Before

UTTARAKHAND ELECTRICITY REGULATORY COMMISSION

Petition No. 34 of 2023

In the Matter of:

<u>Petition seeking approval of capital investment for Supply Installation Testing</u> and Commissioning (SITC) of 220kV XLPE Armoured Power Cable with all accessories including dismantling of existing oil filled cable at Chibro Powerhouse under Section 61 and 86 of the Electricity Act, 2003 read with the relevant regulations and guidelines of the Commission.

And

In the Matter of:

Managing Director, UJVN Limited, "UJJWAL", Maharani Bagh, GMS Road, Dehradun.

...Petitioner

<u>Coram</u>

Shri D.P. GairolaMember (Law) /Chairman (I/c)Shri M.K. JainMember (Technical)

Date of Order: September 05, 2023

<u>ORDER</u>

This Order relates to the Petition filed by Uttarakhand Jal Vidyut Nigam Limited (UJVN Ltd.) (hereinafter referred to as "UJVN Ltd." or "the Petitioner") seeking prior approval of the Commission for 'capital investment for Supply Installation Testing and Commissioning (SITC) of 220kV XLPE Armoured Power Cable with all accessories including dismantling of existing oil filled cable at Chibro Powerhouse under Section 61 and 86 of the Electricity Act, 2003 read with the relevant regulations and guidelines of the Commission'.

Background

- 2. The Petitioner vide its letter No. M-356/UJVNL/02/D(O)/B8 dated 31.03.2023 submitted a Petition for 'capital investment for Supply Installation Testing and Commissioning (SITC) of 220 kV XLPE Armoured Power Cable with all accessories including dismantling of existing oil filled cable at Chibro Powerhouse under Section 61 and 86 of the Electricity Act, 2003 read with the relevant regulations and guidelines of the Commission'.
- 3. The Petitioner under the facts of the case has submitted that:
 - "…
 - 3.4 That Chibro Power Station, an under-ground power station commissioned in 1975-76. The power station is harnessing the water potential power of river Tons. River Tons is a major tributary of Yamuna, carries perennial discharges fed by large catchment of about 4900 sq. km. and flows through a steep and narrow gorge in Himalayas, resulting in a large head and consequently a high power and irrigation potential.
 - 3.5 The power station is provided with a unit system or layout, where each generator is directly connected to a power transformer. Each unit has separate pen stock with a Butterfly Valve (BFV) and all four-unit generators and transformers are installed at a level 520.0 & 521.4 meter respectively inside the cavity of the powerhouse.
 - 3.6 An outdoor conventional type of switchyard was constructed for evacuation of power through the 220 kV oil filled cables from the power transformer to the 220 kV grid. Pot head at both ends of 220 kV oil filled cables are provided to connect the power transformer to 220 kV circuit breakers at switchyard.
 - 3.7 220 kV oil field cables with all accessories were installed & commissioned in 1975 at Chibro powerhouse for transmitting the electric generating energy from 11/220kV, 4X69MVA transformers to 220 kV switchyard.
 - 3.8 The OEM of oil filled cables is M/s Showa Electric Wire & Cable Co. Ltd, Japan. 12 nos. lengths of single phase 220 kV oil filled cables in mainstream and 02 nos. lengths of cables as spare for use in breakdown has been laid down from plant to 220 kV outdoor switchyard. Each cable length is approximately of 554 to 578 meters and the total length is approx. 8050 meters.
 - 3.9 An oil filled cable consists outdoor terminal end at switchyard and indoor (invert) terminal end at transformer end for connection. Degasification plant for centrifuging & topping up of oil and to maintain the desired oil pressure in the cables was installed by the OEM. Also, 6.6 kV copper cables for earthing at both end terminals, protection panel, piano wire with fire protection alarm system, mulsifire protection system and cable trays for laying were used for protection of oil filled cables by the OEM.
 - 3.10 220 kV oil filled cables are in use since commissioning i.e., more than 47 years passed in use. Due to long use and ageing effect, cable insulation has become week. Even at

some places upper insulation of cable has been damaged \mathcal{E} oil is leaked from cable terminal pot heads...

