

MINUTES OF THE 19TH MEETING OF THE EXPERT APPRAISAL COMMITTEE FOR RIVER VALLEY AND HYDRO-ELECTRIC PROJECTS HELD ON 15TH NOVEMBER, 2021 FROM 10:30 AM – 02:00 PM THROUGH VIDEO CONFERENCE.

The 19th meeting of the re-constituted EAC for River Valley & Hydro-electric Projects organized by the Ministry of Environment, Forest and Climate Change, Indira Paryavaran Bhawan, Jor Bagh Road, New Delhi, was held on 15th November, 2021 through video conference, under the Chairmanship of Dr. K. Gopakumar. The list of Members present in the meeting is at **Annexure**.

Agenda No. 19.1

CONFIRMATION OF THE MINUTES OF 18TH EAC MEETING

The minutes of the 18th EAC (River Valley Hydro-electric Project) meeting held on 28th October, 2021 were confirmed.

Agenda No. 19.2

Gandikota Pumped Storage Hydro-electric Project (1000MW), in an area of 190 ha. (469.5 acre) located at village Kondapuram village, Tehsil Muddanur, District Kadapa, Andhra Pradesh by M/s New and Renewable Energy Development Corporation of Andhra Pradesh Ltd. (NREDCAP) – Terms of Reference - reg.

[Proposal No. IA/AP/RIV/235841/2021; F. No. J-12011/16/2021-IA.I (R)]

19.2.1 The proposal is for grant of Terms of Reference (ToR) to Gandikota Pumped Storage Hydro-electric Project (1000MW), in an area of 190 ha. (469.5 acre) located at village Kondapuram village, Tehsil Muddanur, District Kadapa, Andhra Pradesh by M/s New and Renewable Energy Development Corporation of Andhra Pradesh Ltd. (NREDCAP)

19.2.2 The details of the project submitted by project proponent and ascertained from the document submitted are mentioned below:

- i. The proposed project is pumped storage being develop by M/s New and Renewable Energy Development Corporation of Andhra Pradesh Limited (NREDCAP) is the State Nodal Agency for development of renewable power in the state of Andhra Pradesh.
- ii. Gandikota Pumped Storage project envisaged with a proposed installed capacity of 1000MW (4 x 250 MW) and located in Kondeyor in village Kondapuram village, Tehsil Muddanur, District Kadapa, Andhra Pradesh in India and belongs to Rayalaseema region. The nearest sea port is Krishnapatnam Port & is about 230 km from the project site.
- iii. The project falls in the Latitude N 14° 48' 38" and Longitude E 78° 15' 30". It is located 80 km towards west from District headquarters Kadapa. The proposed Upper reservoir at present is not accessible but the Lower is accessible to nearest road network which is at about 5 km from NH-67. Upper dam falls in forest area and there is no habitation. Lower dam is utilized for Irrigation, Drinking water and fisheries purpose. The project area falls under seismic zone-II.
- iv. The project envisages utilization of available head between proposed upper dam and existing Gandikota reservoir as lower pond. An Underground Power House (UGPH) will be located in

between two reservoirs. Both the reservoirs are interconnected through water conductor and the generator and turbines installed at the power house in between the reservoirs.

- v. Gandikota Pumped Storage Project is expected to generate 1000 MW of power for 5 hrs 23 minutes in a day considering 95% of plant availability in a year. Gandikota PSP can generate 1964.92 MU of energy in a year from the said project. Pumping time is required about 7 hours 03 minutes in a day.
- vi. Gandikota reservoir of capacity 760.30 Mcm will be created by an earthen dam across river Penna to serve as Lower reservoir which has a live storage capacity of 669.38 Mcm
- vii. The salient features & civil components of the proposed Gandikota Pumped Storage Hydro-electric Project (1000MW), with their dimensions/parameter are as follows:

CIVIL STRUCTURE	
UPPER RESERVOIR (New) (Rockfill Composite Pit & Bund type)	
Top of Dam	EL 482.00 M
FRL	EL 481 M
MDDL	EL 464 M
Reservoir surface area at FRL	54.50 Ha. (46.51 Ha. At MDDL)
Gross Storage capacity	9.514 MCM
Live storage	8.592 MCM (0.303 TMC)
Dead Storage at MDDL (EL 464 m)	0.922 MCM
Total Length of Dam at top	2930 m
Max. Height of Dam	20 m (from bed level)
Width at the top of the dam	8 m
Intake Structure	
Type	Horizontal Type with anti-vortex lubbers
Inlet Invert Level	EL 441.04
Headrace Tunnel (Concrete Lined)	
Diameter	8.90 m
Length	532 m
No. of Tunnel	2
Inclined Pressure Shaft	
Diameter	7.00 m
Length	383 m
No. of Tunnel	2
Inclination	Inclined at 50o from horizontal
Tailrace Tunnel (Concrete Lined)	
Diameter	8.90 m
Length	755 m
No. of Tunnel	2
Powerhouse Type- Underground Cavern	
Size- 160.00 m (L) x 24 m (W) x 55 m (H)	
1.11 Main Access Tunnel (MAT)	
Type	D - shaped, Length - 746 m
WxH	8.00 m (W) x 8.00 m (H)
Installed Capacity (MW)	1000
No of units	4

Unit Size (MW)	250
Type	Vertical Shaft reversible Francis Turbine
Net Rated Head (m)	258.41
Hours of Peaking Operation	5 Hours 23 minutes
Hours of Peaking Operation	(5.38 Hours)
Annual Energy Generation (GWh)	1964.92
Project Cost (Excl. IDC)	₹ 3698.02 (Crores) (January, 2021 PL)

