4 Gypsum Crystallization

Crystallization of gypsum takes place in the oxidation tank.

$$CaSO_4 + 2H_2O \rightarrow CaSO_4 \cdot 2H_2O$$

The overall reaction occurring in the scrubber vessel can be written as

$$CaCO_3 + SO_2 + \frac{1}{2}O_2 + 2H_2O \rightarrow CaSO_4 \cdot 2H_2O + CO_2$$

4.3 FGD SYSTEM DESCRIPTION

4.3.1 Absorption and Oxidation Sections

Untreated flue gas is introduced into the absorber, where cooling occurs during oxidation and desulfurization. After contacting with the absorbent slurry the clean flue gas flows upward and passes through a mist eliminator to make its entrained liquid removed before entering the stack.

Wet/dry Interface Washing Pipes

The absorber tower is equipped with interface washing pipes. This interface washingpipes supply water directly to the inlet walls of the absorber to clean off any build-up of slurry or other residues from the absorber.

4.3.3 Oxidation in Absorber Tank

The absorber tank is sized to hold enough liquid volume and to ensure adequate residence time for the complete oxidation of HSO3- to SO42-. The absorber slurry bleed from the absorber tank is transferred to the gypsum dewatering section. The flow rate of the absorber make-up water is regulated by an on/off valve which receives a signal from the level control indicator in the absorber tank.

4.3.4 Neutralization In Absorber Tank

In the absorber tank, the absorbent slurry is mixed with the supplied fresh lime-stone to compensate the calcium carbonate consumed in both the absorber tank and absorber tower. A pH meter monitors the pH of bled slurry from the absorber tank. The amount of fresh limestone added to the system is regulated by the FGD plant outlet SO2 concentration which is used as a feedback signal and the inlet sulfur load as feed forward signal. The agitator in the absorber tank mixes the slurry to ensure consistent concentration of absorbent and to prevent settlement of solids during Jet Air Spargers stopping.

4.3.5 Absorbent Slurry, Spray Header Pipe and Recirculation Pumps

The refreshed absorbent slurry is re-circulated from the absorber tank to the absorber header pipe by Absorber recycle pumps. The absorber recirculation pumps are specifically designed to pump solids in suspension. The spray headers distribute the absorbent slurry equally to a multiple number of nozzles from which the absorbent slurry necessary for SO2 absorption is provided. The absorber tank is sized to achieve complete neutralization of H2SO4 using CaCO3 with consequential production of crystallized gypsum (CaSO4.2H2O).

4.3.6 Absorber Mist Elimlnator

A highly efficient mist eliminator is located between the absorber and the stack. The Flue gas-entrained mist ring the mist eliminator is collected and returned to the absorber Tank. A washing spray system is installed to intermittently wash down the mist eliminator element surfaces and thereby prevent any deposit build-up on them.

4.3.7 Flue Gas Section

Untreated Flue gas from boiler is introduced to the FGD plant by Booster Fan. The untreated flue gas is fully treated in the FGD plant and introduced to the reheating system to recover heat of the flue gas. After the flue gas passes through the heat extracting side of Gas-Gas Heater (GGH), the flue gas is in-

troduced to SO2 absorption oxidation system. The flue gas treated in SO2 absorption oxidation system passes through the reheating system again to heat the flue gas up. The heated flue gas is emitted from stack through the outlet duct.

The FGD Inlet & Outlet Gates and Bypass Dampers are provided at appropriate places to direct the flue gas. A by-pass duct is provided to direct 100% flue gas to stack so that the boiler is not forced to be shut down due to FGD failure. The flue gas completely bypasses the FGD system by closing the FGD inlet and FGD outlet dampers.

4.4 Gas to Gas Heater

The treated flue gas from absorber enters the gas-gas heater to be reheated. In the Gas- Gas heater, there is an intrinsically pattern of gas leakage. Two sector plates at hot side (top) and cold side (bottom) are furnished to form a sealing mechanism so that the untreated gas leakage to the treated gas side can be minimized. Untreated gas is leaked into the treated gas side due to the space contained by a rotor sector and two sector plates at the rotor turning.

To reduce fly ash and gas leakage of GGH, a scavenging Fan is installed. Soot blowing system is installed to wash fly ash on the heating elements. The heating elements are washed by steam periodically. Further to soot blowing system by steam, a GGH high pressure washing system and GGH low pressure washing system are installed. The GGH high pressure washing system starts automatically if GGH differential pressure High-High is initiated. The low pressure washing is conducted during FGD plant is out of service if necessary.

4.5 Ball Mill System/Limestone Preparation Section

The purpose of this system is to grind lump limestone to powder and preparation of limestone slurry. Two Limestone Ball Mill systems are installed. The Gravimetric Feeder is installed at the bottom of the Limestone Day Silo Limestone feed rate is weighed by the Gravimetric Feeder. The Wet Ball Mill system consists of Wet Ball Mill, Wet Ball Mill oil unit, Mill Product Tank with an

agitator, Mill Product Pump, Mill Hydro cyclone and 2-way distributor. The Wet Ball Mill is the wet horizontal type.

The Filtrate water is supplied to Wet Ball Mill and Mill Slurry Tank. Slurry from the Wet Ball Mill flows by gravity to the Mill Product Tank and then is pumped up to the Mill Hydro cyclone to be classified. The Mill Hydro cyclone underflow containing the oversized material is re-circulated to the Wet Ball Mill inlet directly, while the overflow is discharged to the Limestone Slurry Feed Tank via the 2-way distributor as a product of Wet Ball Mill system. The limestone slurry is pumped from the Limestone Slurry Feed Tank to the Absorber.