- 3.11 As per Regulation 22 (4) of UERC Tariff Regulations, 2021, a generating company is required to get prior approval for the additional capitalization works exceeding ₹ 5 Crore. The Regulation 22 (4) of UERC Tariff Regulations, 2021 states that: -"Any addition/modification to the existing assets exceeding Rs. 2.50 Crore in case of distribution licensees and Rs. 5 Crore in case of generating companies/transmission licensees shall be taken up only after prior approval of the Commission. The investment approval applications covered under this sub-regulation are excluded from the application of proviso to Sub-regulation (2) of Regulation 10 of UERC (Conduct of Business) Regulations, 2014 in so far as the requirement of submission of documentary evidence with respect to the approval of BoD is concerned."
- 3.12 Therefore, a DPR amounting to ₹27.16 Crore including taxes has been prepared inhouse and is approved by the Competent Authority for Supply Installation Testing and Commissioning (SITC) of 220 kV XLPE Armoured Power Cable with all accessories including dismantling of existing oil filled cable at Chibro Powerhouse. The works proposed in the DPR will be carried out during the financial years 2023-24 and 2024-25.
- 3.13 The estimated cost for carrying out the capital investment for Supply Installation Testing and Commissioning (SITC) of 220 kV XLPE Armoured Power Cable with all accessories including dismantling of existing Oil Filled Cable at Chibro Powerhouse is summarized as under-

S. No	Description	Unit	Qty.	Rate (Rs.)	Total
<i>A</i> .	Supply				
1.	1Cx400Sq MM -220 kV Copper XLPE Cable	Meter	8400	16500.00	138600000.00
2.	6.6 kV 300 Sq mm, copper conductor PVC Bonding Cable	Meter	300	5812.00	1743600.00
3.	220 kV termination Indoor complete in all respect.	NO	14	1383745.00	19372430.00
4.	220 kV termination Outdoor complete in all respect.	NO	14	760465.00	10646510.00
5.	Single phase earthing link box with SVL	NO	12	103675.00	1244100.00
6.	Single phase earthing link box without SVL	NO	12	95448.00	1145376.00
7.	220 kV LA with surge counter meter complete	NO	12	172795.00	2073540.00
8.	C&R Panels for Control & Protection	NO	1	3455865.00	3455865.00
9.	Numerical Protection Relays & Distance Protection Relays for both ends with IEC 61850 protocol as per latest IEC	Lot	1	4114130.00	4114130.00
	Sub Total of (A)			182395551.00	

S. No	Description	Unit	Qty.	Rate (Rs.)	Total
В.	B. Services/Work- (Installation, testing & commissioning)				
1.	1Cx400Sq MM -220 kV Copper XLPE Cable	Meter	8400	2350	19740000.00
2.	6.6 kV 300 Sq mm, copper conductor PVC Bonding Cable	Meter	300	635.00	190500.00
3.	220 kV termination outdoor complete in all respect.	NO	14	400050.00	5600700.00
4.	220 kV termination indoor complete in all respect.	NO	14	438150.00	6134100.00
5.	220 kV Outdoor Termination structure Modification complete withnuts, bolt and foundation	NO	14	177800.00	2489200.00
6.	220 kV Indoor termination arrangement modification & strengthening complete in all respect.	NO	14	133350.00	1866900.00
7.	Single phase earthing link box with SVL	NO	12	57150.00	685800.00
8.	Single phase earthing link box without SVL	NO	12	57150.00	685800.00
9.	220 kV LA with surge counter meter complete	NO	12	82550.00	990600.00
10.	Repair & Strengthening of existing cable trays for making it ready for new cables	Lot	1	952500.00	952500.00
11.	Testing & Commissioning of Cable System	Lot	4	603250.00	2413000.00
12.	Testing & Commissioning of Numerical Relays including programming, settings & Protection scheme of 220 kV Cable with Generator Transformer, Generator Circuit Breaker compatible with existing protection scheme.	Lot	1	825500.00	825500.00
13.	<i>Erection, Testing & Commissioning of</i> <i>Control & Relay Panel</i>	Lot	1	1079500.00	1079500.00
	Sub Total of	(B)			43654100.00
(C)	Work/Services- (Dismantling of exist	ing oil fi	eld cabl	e)	
1.	Dismantling of 220 kV indoor termination for return to UJVNL store at Dakpathar	NO	14	63500.00	889000.00
2.	<i>Dismantling of 220 kV outdoor termination for return to UJVNL store at Dakpathar</i>	NO	14	38100.00	533400.00
3.	Dismantling of 220 kV cable (removal oil) & rolling it on drums for transporting to UJVNL store at Dakpathar including cost of drums	Meter	8400	318.00	2671200.00
	Sub Total of (C) 4093600.00				4093600.00
	Grand Total (Rs.) of (A+B+C) 230143251.00				230143251.00
	GST @18% 4,14,25,785.0				4,14,25,785.00
	Grand Total including GST27,15,69,036.00				