- viii. **Land requirements:** The total land required for the construction of various components of the projects is estimated to be around 190 ha. (469.5 acre) land is required for project construction. Based on the present level of investigations, most of the land required lies in forest area, so ownership status of land to be acquired for the project is yet not known. Based on the ownership status, appropriate, compensatory measures, Resettlement and Rehabilitation Plan will be formulated. Application for Forest Clearance yet to be submitted.
- ix. **Project Cost:** The estimated project cost is ₹ 3698.02 Crores at January, 2021 price levels. The preliminary cost estimate of the project has been prepared as per guidelines of CEA /CWC.
- x. There is no Protected Area in the vicinity of the proposed project. The project site is located about 3.4 km from Gandikota Wildlife Sanctuary.
- xi. **R&R:** Socio-economic survey for the Project Affected Families (PAFs) will be conducted as a part of the site. Based on the findings of the survey an appropriate Resettlement and Rehabilitation Plan will be formulated as per the norms and guidelines of Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013.
- xii. **Alternative Study:** Since the lower reservoir is existing in the present scheme various alternatives were examined to locate the upper reservoir and two possible options were identified at the nearby hilltop. The Topography of the project area suggests that, highest contour available in the vicinity of the project is of the order of 468m and 505m. Accordingly two possible location of the Upper Reservoirs namely Option-1 and Option-2 have been considered for optimizing the project layout. The detailed comparison between both the options is stated as L/H ratio in option-1 is much less than Option-2 which is a major criterion from techno economic standpoint. Moreover, during site visit, it was observed that in Option-2, the Gandikota Village and Wind mill are situated near proposed upper reservoir. Hence, Private Land acquisition will impose additional cost and may involve R&R issues. Therefore, Option-1 is more economical and is the preferred option and hence selected at this stage.
- xiii. **Inter State / Inter-national aspects:** All the components of the proposed PSP are located within the administrative boundary of the state of Andhra Pradesh.

The EAC during deliberations asked information on alternative site analysis, CWC clearance on hydrology, sampling locations, distance of other PSP projects in the region and down-stream impacts of the project on hydrology etc. The PP provided point-wise information as under:

Query 1: Submit Alternative Studied including Environmental Aspects.

Reply:

Option – 1

The upper reservoir is proposed on left bank at geographical co-ordinate N- 14° 49' 47.78'' and E- 78° 13' 53.81'' in NE direction of existing lower Reservoir. The highest possible elevation is at EL-468m on the hilltop. At this location the flat surface area is inadequate to create required capacity in reservoir. Therefore, it is proposed to create pondage through composite bund and pit type upto desired depth for optimum live storage. The length of water conductor is 1567m starting from upper Intake to lower intake. The head available in this type of reservoir is 266.37m and similarly live storage is 8.59 MCM.

Option – 2

The upper reservoir is proposed on right bank at geographical co-ordinate N- 14° 46' 28.93'' E- 78° 17' 6.77''. The highest possible elevation is at EL-505m on the hilltop. At this location the flat surface area is inadequate to create required capacity in reservoir. Therefore, it is proposed to create pondage through composite bund and pit type upto desired depth for optimum live storage. The length of water conductor is 2812m starting from upper Intake to lower intake.

A comparative preliminary analysis is presented in Table-1.

Table-1: Comparison of Layout Options

	Option-1	Option-2
Upper Reservoir	FRL: EL 481.00 m MDDL: EL 464.00 m Bund Height: 19 m Gross Storage: 9.51 MCM Live Storage: 8.59 MCM	FRL: EL 522.00 m MDDL: EL 505.00 m Bund Height: 19 m Gross Storage: 9.51 MCM Live Storage: 8.59 MCM
Gross Head	263.41 m	307.37 m
WCS Length	WCS HRT 532m Penstock 475m Tailrace 830m Total 1837m	WCS HRT 715m Penstock 520m Tailrace 1695m Total 2930m
L/H Ratio	6.97	9.53
Installed Capacity (MW)	1000 (4x250 MW)	1120 (4x280 MW)
Cost	Civil: 1878.02 Cr. E&M: 1820.00 Cr. Total: 3698.02 Cr.	Civil: 2332.96 Cr. E&M: 2038.40 Cr. Total: 4371.36 Cr.
Per MW Cost (INR Cr.)	3.69 Cr.	3.90 Cr.
Annual Energy (MU)	Generation: 1964.92 MU Pumping: 2444.59 MU	Generation: 2155.40 MU Pumping: 2828.56 MU
40 Year Levelised Tariff INR/Kwh	7.82 @2.50 Rs/Kwh Pumping Charge	7.94 @2.50 Rs/Kwh Pumping Charge
Pros & Cons considering	Better L/H Ratio No R&R issue involved	- Total land to be acquired is 221 ha - Major Project area lies in Forest Area

	Option-1	Option-2
Environmental aspects	- Total land to be acquired is 190 ha	- Gandikota Kottalapalli village is just in the vicinity of the Upper reservoir area and reservoir area is submerging agriculture lands hence option-2 has R & R issue involvement. - Existing operational wind turbines are present throughout the periphery of the upper reservoir enclosing their transmission lines. - Water Conductor System length is having approx. 1000 m more length. - Requirement of Surge shaft in TRT. - L/H ratio is unattractive

Comparison in Land Requirement

S. No.	Appurtenance	Area (Ha.)	
		Option-1	Option-2
1	Project Components	130	166
2	Roads	20	15
3	Muck Disposal/ Quarry Site	30	30
4	Contractor's facility	10	10
	Total	190	221

It was further submitted that as evident from above, L/H ratio in Option-1 is much less than Option-2 which is a major criterion from techno economic standpoint. In Option-2, the Gandikota Village and Wind mill are situated near proposed upper reservoir. Hence, Private Land acquisition will impose additional cost and may involve R&R issues. Therefore, Option-1 is more economical and is the preferred option and hence selected at this stage. Option-1 is better considering environmental concerns as it has lesser land requirement than Option-2.