4.6.0 Gypsum Dewatering Section

4.6.1 General Description of Gypsum Dewatering Section

Gypsum slurry is bled from the Absorber Tank to the Gypsum Dewatering system. Gypsum slurry from Unit1 and Unit 2 is collected in the primary Hydro cyclone Feed Tank. The gypsum slurry in the tank is fed to the Primary Hydro cyclone system and the underflow slurry is dewatered in the Gypsum Dewatering Belt filter and then dewatered gypsum discharged to the Gypsum conveyor. The filtrate is collected in the Reclaim Water Tank and reused as make-up for the absorber. The overflow from the Primary Hydro cyclone is collected in the Hydro cyclone Waste Water Tank and fed to the Secondary Waste Water Hydro cyclone. The underflow slurry is collected in the Reclaim Water Tank and the overflow is done in the Waste Water Tank. The liquid in the Waste Water Tank is discharged out of the FGD plant as waste water.

4.6.2 Gypsum Dewatering Belt Filter System

Gypsum Dewatering Belt Filter system comprises the Vacuum Pump, Vacuum Receiver and the Belt filter washing system. Gypsum slurry is dewatered by the

way of vacuum dewatering in the gypsum dewatering belt filter system. The filter is washed by the Belt filter washing Tank pump.

4.6.3 Handling System For Heavy Equipments

Handling system like EOT cranes, EOH and under slung cranes shall be provided for handling of heavy equipments like Wet Ball Mill, Recirculation pumps, vacuum belt filters etc.,

4.7.0 Auxiliary System

4.7.1 Process Water System

Process water is collected in the Process Water Tank. The process water in the tank is fed to the FGD system by Process Water Pump. The process water is used for the following purposes:

a) ABSORBER MAKE-UP WATER

The process water is used for absorber make-up water to control the Absorber Tank level.

b) WET/DRY INTERFACE WASHING

The inside walls of the Absorber (wet/dry interface zone) has interface washing pipes mounted at the Absorber inlet. These interface washing pipes periodically shower water against the Absorber walls to clean off any buildup of soot or other residues from the flue gas.

c) WASHING OF MIST ELIMINATOR

The Mist eliminator is washed intermittently by water fed from the Absorber Washing Tank. Inside of the Absorber Washing Tank is pressurized to supply washing water to the Mist Eliminator with sufficient pressure.

d) WASHING OF GGH DRIP TRAY

The GGH Drip Tray is washed intermittently by water fed from the Process water Pump

e) EMERGENCY QUENCHING WATER

Emergency Quenching Water is supplied from the Overhead Emergency Quench Tank. Since the Tank is kept above absorber, emergency water is supplied with the available head.

f) BELT FILTER WASHING

Cloth of Gypsum belt filter is washed. The water in the Belt filter washing tank is used for cloth washing.

4.7.2 Air System

a. Instrument and Service Air System

Instrument air is used for instrumentation or to control equipment for the Absorber Section, the Gypsum Dewatering Section, and the Limestone Preparation Section.

b. Seal Air System

The seal air is supplied by the Seal Air Fan to the GGH system and the dampers through the heater by seal air fan. Also it is supplied as purge air for GGH during FGD plant stoppage.

4.7.3 Absorber Sump

The absorber area sump is provided to collect drain discharged during shut-off operation of absorber recirculation pumps, dumping operation of the gypsum slurry in the absorber and recirculation pipe. In normal operation, drain from

the GGH system is collected. This sump is used as relay sump to transfer slurry in the absorber system and to the emergency storage tank.

4.7.4 Auxiliary Absorbent Tank

Auxiliary Absorbent Tank is provided to invent gypsum slurry stored in the absorber tank. The tank has the capacity to hold slurry of Absorber.

4.7.5 Other sump system

Gypsum Area Drain Sump is used for collecting drain from the dewatering area. Limestone Area Drain Sump is used for collecting drain from the Ball Mill System.

TELANGANA STATE POWER GENERATION CORPORATION LIMITED

ADDENDUM
TO
DETAILED PROJECT REPORT

BHADRADRI THERMAL POWER STATION
4 X 270 MW

JUNE 2018

DESEIN PRIVATE LIMITED

CONSULTING ENGINEERS
DESEIN HOUSE, GREATER KAILASH-II
NEW DELHI – 110 048

BHADRADRI THERMAL POWER STATION
(4 X 270 MW)

ADDENDUM
TO
DETAILED PROJECT REPORT

1.0 INTRODUCTION

1.1 Telangana State Power Generation Corporation Limited (TSGENCO) is one of the pivotal organizations of Telangana, engaged in the business of Power Generation. Apart from operation & maintenance of the power plants it has undertaken the execution of the ongoing & new power projects scheduled under capacity addition programme and is also taking up renovation & modernization works of the old power stations.

TSGENCO came into existence on 19.05.2014 and commenced operations from 02.06.2014. This was a sequel to Government's reforms in power sector to un-bundle the activities relating to generation, transmission and distribution of power. All the Generating Stations owned by erstwhile APSEB in Telangana area were transferred under the control of TSGENCO.

1.2. The State of Telangana requires substantial addition to its power generating capacity to meet power demand of its rapidly growing industrial, agricultural and other sectors. A number of projects, including **Bhadradri Thermal Power Station (4x270 MW),** have been identified by TSGENCO for augmentation of generating capacity.

1.3 TSGENCO has engaged the services of **DESEIN PRIVATE LIMITED**, Consulting Engineers, for the preparation of Detailed Project Report for 4x270 MW Bhadradri Thermal Power Station in October 2014. The final DPR was submitted by DESEIN in January 2015.