- 4. The Petitioner in its Petition under financing plan and phasing of expenditure has furnished that it shall arrange the expenditure from its internal resources and the total expenditure of Rs. 27.16 Cr. would be incurred during the FY 2023-24 and FY 2024-25.
- 5. The Commission vide its letter dated 06.04.2023 directed the Petitioner to furnish the details of approval limits [administrative as well as financial] of the Competent Authority (ies) pertaining to investments before the Commission.
- 6. The Petitioner in response to the Commission's letter dated 06.04.2023 submitted its compliance vide letter dated 19.04.2023 and submitted that the DPR for the works pertaining to instant Petition would be submitted to the upcoming meeting of Board of Directors for approval. Further, Petitioner vide its letter dated 21.06.2023 furnished a copy of 114th meeting of Board of Directors vide which BoD accorded its approval on DPR for the proposed investment in the instant Petition.
- 7. On examination of the Petition & DPR certain deficiencies/infirmities were identified and accordingly, the Commission vide its letter No. 414 dated 14.07.2023 directed the Petitioner to submit/furnish its compliance on the following latest by 10.08.2023:-
 - "
 - 1. UJVN Ltd. is required to furnish technical specifications for existing & proposed 220 kV power cables along with drum size of the proposed 220 kV XLPE power cable. Further, UJVN Ltd. is required to submit the Pros & Cons of the existing & proposed cables alongwith its expected life & current carrying capacity as per site ambient conditions.
 - 2. UJVN Ltd. is required to furnish a key SLD of Chibro HEP indicating Generator, Bus duct (if any), GT, power cables, station transformer, auxiliary transformer, breakers, incoming & outgoing feeders at 220 kV and CT/PT details. Preferably a metering & protection SLD be provided for Chibro HEP.
 - 3. UJVN Ltd. is required to furnish GA drawing of cable tray arrangement showing its width/height, dia of cable (in mm), cable to cable gap (in mm) and number of runs per cable tray in existing and proposed scenario's. Further, UJVN Ltd. is required to confirm regarding the suitability of the existing cable tray arrangement for accommodating the proposed 1CX400 sqmm cable runs.
 - 4. UJVN Ltd. is required to submit the colored cross-sectional drawing along with various dimensions (in mm) of existing oil filled cable showing insulation, conductor, oil filled areas, sheath, armoring etc. Further, cross sectional drawing of proposed XLPE cables is also to be furnished covering aforesaid descriptions and details of bending radius.
 - 5. UJVN Ltd. is required to justify why the Aluminum Conductor Cable has not been taken in place of copper alongwith cost benefit analysis for the same substantiating w.r.t.

I²R losses and other techno-commercial reasoning. Moreover, UJVN Ltd. is required to furnish the reason for proposing the 1C X 400 Sqmm size XLPE Armoured Copper Power cable & not the lesser size and also furnish cable sizing calculation sheet in support of its proposal duly considering the relevant parameters of voltage drop, I²R losses, fault current etc.