Query 2: Submit CWC clearance for hydrology

Reply: Feasibility Study Report - Hydrology chapter of Gandikota Pumped Storage Hydro-electric Project (1000 MW), Andhra Pradesh from CWC vide its letter dated 28.10.2021 has been submitted for consideration.

Query 3: Submit Sampling location maps for various aspects of Environment

Reply: Ambient air quality monitoring stations, Noise sampling location, Soil sampling location and Water sampling location around the proposed boundary has been submitted along with photographs.

Query 4: Submit Map & distance of proposed 7 Pumped Storage Projects in Krishna Basin

Reply: Following table along with kml file has been submitted by the PP for further consideration.

S.I.	Name of Proposed PSP	One-time filling Water Source	District	River/Source	Areal Distance (km)
1	Chitravathi PSP	Existing Lower Reservoir	Anantpur	Chitravathi River (Tributary of Penna River)	From Owk Site: 69 km From Gandikota PSP site: 38 km
2	Gandikota PSP	Existing Lower Reservoir	YSR Kadapa	Penna River	From Owk PSP Site : 44 km From Somasilla PSP Site: 115 km
3	Owk PSP	Existing Lower Reservoir	Kurnool	Water Diverted from Krishna River (Sriselum Reservoir)	From Gandikota PSP Site : 44 km From Chitravathi PSP Site : 69 km
4	Somasilla PSP	Existing Lower Reservoir	Nellore	Penna River	From Gandikota PSP site : 115 km
5	Yerravaram PSP	Nallah/Stream	Vishakhapatnam	Nallah/Stream	From Kurukuttin & Karrivalasa PSP Site: 119 km
6 & 7	Kurukutti & Karrivalasa PSP	Nallah/Stream	Vijayanagara	Nallah/Stream	From Yerravaram PSP Site: 119 km



Query 5: Submit Undertaking of no impact of downstream project of hydrological aspect

Reply: An undertaking vide letter dated 15.11.2021 has been submit which states that there will be no downstream impact due to operation of the proposed Gandikota Pumped Storage Hydro Power Project (1000 MW) in terms of hydrological aspect.

19.2.3 The EAC during deliberations noted the following:

EAC in the present meeting (19th meeting) deliberated on the information submitted (Form 1, PFR, etc.) and noted that the lower reservoir will be existing Gandikota reservoir. It was also noted that presently, water in the Gandikota reservoir is used for drinking and irrigation purpose in the region.

Further, it was noted that the live storage of the existing lower Gandikota Reservoir is stored between MDDL 202.90 m and FRL 212.0 m. Elevation of 9.10 m stores 23.629 TMC (669.095 MCM) water. The pumping water requirement is just 9.154 MCM (1.28% of the live storage of existing Gandikota reservoir). Considering the pumping operation at MDDL level, the minimum level needed is 203.059 m. The fluctuation is of the order of 0.159 m or 15.9 cm at MDDL level (1.74% of live storage depth) which will be even less at higher storage level operation.

The EAC noted that there are two other projects namely Chitravathi Pumped storage project (upstream) and Somasilla Pumped storage project (downstream) also proposed on Penna river. It was also noted by EAC that as per PFR submitted by PP the project site is located about 3.4 km from Gandikota Wildlife Sanctuary.

19.2.4 *The EAC after detailed deliberation on the information submitted and as presented during the meeting recommended the proposal for grant of Standard ToR for conducting EIA study for*

construction of Gandikota Pumped Storage Hydro-electric Project (1000MW), in an area of 190 ha. (469.5 acre) located at village Kondapuram village, Tehsil Muddanur, District Kadapa, Andhra Pradesh by M/s New and Renewable Energy Development Corporation of Andhra Pradesh Ltd. (NREDCAP), under the provisions of EIA Notification, 2006, as amended along with the following additional ToR:

- i. As the project site is close to Bird sanctuary, project impact on avi fauna shall be studied and incorporated in EIA/EMP report including the study of impacts on birds fly- ways, natural habitat, population patterns, migration patterns etc. through reputed Government expert institute.
- ii. Scope of watershed development in the 10 km radius of the project shall be studied in consultation with Indian Council of Agriculture Research (ICAR) and accordingly a detailed Water Shed development Plan shall be prepared and incorporated in EIA/EMP report.
- iii. Baseline data as mentioned in Standard ToR shall be collected for preparation of EIA/EMP report along with soil characteristics which shall be studied at minimum 10 locations. The ground water level at 10 locations shall be measured in project area in all three seasons.
- iv. The PP shall explore the possibility of fulfilling the entire power requirement to pump the water from the lower reservoir to the proposed upper reservoir from renewable sources except under exceptional unforeseen situations.
- v. A study shall be carried out on impact of project activity on the aquatic and terrestrial ecosystem, within project area classifying the impact zones (highly impact/low impact zone) based on seasonal variations and covering the aspects related to impacts on aquatic ecosystem/primary productivity due to quantity of water to be lifted for power generation and thermal stratification. Accordingly, Environment Management plan shall be prepared.
- vi. Fisheries Management Plan shall be prepared along with other Environmental Safety Measures for Penna River as well as in Gandikota reservoir and shall be incorporated in the EIA/EMP report.
- vii. Declaration by the project proponent by way of affidavit that “No” Inter-state issue / policies issue is involved with any state in the project.
- viii. All the tasks including conducting public hearing shall be done as per the provisions of EIA Notification, 2006 and as amended from time to time. Public hearing issues raised and compliance of the same shall be incorporated in the EIA/EMP report in the relevant chapter. Statement on the commitments (activity-wise) made during public hearing to facilitate the discussion on the CER in compliance of the Ministry’s OM F.No.22-65/2017-IA.III dated 30th September, 2020 shall be submitted.
- ix. Pre-DPR Chapters viz., Hydrology, Layout Map and Power Potential Studies duly approved by CWC /CEA shall be submitted.
- x. Techno-economic viability of the project must be recommended from CEA/CWC.
- xi. Environmental matrix during construction and operational phase needs to be submitted.
- xii. Matrix formulated on the basis of detailed study and field survey of flora and Fauna methodology used shall be mentioned in the EIA report.
- xiii. Both capital and recurring expenditure under EMP shall be submitted.