1.4 It has become necessary to revalidate the total costing at par with present day costs of plant & machinery and financial analysis in line with Government of India (GoI)/Central Electricity Authority (CEA), CERC/SERC norms and the new MOEF guidelines considering the following:

a) Modifications in Boiler auxiliaries to keep the provision of installation of SCR at a later date to achieve NO_x level of 100mg/NM^3.

b) Modification in the ESPs and associated systems to limit the particulate emission levels of 30mg/NM^3.

c) Addition of FGD Plant to bring down the SO_x levels below 100mg/$NM^3$and modifications in the flue gas ducting of ID system for introduction of FGD plant.

d) Addition of CTs, CVTs, and Bus Reactors as per TSTRANSCO's requirement.

e) Introduction of GST.

2.0 NEED FOR REVISED COST ESTIMATES

2.1 The revised cost estimates are worked out based on the following:

2.1.1 Ministry of Environment & Forests notification will be implemented with respect to water consumption, zero liquid discharge and revised environmental standards for particulate emission, SO_x, NO_x and mercury emissions as mentioned below:

Particulate Matter	-	30 mg/Nm^3
Sulphur Dioxide (SO_2)	-	100 mg/Nm^3
Oxide of Nitrogen (NOx)	-	100 mg/Nm^3
Mercury (Hg)	-	0.03 mg/Nm^3

1) **Particulate matter:** Particulate matter in the flue gas leaving the ESP will be limited to 30 mg/Nm^3 by adding one additional field in the ESP.

2) **Sulphur Dioxide (SO_2) Control**: FGD System, lime stone based will be installed complete with necessary pumps, piping and valves, control and instrumentation and moisture separators for the flue gas to remove SO_2 for all load combinations from minimum continuous to BMCR conditions to meet the limits.

FGD system will be designed and constructed to operate as specified at maximum continuous rated load, i.e., 24 hours per day, 7 days per week, 365 days per year, except during unit outages.

FGD system will include an emergency water quenching system to protect absorber modules, linings, and internals from damage in the event of loss of water to scrubber module at normal flue gas temperature for a period of 30 minutes.

Adequately sized lime stone and gypsum handling facilities will be provided in the project.

3. Oxides of Nitrogen (Nox) Control:

Modifications in the Boiler Auxiliaries will be carried out to install SCR system at a later date. The system will include strengthening of boiler second pass columns, provision of bypass ducts with isolation dampers in the flue gas ducts for easy installation of SCR equipment at a later date with minimum unit outage time.

2.1.2 Electrical Works

The following equipment/systems are considered for the project and included in the basic project cost.

a) Bus reactors: 2 nos. 125 MvA bus reactors for 400 kV switchyard will be provided as envisaged by SRPC during the 39th meeting of standard Committee on Power systems planning of Southern region held on 28.12.2015 & 29.12.2015.

b) 0.2S class metering CTs and CVTs will be provided for Generating Transformers and Station Transformers also for traffic metering as per the requirement of TSTRANSCO.

3.0 COST ESTIMATES AND FINANCIAL ANALYSIS

3.1 Cost Estimates

An estimate of the total cost of the project has been made. The estimate has been made under three heads, namely Mechanical, Electrical and Civil.

The following factors have been taken into account in the preparation of the cost estimates:

1. Being a green field site, land for the project is being acquired. An amount of Rs. 100 Crores is earmarked for purchase of land for power project, ash pond, rail corridor and raw water pipeline corridor from Godavari River to project site.

2. Cost of spares has been taken as 4% of the equipment cost.

3. Excise duty @ 12.30% including education cess of equipment cost up to 30th June 2017 and GST @ 18% from 1st July 2017.

4. Freight @ 4% and insurance @ 1% on the equipment cost have been taken.

5. CST @ 2.06% of equipment cost have been considered for the equipment supplied to Bhadradri site up to 30th June 2017.

6. Erection, testing & commissioning has been taken @ 10% of equipment cost.

7. Service tax & education cess @ 12.36 % has been considered on erection, testing & commissioning and freight & insurance cost for the work completed up to 30th June 2017 and GST @ 18% from 1st July 2017.

8. Repayment of long term loan has been considered 10 years on quarterly basic considering a moratorium period of 2 years after commercial operation.

9. Projection of project cost has been done for 25 years economic life of Power Plant.

3.2 Financing Structure

It is proposed to finance the project such that Capital structure is built up of:

Equity Capital - 30%
Debt Capital - 70%

The equity capital will be funded by TSGENCO.

The financing of debt capital, comprising loan capital and interest during construction will be arranged from Indian Financial institutions.

3.3 Interest during Construction (IDC)

An interest rate of 12% has been considered for pre- commissioning period.

Also the payment of interest has been worked out at the end of each quarter of construction period in line with PFC/ financial institutions requirements.

3.4 **Working Capital**

Provision for working capital requirement has been made in line with CERC/SERC guidelines.

i. 1 month O&M expenses
ii. 2 months receivables
iii. 2 month fuel charges (coal)
iv. 2 months support fuel charges
v. Maintenance spares

Interest rate for working capital has been considered as 12% per annum.

3.5 Discounting factor has been considered as 13.10%.

3.6 Project Competition Period is considered as **33 Months** from Zero Date (Issue of advance to EPC contractor).

3.7 **Cost of Generation**

Indices for working out cost of generation are given below. GOI guideline & CERC indices, wherever utilized, are marked with asterisk.