- xiv. *Endemic plant and animal species found in the area concerned shall be provided with valid scientific references instead listing entire endemic species found in the State.*
- xv. *Environmental Cost Benefit Analysis shall be done in terms of water availability, water uses for generation of hydro power and Ecological flows in the Penna River.*
- xvi. *Undertaking regarding water allocated to this scheme shall not be diverted to other purpose such as lift irrigation scheme etc.*
- xvii. *Photograph of sampling location shall contain specific date and time along with coordinates which shall be incorporated in EIA.*
- xviii. *Details of quantity of muck generation component wise (Excavation in tunnels, pressure shaft and powerhouse etc) and disposal site/ transportation to be provided.*
- xix. *Tentative no. of project affected families shall be identified and accordingly appropriate Rehabilitation & Resettlement plan shall be prepared.*
- xx. *Details of Flora and Fauna reported in submergence area, No.s of tree along with their density required to be cut for reservoir creation and other project component.*
- xxi. *Ground water depth in project vicinity area to be collected and to be incorporated in EIA/EMP report.*
- xxii. *Impact on aquatic ecosystem due to quantity of water to be lifted for power generation be incorporated in EIA/EMP report.*
- xxiii. *Impact of Project activity on the aquatic and terrestrial ecosystem, within study area to be studied and be incorporated in EIA/EMP report.*

Agenda No. 19.3

Owk Pumped Storage Hydro-electric Project (800MW), in an area of 390 ha. (157.8 acre) located at village Owk, Tehsil Owk, District Kurnool Andhra Pradesh by M/s New and Renewable Energy Development Corporation of Andhra Pradesh Ltd. (NREDCAP) – Terms of Reference - reg.

[Proposal No. IA/AP/RIV/235874/2021; F. No. J-12011/17/2021-IA.I (R)]

19.3.1 The proposal is for grant of Terms of Reference (ToR) to Owk Pumped Storage Hydro-electric Project (800MW), in an area of 390 ha. (157.8 acre) located at village Owk, Tehsil Owk, District Kurnool Andhra Pradesh by M/s New and Renewable Energy Development Corporation of Andhra Pradesh Ltd. (NREDCAP).

19.3.2 The details of the project submitted by project proponent and ascertained from the document submitted are mentioned below:

- i. The proposed project is pumped storage being develop by M/s New and Renewable Energy Development Corporation of Andhra Pradesh Limited (NREDCAP) is the State Nodal Agency for development of renewable power in the state of Andhra Pradesh.

- ii. The Project is located near village Owk in Kurnool district in the state of Andhra Pradesh in India and belongs to Rayalaseema region. The project falls in the Lat. N 15° 18' and Long. E 78° 08'.
- iii. The proposed Owk Pumped Storage project envisages utilization of available head between proposed upper dam and existing Owk reservoir Paleru River (a tributary of Krishna River) as lower reservoir. An Underground Power House (UGPH) will be located in between two reservoirs. The water conductor system will connect the two reservoirs through an underground power house.
- iv. The Proposed Pumped Storage (PSP) scheme will generate 800 MW of power by utilizing net design head of 157.18m.
- v. The Upper reservoir is proposed to be built with a live storage of 12.164 MCM. This is about 10.36% capacity of the lower reservoir, however this would be only a one time requirement. The 90% dependable flow at lower reservoir site is 12.82 MCM, which is sufficient enough for the requirement of water/storage capacity of proposed upper reservoir. Depth of the upper reservoir (FRL-MDDL) is proposed to be 19m. The annual evaporation loss in the region as per CWC report is 2373mm.
- vi. The key details of the scheme are summarized below:

Installed Capacity (MW)	800 MW
No of units	4 nos.
Unit Size (MW)	200
Type of Turbine	Vertical reversible Francis Turbine
Head (min) (m)	142.0 m
Net Design Head (m)	157.18 m
Head (max) (m)	168.53 m
Hours of Peaking Operation	5 hrs 50 Min.
Annual Energy Generation (GWh)	4666.67 GWh
Annual Pumping Energy (GWh)	5825.33 GWh
Cycle Efficiency (%)	80.12%
Head Loss (m)	4.0m
Life of Project	40 years

- vii. Owk Pumped Storage Project involves minimum and simple civil works and could be completed in 41 /2 years. The project would afford an annual design energy generation of 1703.33 GWh per year. The cost per MW installed works out as Rs 3.61 Crores.
- viii. The scheme would afford on annual peaking period energy generation of 1703.33 GWh annually. For assessing the tariff, design energy generation of 1618.16 GWh, calculated with 95% capacity availability in a normal dependable year, has been adopted. The project would provide 800 MW of 5 hours and 50 minutes daily peaking capacity benefits.
- ix. **Salient Features:**

1. LOCATION	
Country	India
State	Andhra Pradesh
District	Kurnool

River	Paleru river a tributary of Krishna river
Upper Reservoir	Lat. N 15° 9' 37.34'' and Long. E 78° 4' 4.11''
Owk Reservoir (Lower Reservoir)	Lat. N 15° 11' 6.16'' and Long. E 78° 5' 6.58''
Access to the Project	
Road	80 km from District HQ Kurnool
Airport	Kadapa : 130 km Kurnool : 80 km
Railhead (with unloading facilities)	Tadipatri : 40 km Banganpalli : 22 km
Port	Krishnapatnam : 281 km Chennai : 438 km
2. PROJECT	
Type	Pumped Storage Project
Installed Capacity	800 MW
Peak Operating duration	5.6 hours
3.0 Average Annual Rainfall	670.5 mm
4.0 CIVIL STRUCTURE	
4.1 UPPER RESERVOIR (New) (Bund Type)	
FRL	392 m
MDDL	373m
Available Live storage	12.164 MCM
Dead Storage	2.887 MCM
4.2 LOWER RESERVOIR (Existing)	
FRL	EL. 227.00 m
MDDL	EL. 219.46 m
Live storage	69.901 MCM
Dead Storage	47.544 MCM
4.3 Intake Structure	
Type	Circular with bell mouth Intake
H x W x L x No.	13.5m x 10m x 10m x 2
Dia. Of Tunnel	8.5m
4.4 Headrace Tunnel cum Pressure Shaft (Steel Lined)	
Diameter	8.5 m
Length	421 m
No. of Tunnel	2

4.5 Pressure Shaft (Steel Lined)	
D x L x line After Bifurcation	5.5 m x 30 m x 4
4.6 TRT Surge Chamber	
LxWxH	135m x 10m x 88m
4.7 Tailrace Tunnel (Concrete Lined)	
Diameter Length No. of Tunnel After bifurcation tunnel from draft tube (D x L x line) (Steel Lined)	9.3 m 966 m2 5.5m x 87m x 4
4.9 Outlet Structure	
Type	Circular with bell mouth Intake
H x W x L x No.	14.7m x 10.5m x 10.5m x 2
Dia. Of Tunnel	9.3 m
4.10 Powerhouse	
Type Size	Under ground, 210 m x 24 m x 51.5 m
4.11 Transformer Room including Secondary GIS	
Type L x W x H	Under ground 190 m x 18 m x 25.5 m
4.12 Main Access Tunnel (MAT)	
Type W X H	D- shape 8.00 m x 8.50 m
5.0 Electromechanical Equipment	
5.1 Pump Turbine	
Type	Vertical reversible Francis Turbine
Number of unit	4 (Four)
Max. Head as Turbine	168.53 m
Rated Turbine Head	157.18 m
Min. Head as Turbine	142.0m
Turbine Output at Rated Head	203.04 MW
Turbine Output at 10% overhead operation	220 MW
Max. Head as Pump	176.53 m
Rated Pump Head	165.18 m

Min. Head as Pump	150 m
Max. discharge of Turbine at rated Turbine head	147.96 Cumec
Specific Speed	176.91 rpm
5.2 Generator-Motor	
Type	3 phase AC Synchronous Generator – Motor, Semi Umbrella Type
Number of unit	4
Rated Capacity	200 MW
Rated Voltage	13.8 kV +/- 10%
Rated Frequency	50 cycles per second
Rated Speed	187.5 rpm
Over Load Capacity	220 MW
5.3 Main Transformer	
Type	Indoor, oil immersed, single phase Transformer with OLTC
Numbers	14 nos. of single phase Transformer
Rated Capacity	87 MVA
Rated Voltage	13.8 kV / 420kV
Connection	LV Delta / HV Star
Neutral Grounding System for Secondary Winding	HV Star solidly Grounded
5.4 Generator-Motor Circuit Breaker	
Type	SF 6 Type
Number of Unit	4
Rated Voltage	13.8 kV
Rated Normal Current	12000 Amps per phase
Phase Reversal Equipment	Required for changing of operation from Generation to Pumping and vice-versa
5.5 Gas Insulated Switchgear	
5.5.1 Circuit Breaker	
Type	GIS Type (SF6 Gas)
Number of Feeder	9
Rated Voltage	420 kV
Rated Normal Current	2000 Amps

Rated Short Time (1sec) withstand Current	50 kA		
5.6 220 kV XLPE Cable			
Type	Cross Linked Poly Ethelene		
Rated Voltage	420 kV		
Number of Circuits	4x 1 + 1 (Spare) Cables		
5.7 Pump Staring Method			
Type	Static Frequency Method or Back –to –back method		
5.8 EOT Crane			
Type	Capable of Tandem operation		
Number of Unit	2		
Rated Capacity	270/50/10 MT		
Span	24 m		
5.9 Transmission Line			
Type	Double D/C Single Moose Conductor		
Capacity Voltage Level	400 kV		
Length	Bethamcherla Sub-station - 27 KM (Approx.)		
6. Project Cost			
Item	Estimated Cost (Rs. Lakh)		
Direct Charges	Rs. 286154.29 lakhs		
Indirect Charges	Rs. 2828.36 lakhs		
Total	Rs. 288982.65 lakhs		
7. Project Benefit's			
Sr.No.	Off Peak Energy Rate (Rs/kWh)	First Tariff (Rs/kWh)	Levelized Tariff (Rs/kWh)
1	3	8.33	7.89
2	2.5	7.65	7.22
3	2	6.98	6.54

- x. **Seismicity of project area:** The area falls under seismic zone-III as per Seismic Zonation Map of India (IS 1893 – 1984). The district falls in Zone II (least active seismic zone).
- xi. **Cost and benefits of the Scheme:** The scheme would afford on annual peaking period energy generation of 1703.33 GWh annually. For assessing the tariff, design energy generation of 1618.16 GWh, calculated with 95% capacity availability in a normal dependable year, has been adopted. The project would provide 800 MW of 5 hours and 50 minutes daily peaking capacity benefits.