		(100% Domestic Coal)
➢	Plant Capacity	4 x 270 MW
➢	Auxiliary Energy Consumption	9%
➢	Station Heat Rate (kcal/kwh)	2300
➢	Depreciation	For first 12 years – 5.28% & for balance 13 years – 2.05%
➢	O&M	2.08% Escalated @ 4% every year

➢ Loan Repayment period	10 years
➢ Interest on Loan	12% per annum
➢ Loan repayment	40 equal quarterly installments With 2 year moratorium
➢ GCV of coal (Design)	4550 kcal/kg
➢ Present day Coal Price	Rs. 3875/tonne on delivered basis with 4 % annual escalation
➢ GCV of Support fuel	10,000 kcal/kg
➢ Support fuel present day price	Rs 55,000/tonnes for HFO/LDO
➢ PLF	85%
➢ Return on Capital Employed (RoCE)	13.65%
➢ Completion Schedule	33 months
➢ Economic Life of plant	25 years

3.8 Cost of the Project

Cost of Project excluding IDC	Rs.7744.13 Crores
Interest During Construction	Rs. 792.85 Crores
Total Cost of Project including IDC	Rs. 8536.98 Crores
Cost per MW	Rs. 7.90 Crores

3.9 Tariff

Levellised tariff at 85% PLF	Rs 5.28/kwh
First year tariff at 85% PLF	Rs. 4.97/kwh

3.10 Financial Evaluations

Internal Rate of Return (IRR)	18.86%
Debt Service Coverage Ratio (DSCR) (Average)	1.72

Capital cost and other financial computations are as per tables enclosed herewith.

TSGENCO, Bhadradri Thermal Power Station (4x270 MW)
Cost Estimates

S.No.	Description	Amount in Rs. Crores
EPC Works		
A	**Supply - EPC**	
	I. Mechanical including mandatory spares	2720.00
	II. Electrical & Instrumentation including mandatory spares	379.50
	Total (EPC Supply) - (I+II)	**3099.50**
	Initial Spares @ 4% of (Excluding FGD) (EPC Supply)	0.00
	Excise Duty / CST / GST @ 18% of (EPC Supply)	447.10
	Total EPC Supply including Taxes & Duties	**3546.60**
B	**Erection, Testing & Commissioning**	
	1. E&C Works	392.26
	2. Freight @ 4% and Insurance @ 1%	69.32
	Service Tax / GST @ 18% on (1) & (2)	90.25
	Total Erection, Testing & Commissioning including Taxes	**551.83**
	Total EPC (Supply + Services) (A+B)	**4098.43**
C	**FGD (including unloading, ETC, Freight, Insurance & GST)**	**680.00**
D	**Additional Electrical (including GST)**	**12.55**
E	**Civil Works (EPC)**	**1476.03**
	Grand Total EPC (Supply + Services + Civil) (A+B+C+D+E)	**6267.01**
Non EPC (E&M)		
F	Railway Marshalling Yard	70.00
G	Cost of Start up power/Construction power	10.00
H	Raw Water intake pipeline, Booster Pump etc.	15.00
I	**Total non EPC**	**95.00**
J	**Others**	
	Contingency	30.00
	Establishment Cost	70.00
	Consultancy & Engineering Services	12.00
	Start up fuel	100.00
	Operators training	3.00
	Total (Others)	**215.00**
K	**Civil Works - Non EPC**	**1167.12**
L	**Total IDC**	**792.85**
M	**Grand Total (A+B+C+D+E+I+J+K+L) Project Cost including IDC**	**8536.98**
N	**Cost Per MW**	**7.90**

TSGENCO, Bhadradri Thermal Power Station (4x270 MW) Detailed Cost Estimates		
S.No.	**Description**	**Amount in Rs. Cr**
I.	**Mechanical**	
1	Boiler Turbine Generator (BTG) Package with associated auxiliaries, ESP & Auxiliary, Instrumentation	2164.00
2	Coal Stockyard, handling, coal conveying with auxiliaries including Civil Works	220.00
3	Ash handling plant with auxiliaries and dry ash storing facilities including Civil Works	110.00
4	CW and ACW System	28.00
5	DM Plant System, condensate tanks	26.00
6	Compressed Air System	13.00
7	Fire fighting system including Hydrant system, Foam system, fire detection and alarm system	20.00
8	Air conditioning & ventilation system	18.00
9	Station LP Piping	25.00
10	Cranes and hoists	10.00
11	Elevators	7.00
12	Chemical dosing system	5.00
13	Effluent Treatment Plant	20.00
14	Miscellaneous Equipment including CO2 gas bottles etc	25.00
15	Painting and Protection	4.00
16	Pollution control and monitoring system	3.00
17	Misc. Pumps, piping, mill reject system	22.00
	Total - I (Mechanical)	**2720.00**
II.	**FGD**	
1	Boiler modification for future installation of SCR, modification of ESP and installation of FGD with FGD mandatory spares	395.85
2	Freight & Insurance for FGD	9.76
3	Unloading of material at site, erection testing and commissioning of FGD eqpt.	53.11
4	Civil works for boiler modification, ESP modification and FGD	117.55
5	GST on the above	103.73
	Total - II FGD	**680.00**
III.	**Electrical & Instrumentation**	
1	Generator Transformer 330 MVA Single Phase	60.00
2	Unit Transformers 16/20 MVA, 18/6.9 kV	16.00
3	Station Transformer 400/6.9/6.9 kV, 70/35/35 MVA	12.00
4	Service Transformers 6.9/0.433 kV, 1600/2000/2500 kVA dry type	11.00
5	Isolated phase bus ducts 16.5 kV, 1600/1000 Amps	15.00
6	6.9 kV phase segregated phase bus duct	9.00
7	0.415 kV non-segregated phase bus duct	4.50
8	6.6 kV Switchgears	29.00
9	415 V Switchgears/MCCs	27.50
10	220 V DC System for units, common & BOP	10.00
11	Power & Control Cables, Cable Trays & Accessories	55.00
12	Generator Control/Relay/Transducer Panels	3.00
13	400 kV Switchyard	50.00

14	Station Lighting System	7.00
15	Local PB Stations, control stations, JBs etc	3.00
16	Earthing & Lightning protection etc.	10.00
17	DG Set & Accessories, 750 kVA	7.50
18	Communication System	5.00
19	Instrumentation & Control System	45.00
	Total - III (Electrical and I&C)	**379.50**
IV.	**Additional Electrical**	
1	Additional CTs, CVTs and bus reactors as per the requirement of TSTRANSCO	12.55
	Total - IV (Additional Electrical)	**12.55**
V.	**Civil (EPC Scope)**	
1	Site development, soil investigation, drainage, sanitary, sewage system, temporary construction and enabling works	20.00
2	Plant roads, drains & culverts	45.00
3	Power house building foundations for boiler, TG, ESP, Fan, Equipment, Transformer yard, Mill, bunker, Switchyard, Control room, CW piping, pumphouse with channel etc.	293.87
4	Structural steel structures including bunker bays	315.00
5	PTP including Clariflocculator, clarified water tanks etc	42.00
6	Natural Draft Cooling Towers (NDCT) (4 nos)	160.00
7	Raw water reservoir	40.00
8	DM Plant building with foundations, neutralizing pit, condensate storage tanks, DM storage tanks etc	45.00
9	RCC Chimney twin flues (275 mts high) - 2 Nos.	150.00
10	LP Pipe supports & cooling water pipe supports, cooling tower dischrge channel, CWPH, cable and pipe trenches	50.00
11	Miscellaneous Plant & non plant building slike Dg building, compressor house, ESP control room, canteen building, service building, security	45.00
12	Disposal line for ash dyke	45.00
	Cost of civil works excluding taxes	1250.87
13	GST/TSVAT on civil works	225.16
	Cost of Civil Works Including Taxes	**1476.03**
VI.	**Civil (Non EPC Scope)**	
1	Land	100.00
2	Compound wall and fencing for site	13.00
3	a. Ash dyke	50.50
	b. Diversion of surplus course passing through Ash Dyke Area	5.00
4	Township (including hostel, Guest house, super market, hospital, approach road and drainage	261.22
5	Raw water intake structure	110.92
6	Marshalling yard including consultancy for DPR	301.65
7	Flood bank along Godavari River	50
8	Construction for hostel building for security personel	10
9	Straightening of the Flood canal in Power Plant premises	1.6
10	Green Belt	4.28
	Total Non EPC Works cost excluding taxes but including land cost	908.17

9	GST/TSVAT @ 18% of Rs.798.25 Crore (Total civil works cost excluding land cost)	145.47
10	Labour cess @ 1% on 33% on Rs.798.25 Crore (Total civil works cost excluding land cost)	2.67
11	Freight & Insurance at 10% on Rs.798.25 Crore (Total civil works cost excluding land cost)	80.82
12	CSR development works	30
	Total Non EPC civil works cost including taxes, land cost & CSR works	**1167.12**

Phasing of Expenditure & IDC Calculation

(All Figures in Rupees)

Project Cost without IDC			7744.13	Crores
Project Completion Period			33	months
Debt(%)			70	
Debt (including IDC)			5975.89	Crores
Equity(%)			30	
Equity			2561.09	Crores
Project Cost including IDC			8536.98	Crores
Rate of interest			12.00	%
No. of Installment/year			4	

IDC 792.85 Crores

Quarterly Installment		1	2	3	4	5	6	7	8	9	10	11	
Phased Expenditure(%)		10	5	5	5	7.5	7.5	10	10	10	15	15	100
Phased Expenditure		774.41	387.21	387.21	387.21	580.81	580.81	774.41	774.41	774.41	1161.62	1161.62	
Fund Requirement arranged from	Equity	232.32	116.16	116.16	116.16	174.24	174.24	232.32	232.32	232.32	348.49	348.49	
	Debt	542.09	271.04	271.04	271.04	406.57	406.57	542.09	542.09	542.09	813.13	813.13	
Opening Balance	Equity	0.00	234.76	357.07	481.96	609.46	798.33	991.17	1246.74	1507.69	1774.11	2163.52	
	Debt	0.00	547.78	833.17	1124.56	1422.07	1862.77	2312.72	2909.07	3517.94	4139.60	5048.20	
Total Equity		232.32	350.93	473.24	598.12	783.70	972.57	1223.49	1479.07	1740.01	2122.60	2512.00	
Total Debt		542.09	818.83	1104.22	1395.61	1828.64	2269.33	2854.81	3451.16	4060.03	4952.73	5861.34	
IDC		8.13	20.50	29.06	37.80	48.76	61.98	77.51	95.40	113.67	136.38	163.64	
Arrangement of Interest & Upfront payment from	Equity	2.44	6.15	8.72	11.34	14.63	18.59	23.25	28.62	34.10	40.92	49.09	
	Debt	5.69	14.35	20.34	26.46	34.13	43.39	54.26	66.78	79.57	95.47	114.55	
Closing Balance of	Equity	234.76	357.07	481.96	609.46	798.33	991.17	1246.74	1507.69	1774.11	2163.52	2561.09	
	Debt	547.78	833.17	1124.56	1422.07	1862.77	2312.72	2909.07	3517.94	4139.60	5048.20	5975.89	
Debt : Equity Ratio		2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	
Net Requirement of Fund	Equity	234.76	122.31	124.88	127.50	188.87	192.84	255.58	260.94	266.42	389.40	397.58	
	Debt	547.78	285.39	291.39	297.51	440.70	449.95	596.35	608.87	621.66	908.60	927.68	