- xii. **Land requirements:** The total land to be acquired for the project is approximately 390 acres. Based on the site visit, most of the land required is Government (revenue) land. The clearance and acquisition of land will be as per the land guidelines. Suitable site will be selected for muck disposal at FSR/DPR stage.
- xiii. During preliminary investigation no National Park, Wildlife sanctuary, Tiger/Elephant reserve, biosphere reserve etc within 15 km of the project area. Application for Forest Clearance yet to be submitted.
- xiv. **Project Cost:** The estimated project cost is Rs. 2889.83 Crore at March, 2021 price levels. The preliminary cost estimate of the project has been prepared as per guidelines of CEA / CWC.
- xv. **R&R:** The land to be acquired for various project appurtenances including reservoir submergence will be assessed. Based on ownership status of land, the quantum of private land to be acquired will be assessed. The number of families losing land and homestead will be estimated. A R&R plan shall be devised using the norms and guidelines of the “Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013”, if private land acquisition is envisaged.
- xvi. **Alternative sites:** Since the lower reservoir exists in the present scheme, various alternatives were examined to locate the upper reservoir and only possible option has been identified at the nearby hilltop. Technically there are two possible methods to create an artificial upper reservoir either by constructing a bund of requisite height around the flat area available to create pondage for the required generation or excavating a pit to certain depth to create pondage. Preparation of Feasibility Report & Detailed Project Report for Owk Pumped Storage Project (800 MW) In Kurnool district, Andhra Pradesh There is only one option found which is feasible for Pumped Storage Project. In this option, the location of upper reservoir is proposed on left bank at geographical co-ordinate 15° 9' 37.34'' N latitude and 78°4' 4.11'' E longitude in SW direction of existing Reservoir. The highest contour available is EL-373m which has sufficient surface area possible to get live storage of 12.17 MCM. The reservoir of Bund type is proposed so that enough head is availed for energy generation. The total length of water conductor system is 1603m starting from upper intake to lower intake I.
- xvii. **Inter State / Inter-national aspects:** All the components of the proposed PSP are located within the administrative boundary of the state of Andhra Pradesh.

The EAC during deliberations asked information on alternative site analysis, CWC clearance on hydrology, sampling locations, distance of other PSP projects in the region and down-stream impacts of the project on hydrology etc. The PP provided point-wise information as under:

Query 1: Alternative Studied including Environmental Aspects.

Reply: The existing Owk Reservoir has been proposed as lower reservoir for the Pumped storage scheme with Full Reservoir Level of El.227m and Minimum draw downlevel of El. 219.46m. An artificial Reservoir is proposed as upper Reservoir which is constructed as bund type Reservoir at Elevation-373.0m. The live storage capacity for pump storage scheme required is only 12.17 MCM. The proposed project will generate 800 MW of power by utilizing net design head of 157.18 m. The water from the upper reservoir will be diverted through Power House and TRT to the existing lower reservoir. The water will be pumped back to the upper reservoir through TRT-Reversible Turbines-pressure shaft-HRTto upper reservoir.

Alternative Layout studies:

Since the lower reservoir exists in the present scheme, various alternatives were examined to locate the upper reservoir and only possible option has been identified at the nearby hilltop. Fig 1.1 showing OWK reservoir along with the nearby locations of locating the upper reservoir maximum elevation for OWK PSP. Location-3 having Max. El. 375m has been chosen as it offers maximum head of the order of 157 m amongst all nearby location.

Hence for the selected site; maximum elevation for Upper Reservoir and shortest water conductor WCS system are available. The basic data for Upper and Lower Reservoir are given in Table-1

Table-1 Basic Data for Upper and Lower Reservoir

Upper Reservoir Basic Data	
FRL	392m
MDDL	373m
Live Storage	12.17 MCM
Dead Storage	2.887 MCM
Reservoir Surface Area	69.09 Ha (59.03Ha. at MDDL)
Lower OWK Reservoir (Existing) Basic Data	
FRL	227m
MDDL	219.46m
Live Storage	88.67 MCM
Dead Storage	28.80 MCM
Length of Water conductor System	1561m
Gross Head Available	161.18m

The total land requirement for the project is 157.8 ha or 390 acre. The details are given in Table-2

Table-2: Details of Land Requirement for the project

S. No.	Appurtenance	Area	
		ha	Acre
1.	Project Components	121.4	300
2.	Roads	8.1	20
3.	Muck Disposal/ Quarry Sites	20.2	50
4.	Contractor's facility	8.1	20
	Total	157.8	390

The break-up of land requirement for Project components are as given in Table-3

Table-3: Break-up of land requirement for Project components

S. No.	Project Components	Area (ha) Underground	Area (ha) Surface
1.	Dam, Upper Reservoir	-	82.3
2.	HRT cum Pressure Shaft	2.5	-
3.	Power House	6.58	-
4.	TRT	12.12	-

5.	CAT & MAT	17.9	-
	Total	39.1	82.3
	Grand Total (underground + Surface)	121.4	

Query 2: Submit CWC clearance for hydrology

Reply: Feasibility Study Report - Hydrology chapter of Owk Pumped Storage Hydro-electric Project (800 MW), Andhra Pradesh from CWC vide its letter dated 1.10.2021 has been submitted for consideration.

Query 3: Submit Sampling location maps for various aspects of Environment

Reply: Ambient air quality monitoring stations, Noise sampling location, Soil sampling location and Water sampling location around the proposed boundary has been submitted along with photographs.

Query 4: Submit Map & distance of proposed 7 Pumped Storage Projects in Krishna Basin

Reply: Following table along with kml file has been submitted by the PP for further consideration.

S.I.	Name of Proposed PSP	One-time filling Water Source	District	River/Source	Areal Distance (km)
1	Chitravathi PSP	Existing Lower Reservoir	Anantpur	Chitravathi River (Tributary of Penna River)	From Owk Site: 69 km From Gandikota PSP site: 38 km
2	Gandikota PSP	Existing Lower Reservoir	YSR Kadapa	Penna River	From Owk PSP Site : 44 km From Somasilla PSP Site: 115 km
3	Owk PSP	Existing Lower Reservoir	Kurnool	Water Diverted from Krishna River (Sriselum Reservoir)	From Gandikota PSP Site : 44 km From Chitravathi PSP Site : 69 km
4	Somasilla PSP	Existing Lower Reservoir	Nellore	Penna River	From Gandikota PSP site : 115 km
5	Yerravaram PSP	Nallah/Stream	Vishakhapatnam	Nallah/Stream	From Kurukuttin & Karrivalasa PSP Site: 119 km
6 & 7	Kurukutti & Karrivalasa PSP	Nallah/Stream	Vijayanagar	Nallah/Stream	From Yerravaram PSP Site: 119 km



Query 5: Submit Undertaking of no impact of downstream project of hydrological aspect.