TELANGANA STATE POWER GENERATION CORPORATION LIMITED
4 x 270 MW MANUGURU THERMAL POWER PROJECT

Base Case:	4x270 MW TPS
Plant Load Factor (PLF):	85%

Project : **4x270 MW Units (Life 25 years)**

Capacity (MW)	1080

Project Cost	
US$	0.00
Rs	8536.98
Total Eq. Rs (Crores)	8536.98
FINANCING	
DEBT	
US$ (Million)	0.00
Rs (Crores)	5975.89
Total Debt Rs (Crores)	5975.89
EQUITY	
US$ (million)	0.00
Rs (Crores)	2561.09
Total Equity Rs (Crores)	2561.09

Fuel	**Coal**		**Annual Esclation**	**Support fuel**	**HFO**
Price	3875 Rs/tonne		4.0%	Price	55000 Rs/tonne
GCV	4550 Kcal/Kg			GCV	10000 Kcal/Kg
Transportation Charge (incl. Above)				Transportation charge(incl.above)	
SHR	2300 kCal/kWh			Oil Consumption	0.5 ml/kwh
Aux. Cons	9.0%			Sp.Gr.	0.9
Dep'tion for 1-12 years		5.28%			
Dep'tion for 13-25 years		2.05%			
RoCE	13.65%				
Dis'ting Factor	13.10%				
Int. on Long term loan	12.00%				
O&M Cost	2.08%	4.00% Annual Esc.			

LEVELLIZED TARIFF AT 85% PLF	5.28	Rs/KWh
FIRST YEAR TARIFF AT 85% PLF	4.97	Rs/KWh

TELANGANA STATE POWER GENERATION CORPORATION LIMITED
4 x 270 MW MALUGURU THERMAL POWER PROJECT

YEAR		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Coal price at site `/tonne		3875.00	4030.00	4191.20	4358.85	4533.20	4714.53	4903.11	5099.24	5303.21	5515.33	5735.95	5965.38	6204.00	6452.16	6710.25	6978.66	7257.80	7548.11	7850.04	8164.04	8490.60	8830.23	9183.44	9550.77	9932.80
supp.Fuel site price `/tonne		55000.00	55000.00	55000.00	55000.00	55000.00	55000.00	55000.00	55000.00	55000.00	55000.00	55000.00	55000.00	55000.00	55000.00	55000.00	55000.00	55000.00	55000.00	55000.00	55000.00	55000.00	55000.00	55000.00	55000.00	55000.00
Gross Units Generated			Million Units (MU)																							
PLF																										
	85%	8041.68	8041.68	8041.68	8041.68	8041.68	8041.68	8041.68	8041.68	8041.68	8041.68	8041.68	8041.68	8041.68	8041.68	8041.68	8041.68	8041.68	8041.68	8041.68	8041.68	8041.68	8041.68	8041.68	8041.68	8041.68
Net Units Sent Out			Million Units (MU)																							
PLF																										
	85%	7317.93	7317.93	7317.93	7317.93	7317.93	7317.93	7317.93	7317.93	7317.93	7317.93	7317.93	7317.93	7317.93	7317.93	7317.93	7317.93	7317.93	7317.93	7317.93	7317.93	7317.93	7317.93	7317.93	7317.93	7317.93
Coal Charge `/Kwh		1.96	2.04	2.12	2.20	2.29	2.38	2.48	2.58	2.68	2.79	2.90	3.02	3.14	3.26	3.39	3.53	3.67	3.82	3.97	4.13	4.29	4.46	4.64	4.83	5.02
Total Variable Charge `/kwh		1.96	2.04	2.12	2.20	2.29	2.38	2.48	2.58	2.68	2.79	2.90	3.02	3.14	3.26	3.39	3.53	3.67	3.82	3.97	4.13	4.29	4.46	4.64	4.83	5.02
Total Variable Cost			Rs (Crores)																							
PLF																										
	85%	1575.20	1638.21	1703.73	1771.88	1842.76	1916.47	1993.13	2072.85	2155.77	2242.00	2331.68	2424.94	2521.94	2622.82	2727.73	2836.84	2950.31	3068.33	3191.06	3318.70	3451.45	3589.51	3733.09	3882.41	4037.71

YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Fixed cost ` (crores)																									
Supp.fuel charge	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.90
Depreciation	446.79	446.79	446.79	446.79	446.79	446.79	446.79	446.79	446.79	446.79	446.79	446.79	173.47	173.47	173.47	173.47	173.47	173.47	173.47	173.47	173.47	173.47	173.47	173.47	173.47
O&M Charges	177.74	184.84	192.24	199.93	207.93	216.24	224.89	233.89	243.24	252.97	263.09	273.62	284.56	295.94	307.78	320.09	332.89	346.21	360.06	374.46	389.44	405.02	421.22	438.07	455.59
RoCE @ 13.65%	1298.01	1301.20	1304.67	1224.58	1144.63	1064.83	985.17	905.65	826.31	747.14	670.42	591.55	506.25	511.35	516.65	522.17	527.91	533.87	540.07	546.53	553.24	560.22	567.47	575.02	582.87
Tax On Income	119.89	119.96	126.76	124.33	121.89	119.46	117.04	113.49	111.07	108.66	204.12	199.49	183.84	184.05	184.26	184.48	184.72	184.96	185.21	185.47	185.74	186.02	186.32	186.62	186.94
Total Fixed cost at 85%	2062.34	2072.70	2090.35	2015.53	1941.15	1867.23	1793.80	1719.72	1647.34	1575.46	1604.33	1531.35	1168.03	1184.71	1202.07	1220.12	1238.89	1258.41	1278.72	1299.83	1321.79	1344.63	1368.38	1393.08	1418.77
Fixed Cost per Unit at 85%	2.82	2.83	2.86	2.75	2.65	2.55	2.45	2.35	2.25	2.15	2.19	2.09	1.60	1.62	1.64	1.67	1.69	1.72	1.75	1.78	1.81	1.84	1.87	1.90	1.94

TELANGANA STATE POWER GENERATION CORPORATION LIMITED
4 x 270 MW MANUGURU THERMAL POWER PROJECT

Payment of Fixed Cost Rs (Crores)		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	85%	2062.34	2072.70	2090.36	2015.53	1941.15	1867.23	1793.80	1719.72	1647.32	1575.46	1604.33	1531.35	1168.03	1184.71	1202.07	1220.12	1238.89	1258.41	1278.72	1299.83	1321.79	1344.63	1368.38	1393.08	1418.77
	85%	2.82	2.83	2.86	2.75	2.65	2.55	2.45	2.35	2.25	2.15	2.19	2.09	1.60	1.62	1.64	1.67	1.69	1.72	1.75	1.78	1.81	1.84	1.87	1.90	1.94
Levellised Fixed Rs/kWh																										
	85%	2.82	2.50	2.23	1.90	1.62	1.38	1.17	0.99	0.84	0.71	0.64	0.54	0.36	0.33	0.29	0.26	0.24	0.21	0.19	0.17	0.15	0.14	0.12	0.11	0.10
	85%	2.43																								
Payment of FC+VC Rs (Crores)																										
	85%	3637.54	3710.90	3794.09	3787.41	3783.91	3783.70	3786.93	3792.58	3803.09	3817.46	3936.00	3956.30	3669.97	3807.53	3929.80	4056.96	4189.20	4326.74	4469.78	4618.53	4773.24	4934.14	5101.47	5275.50	5456.48
Rs/kwh																										
	85%	4.97	5.07	5.18	5.18	5.17	5.17	5.17	5.18	5.20	5.22	5.38	5.41	5.04	5.20	5.37	5.54	5.72	5.91	6.11	6.31	6.52	6.74	6.97	7.21	7.46
Levellised Total Tariff																										
		4.97	**4.48**	**4.05**	**3.58**	**3.16**	**2.79**	**2.47**	**2.19**	**1.94**	**1.72**	**1.57**	**1.40**	**1.15**	**1.05**	**0.96**	**0.87**	**0.80**	**0.73**	**0.67**	**0.61**	**0.56**	**0.51**	**0.46**	**0.42**	**0.39**
	85%	**5.28**																								

INR Loan		5975.89 Rs (Crores)										
Interest		12.00%										
Repayment Period		10 YEARS + 2 Years Moratorium										
Qtr-1												
Outstanding loan	5975.89	5975.89	5975.89	5378.30	4780.71	4183.12	3585.53	2987.94	2390.35	1792.77	1195.18	597.59
Interest	179.28	179.28	179.28	161.35	143.42	125.49	107.57	89.64	71.71	53.78	35.86	17.93
Repayment			149.40	149.40	149.40	149.40	149.40	149.40	149.40	149.40	149.40	149.40
Qtr-2												
Outstanding loan	5975.89	5975.9	5826.5	5228.90	4631.3	4033.7	3436.1	2838.5	2240.96	1643.37	1045.78	448.19
Interest	179.28	179.3	174.8	156.87	138.9	121.0	103.1	85.16	67.23	49.30	31.37	13.45
Repayment			149.40	149.40	149.40	149.40	149.40	149.40	149.40	149.40	149.40	149.40
Qtr-3												
Outstanding loan	5975.89	5975.89	5677.09	5079.50	4481.91	3884.33	3286.74	2689.15	2091.56	1493.97	896.38	298.79
Interest	179.28	179.28	170.31	152.39	134.46	116.53	98.60	85.16	67.23	49.30	31.37	13.45
Repayment			149.40	149.40	149.40	149.40	149.40	149.40	149.40	149.40	149.40	149.40
Qtr-4												
Outstanding loan	5975.89	5975.89	5527.69	4930.11	4332.52	3734.93	3137.34	2539.75	1942.16	1344.57	746.99	149.40
Interest	179.28	179.28	165.83	147.90	129.98	112.05	94.12	76.19	58.26	40.34	22.41	4.48
Repayment			149.40	149.40	149.40	149.40	149.40	149.40	149.40	149.40	149.40	149.40
Total Interest	717.11	717.11	680.21	618.50	546.79	475.08	403.37	336.14	264.43	192.72	121.01	49.30

Total Interest Rs (Crores)	717.11	717.11	680.21	618.50	546.79	475.08	403.37	336.14	264.43	192.72	121.01	49.30

Working Capital																										
Fuel Charges 85% (2 months)	262.53	273.03	283.96	295.31	307.13	319.41	332.19	345.48	359.29	373.67	388.61	404.16	420.32	437.14	454.62	472.81	491.72	511.39	531.84	553.12	575.24	598.25	622.18	647.07	672.95
Support fuel charges (2 Months)	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32
One month O&M	14.91	15.40	16.02	16.66	17.33	18.02	18.74	19.49	20.27	21.08	21.92	22.80	23.71	24.66	25.65	26.67	27.74	28.85	30.00	31.21	32.45	33.75	35.10	36.51	37.97
Maintenance spares	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37
Two months Receivables at 85%	606.16	618.48	632.35	631.24	630.65	630.62	631.15	632.10	633.85	636.24	656.00	659.38	614.99	634.59	654.97	676.16	698.20	721.12	744.96	769.76	795.54	822.36	850.25	879.25	909.41
Working Capital at 85%	972.29	995.61	1021.01	1031.90	1043.79	1056.74	1070.77	1085.75	1102.10	1119.68	1155.22	1175.03	1147.72	1185.07	1223.92	1264.33	1306.35	1350.05	1395.50	1442.76	1491.92	1543.35	1596.22	1651.51	1709.02