Reply: An undertaking vide letter dated 15.11.2021 has been submit which states that there will be no downstream impact due to operation of the proposed Owk Pumped Storage Hydro Power Project (800 MW) in terms of hydrological aspect.

19.2.3 The EAC during deliberations noted the following:

EAC in the present meeting (19th meeting) deliberated on the information submitted (Form 1, PFR, etc.) and noted that the lower reservoir will be existing Owk reservoir fed by Paleru River (a tributary of Krishna River).

It was also noted that Owk reservoir receives water through a tunnel from Srisaïlam project right bank canal (SRBC), as such the time required for meeting the 12.1705 MCM (12.164 MCM + 0.0065 MCM evaporation loss) would depend on the releases/ flow received from SRBC which would vary depending upon the canal flow. As such, the estimate for time for filling would be more than a year.

Further, it was noted that the live storage required for proposed project is 12.17 MCM, upper reservoir having a Pit of 1233m length, 893m width and 19m depth is proposed at upper reaches, where the FRL is El.392-m and MDDL is El. 373.0m and an earthen dam of 22m height upto EL-495m.

19.2.4 *The EAC after detailed deliberation on the information submitted and as presented during the meeting recommended for grant of Standard ToR to Owk Pumped Storage Hydro-electric Project (800MW), in an area of 390 ha. (157.8 acre) located at village Owk, Tehsil Owk, District Kurnool Andhra Pradesh by M/s New and Renewable Energy Development Corporation of Andhra*

Pradesh Ltd. (NREDCAP) under the provisions of EIA Notification, 2006 and as amended along with the following additional/specific ToR:

- i. Scope of watershed development in the 10 km radius of the project shall be studied in consultation with Indian Council of Agriculture Research (ICAR) and accordingly a detailed Water Shed development Plan shall be prepared and incorporated in EIA/EMP report.*
- ii. A study shall be carried out on impact of project activity on the aquatic and terrestrial ecosystem, within project area classifying the impact zones (highly impact/low impact zone) based on seasonal variations and covering the aspects related to impacts on aquatic ecosystem/primary productivity due to quantity of water to be lifted for power generation and thermal stratification. Accordingly, Environment Management plan shall be prepared.*
- iii. Baseline data as mentioned in Standard ToR shall be collected for preparation of EIA/EMP report along with soil characteristics which shall be studied at minimum 10 locations. The ground water level at 10 locations shall be measured in project area in all three seasons.*
- iv. Endemic plant and animal species found in the area concerned shall be provided instead listing entire endemic species found in the State.*
- v. Environmental Cost Benefit Analysis shall be done in terms of water availability, water uses for generation of hydro power and Ecological flows in the Penna River.*
- vi. Project impact on avi fauna shall be studied and incorporated in EIA/EMP report.*
- vii. The PP shall explore the possibility of fulfilling the entire power requirement to pump the water from the lower reservoir to the proposed upper reservoir from renewable sources except under exceptional unforeseen situations.*
- viii. Fisheries Management Plan shall be prepared along with other Environmental Safety Measures for Paleru River as well as in Owk reservoir and shall be incorporated in the EIA/EMP report.*
- ix. Declaration by the project proponent by way of affidavit that “No” Inter-state issue / policies issue is involved with any state in the project.*
- x. All the tasks including conducting public hearing shall be done as per the provisions of EIA Notification, 2006 and as amended from time to time. Public hearing issues raised and compliance of the same shall be incorporated in the EIA/EMP report in the relevant chapter. Statement on the commitments (activity-wise) made during public hearing to facilitate the discussion on the CER in compliance of the Ministry’s OM F.No.22-65/2017-IA.III dated 30th September, 2020 shall be submitted.*
- xi. Pre-DPR Chapters viz., Hydrology, Layout Map and Power Potential Studies duly approved by CWC /CEA shall be submitted.*
- xii. Techno-economic viability of the project must be recommended from CEA/CWC.*
- xiii. Environmental matrix during construction and operational phase needs to be submitted.*
- xiv. Matrix formulated on the basis of detailed study and field survey of flora and Fauna methodology used shall be mentioned in the EIA report.*

- xv. *Both capital and recurring expenditure under EMP shall be submitted.*
- xvi. *Undertaking regarding water allocated to this scheme shall not be diverted to other purpose such as lift irrigation scheme etc.*
- xvii. *Photograph of sampling location shall contain specific date and time along with coordinates which shall be incorporated in EIA.*
- xviii. *Details of quantity of muck generation component wise (Excavation in tunnels, pressure shaft and powerhouse etc) and disposal site/ transportation to be provided.*
- xix. *Tentative no. of project affected families shall be identified and accordingly appropriate Rehabilitation & Resettlement plan shall be prepared.*
- xx. *Details of Flora and Fauna reported in submergence area, No.s of tree along with their density required to be cut for reservoir creation and other project component.*
- xxi. *Ground water depth in project vicinity area to be collected and to be incorporated in EIA/EMP report.*
- xxii. *Impact on aquatic ecosystem due to quantity of water to be lifted for power generation be incorporated in EIA/EMP report.*
- xxiii. *Impact of Project activity on the aquatic and terrestrial ecosystem, within study area to be studied and be incorporated in EIA/EMP report.*
- xxiv. *Inter-state issues shall be examined in consultation with CWC.*

Agenda No. 19.4

Teesta Low Dam – I & II (Combined) Hydro-Electric Project 71 MW (2x30+1x11MW) in an area of 170 ha by M/s West Bengal State Electricity Distribution Company Limited in Triveni town, Tehsil Rangli Rangliot, District Darjeeling, West Bengal – Reconsideration of Terms of Reference - reg.