TELANGANA STATE POWER GENERATION CORPORATION LIMITED
4 x 270 MW MANUGURU THERMAL POWER PROJECT

FINANCIAL ANALYSIS:Projected Profit & Loss account for 25 years at 85% PLF

All figures are in Rs (Crores)

	Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	Income from sale of power @ cost of annual generation	3637.54	3710.90	3794.09	3787.41	3783.91	3783.70	3786.93	3792.58	3803.09	3817.46	3936.00	3956.30	3689.97	3807.53	3929.80	4056.96	4189.20	4326.74	4469.78	4618.53	4773.24	4934.14	5101.47	5275.50	5456.48
2	Other Income	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Total Income (1+2)	3637.54	3710.90	3794.09	3787.41	3783.91	3783.70	3786.93	3792.58	3803.09	3817.46	3936.00	3956.30	3689.97	3807.5	3929.80	4056.96	4189.20	4326.74	4469.78	4618.53	4773.24	4934.14	5101.47	5275.50	5456.48
4	Cost of fuel	1575.20	1638.21	1703.73	1771.88	1842.76	1916.47	1993.13	2072.85	2155.77	2242.00	2331.68	2424.94	2521.94	2622.82	2727.73	2836.84	2950.31	3068.33	3191.06	3318.70	3451.45	3589.51	3733.09	3882.41	4037.71
5	Operation & Maintenance	177.74	184.84	192.24	199.93	207.93	216.24	224.89	233.89	243.24	252.97	263.09	273.62	284.56	295.94	307.78	320.09	332.89	346.21	360.06	374.46	389.44	405.02	421.22	438.07	455.59
6	Earning before interest, depreciation,ta (EBDIT) (3-4-5)	1884.60	1887.86	1898.12	1815.60	1733.22	1650.99	1568.91	1485.84	1404.08	1322.49	1341.23	1257.74	883.47	888.77	894.29	900.03	906.00	912.20	918.66	925.37	932.35	939.61	947.16	955.02	963.18
7	Depreciation	446.79	446.79	446.79	446.79	446.79	446.79	446.79	446.79	446.79	446.79	446.79	446.79	173.47	173.47	173.47	173.47	173.47	173.47	173.47	173.47	173.47	173.47	173.47	173.47	173.47
8	Earning before interest, tax (EBIT) (6-7)	1437.81	1441.06	1451.33	1368.81	1286.43	1204.20	1122.12	1039.04	957.29	875.70	894.44	810.95	710.00	715.30	720.82	726.56	732.52	738.73	745.19	751.90	758.88	766.14	773.69	781.55	789.71
9	Interest on working capital	121.54	124.45	127.63	128.99	130.47	132.09	133.85	135.72	137.76	139.96	144.40	146.88	143.46	148.13	152.99	158.04	163.29	168.76	174.44	180.35	186.49	192.88	199.53	206.44	213.63
10	Interest on Long-term loan	717.11	717.11	690.21	618.50	546.79	475.08	403.37	336.14	264.43	192.72	121.01	49.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	Profit before tax (PBT) (8-9-10)	599.17	599.51	633.49	621.32	609.16	597.02	584.90	567.18	555.09	543.02	629.03	614.77	566.53	567.17	567.83	568.52	569.23	569.97	570.75	571.55	572.39	573.26	574.17	575.11	576.09
12	Tax (MAT @ 20.01% on PBT for first 10 yrs)	119.89	119.96	126.76	124.33	121.89	119.46	117.04	113.49	111.07	108.66	204.12	199.49	183.84	184.05	184.26	184.48	184.72	184.96	185.21	185.47	185.74	186.02	186.32	186.62	186.94
13	Profit after tax (PAT) (11-12)	479.28	479.54	506.73	496.99	487.27	477.56	467.86	453.69	444.02	434.36	424.91	415.28	382.69	383.12	383.57	384.03	384.52	385.02	385.54	386.08	386.65	387.24	387.85	388.48	389.15

DSCR Calculation

	EBDIT	1884.60	1887.86	1898.12	1815.60	1733.22	1650.99	1568.91	1485.84	1404.08	1322.49	1341.23	1257.74	883.47	888.77	894.29	900.03	906.00	912.20	918.66	925.37	932.35	939.61	947.16	955.02	963.18
	Interest	717.11	717.11	690.21	618.50	546.79	475.08	403.37	336.14	264.43	192.72	121.01	49.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Principal Repayment	0.00	0.00	597.59	597.59	597.59	597.59	597.59	597.59	597.59	597.59	597.59	597.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DSCR	2.63	2.63	1.47	1.49	1.51	1.54	1.57	1.59	1.63	1.67	1.87	1.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Average DSCR	**1.72**																								

FINANCIAL ANALYSIS : Profitability indicators

IRR Calculation

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Capital Expenditure	8536.98																								
EBDIT		1884.60	1887.86	1898.12	1815.60	1733.22	1650.99	1568.91	1485.84	1404.08	1322.49	1341.23	1257.74	883.47	888.77	894.29	900.03	906.00	912.20	918.66	925.37	932.35	939.61	947.16	955.02
Net Cash flow	-8536.98	1884.60	1887.86	1898.12	1815.60	1733.22	1650.99	1568.91	1485.84	1404.08	1322.49	1341.23	1257.74	883.47	888.77	894.29	900.03	906.00	912.20	918.66	925.37	932.35	939.61	947.16	955.02
IRR	**18.86%**																								