[Proposal No. IA/WB/RIV/219929/2021; F. No. J-12011/11/2021-IA.I (R)]

19.4.1 The proposal is for grant of Terms of Reference (ToR) to Teesta Low Dam -I & II (Combined) Hydro-Electric Project 71 MW (2x30+1x11MW) in an area of 170 ha by M/s West Bengal State Electricity Distribution Company Limited in Triveni town, Tehsil Rangli Rangliot, District Darjeeling, West Bengal

19.4.2 The proposal was earlier considered by the EAC in its 15th meeting held on 27th July, 2021, and project was deferred the proposal seeking additional information from Project Proponent (PP).

Point-wise replies submitted by the PP vide letter dated 8th September, 2021 in response to additional details sought (ADS) by EAC in its 15th meeting are as follows:

Query 1: Detailed report on Environmental Cost Benefit analysis shall be done due to project location in dense forest area with high biodiversity and accordingly a site suitability study shall be carried out in terms of viability of the project.

Reply: As per the present level of investigations, about 170 ha of forest is to be acquired. The breakup of land required for the project is given as below:

Component	Area (ha)
Submergence area at FRL	125.2
Penstock	1.4
Barrage site & other structures	8.0
Colony and roads	7.5
Power house & Tail Race	2.0
Switchyard	3.0
Muck Disposal Area	5.9
Quarry sites	5.0
Other Miscellaneous requirements	12.0
Total	170.0

MoEF&CC vide letter No. 7-69/2011-FC(Pt.), dated 1st August,2017, issued Guidelines for conducting Cost Benefit Analysis for projects involving diversion of forest land under the provisions of the Forest (Conservation) Act, 1980.

Environmental Cost

- Cost of Loss to Ecological Services.
- Cost of Loss of animal husbandry productivity, including loss of fodder.
- Cost of Habitat Fragmentation.
- Compensatory afforestation & soil moisture conservation cost.
- Loss of Public facilities and administrative infrastructure.
- Possession value of forest land diverted.
- Cost of human resettlement.
- Cost of Loss of Agriculture Production

Environmental Benefits

- Increase in Productivity (Electric Generation).
- Benefits to the State.
- Benefits to Local Population.
- Economic benefits.
- Employment Generation.
- Economic benefits due to compensatory afforestation

At present, PFR has been prepared for the project in which it is indicated that a significant degree of optimization has been carried out by lowering size of the project components leading to reduction in submergence, lesser land requirement and significant reduction in impact in Environment as a whole along with reduction of project cost also to make project more attractive. A brief preliminary comparison showing the optimization has been submitted. Detailed Project Report and EIA Report are yet to be prepared. EAC (RVC&HEP) to accord clearance for Terms of Reference (ToR) for conducting EIA Study, and Environmental Cost Benefit Analysis shall be carried out as part of the EIA Report. PP shall include the detailed Environmental Cost Benefit Analysis as a part of EIA Report.

Query 2: PP should ensure that entire land coming under the project have been acquired.

Reply: As per the present level of investigations, about 170 ha of forest land is to be diverted for the project. Once all the statutory clearances are obtained, the forest land will be diverted as per the norms. PP undertaken that project construction will not be taken up prior to diversion of the forest land.

19.4.3 The EAC during deliberations noted the following:

EAC in the present meeting (19th meeting) deliberated on the additional information submitted by PP and noted that points raised by the EAC in the earlier meeting were not properly addressed by the project proponent. Further, it was noted that the project is located in a very dense forest area and site suitability submitted by PP in terms of Eco-sensitivity of the project area is not in favour to grant Terms of Reference to the project.

EAC was in view that due to project installation can lead to severe impacts on wildlife habitat in dense forest area.

19.4.4 *The EAC after detailed deliberation observed that information submitted by PP are not satisfactory in nature therefore following are the deficiencies which required for further consideration of the project. It was desired that PP may submit the below mentioned information:*

- i. Conduct detailed study on site suitability by covering all ecological aspects such as loss of biodiversity, habitat fragmentation, loss of forest etc.*
- ii. Undertaking shall be submitted stating that minimum E-flow 20% in lean season will be maintained as recommended in CIA&CCS study report.*
- iii. NOC/ Consent from Govt. of Sikkim needs to be submitted as submergence of the project area is falling in jurisdiction of Govt of Sikkim.*

The meeting ended with vote of thanks to the Chair.

ATTENDANCE LIST

Sr. No.	Name & Address	Role	Attendance
1	Dr. K. Gopakumar	Chairman	P
2	Dr. N. Lakshman	Member	P
3.	Dr. Narayan Shenoy K	Member	P
4.	Dr. Mukesh Sharma	Member	P
5	Dr. A. K. Malhotra	Member	P
6	Dr. Uday Kumar R.Y.	Member	P
7.	Shri Amrendra Kumar Singh	Representative of (CWC))	P
8.	Shri Yogendra Pal Singh	Member Secretary	P

APPROVAL OF THE CHAIRMAN



Yogendra Pal Singh via nic.in
to me ▾

Dec 12, 2021, 8:16 PM (14 hours ago) ☆ ↶ ⋮

From: kgopa@isc.ac.in
To: "Yogendra Pal Singh" <yogendra78@nic.in>
Sent: Sunday, December 12, 2021 7:33:59 PM
Subject: Re: draft minutes of the 19th EAC (RIV&HEP) meeting held on 15.11.2021- reg

Dear Yogendra
If all the members have given the comments and accepted this then kindly go ahead and I approve it.
With regards
Prof K Gopakumar

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From: Yogendra Pal Singh <yogendra78@nic.in>
Sent: Sunday, December 12, 2021 8:01:06 AM
To: Gopakumar K <kgopa@isc.ac.in>
Subject: Fwd: draft minutes of the 19th EAC (RIV&HEP) meeting held on 15.11.2021- reg

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