- 6. UJVN Ltd. is required to confirm regarding existing and proposed protection philosophy for the underground 220 kV oil filled cables along with justification for proposing protection philosophy.
- 7. UJVN Ltd. is required to furnish copy of last oil pressure test done for each run of 220 kV oil filled power cable. Further, UJVN Ltd. is required to confirm whether any test/inspection has been carried out inline with provisions of Regulations 22 (2) e) of UERC (MYT) Regulations, 2021 for substantiating the need for additional capitalization.
- 8. UJVN Ltd. is required to confirm regarding significance of earthing link box with SVL and earthing link box without SVL and also furnish justification for using such arrangement.
- 9. UJVN Ltd. is required to furnish details regarding fire detection and protection system deployed/to be deployed for existing/proposed cables. (viz. LHS cable, if any)
- 10. UJVN Ltd. is required to confirm regarding usage/significance of Piano wire.
- 11. UJVN Ltd. is required to confirm regarding the existing earthing/bonding arrangement in the cable and furnish proposed earthing/bonding arrangement along with reasoning for the same.
- 12. UJVN Ltd. is required to submit the details of faults occurred in the existing Cables post year 2002 i.e. year in which OEM had recommended for the replacement of the oil filled 220 kV Cables.
- 13. UJVN Ltd. is required to submit the details of usage of spare cable during the fault in the main cables since the commissioning of the project.
- 14. UJVN Ltd. is required to submit the reasons for considering the per unit dismantling cost of indoor terminal more than the outdoor terminal. Further, UJVN Ltd. is required to clarify whether the dismantled 220 kV indoor & outdoor terminals would be put in scrap or can be re-used.
- 15. UJVN Ltd. is required to submit unit-wise monthly Peak Load of each GT for last 5 years in MW.
- 16. UJVN Ltd. submitted that the Degasification plant has not been operational for last 25 years which has been installed to centrifuge & top-up the oil in order to maintain the desired oil pressure in the cables. UJVN Ltd. also submitted that the oil pressure in the existing cables is less than the desired pressure of 1.5 2 Kg/Cm2. In this regard, UJVN Ltd. is required to submit the justification that why the Degasification plant has not been repaired in the last 25 years. UJVN Ltd. is required to furnish the refurbishment cost for Degasification plant and the cost of oil required annually for topping up.
- 17. UJVN Ltd. submitted that the tender for "Replacement of 220 kV oil filled cable by new XLPE cable (3850 meters- 07 length of 550 meters long for 02 units with 01 spare) was invited in year 2007 which was cancelled on account of quality & reasonability of rates

received from the bidders. UJVN Ltd. is required to submit the reason for not re-inviting the tender during the last 15 years if the necessity of works were recognized in year 2007. Further, UJVN Ltd. is required to submit the details of generation loss occurred since year 2008 due to fault in oil filled cables of those 02 Units whose bids were invited in year 2007.

- 18. UJVN Ltd. is required to furnish details of year-wise expenditure incurred on the 220 kV oil filled cables at Chibro HEP.
- 19. UJVN Ltd. is required to confirm regarding the 220 kV power cable terminations kits and rationale for using specific connectors at GT and switchyard end.
- 20. UJVN Ltd. is required to confirm whether 220 kV oil filled cables have been/are being used at any of its other power plants.
- 21. UJVN Ltd. is required to furnish the details of expected generation loss in MUs due to execution of the proposed works."
- 8. In compliance to the deficiencies, UJVN Ltd. vide its letter dated 08.08.2023 submitted its point-wise compliance as mentioned below:-

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Clarification to deficiencies raised by Hon'ble UERC on the Petition seeking approval of capital investment for SITC of 220 kV XLPE Armoured Power Cable with all accessories including dismantling of existing oil filled cable at Chibro Power house under section 61 and 86 of the Electricity Act, 2003 read with the relevant regulations and guidelines of the Commission.

S.N.	Deficiencies	Petition of UJVNL
1	UJVN Ltd. is required to furnish technical specifications for existing & proposed 220 kV XLPE power cable along with drum size of the proposed 220 kV XLPE power cable. Further, UJVN Ltd. is required to submit the Pros & Cons of the existing & proposed cables along with its expected life & current carrying capacity as per site ambient conditions.	As per annexure- 1 enclosed.
2	UJVN Ltd. is required to furnish a key SLD of Chibro HEP indicating Generator, Bus duct (if any), GT, power cables, station transformer, auxiliary transformer, breakers, incoming & outgoing feeders at 220 kV and CT/PT details. Preferably a metering & protection SLD be provided for Chibro HEP.	As per annexure- 2 enclosed.
3	UJVN Ltd. is required to furnish GA drawing of cable to cable tray arrangement showing its width/height, dia of cable gap (in mm) and number of runs per cable tray in existing and proposed scenario's. Further, UJVN Ltd. is required to confirm regarding the suitability of the existing	 Drawing as per annexure- 3 enclosed. Details of existing 220 kV OFC cable: 1. Earthing details - single side at switchyard, 2. OD - 95 mm, 3. Conductor size - Single core 150 mm², 4. Weight of OFC Cable - 9.9 kg/meter

	cable tray arrangement of accommodating	5. Center to center distance – 105 mm,
	the proposed 1C X 400 sq mm cable runs.	6. Distance between cables – 10 mm,
		7. Size of existing cable tray - Width – 650
		mm, Height – 65 mm & width 450 mm,
		Height -65 mm.
		Details of new proposed 220 kV Cu
		XLPE cable:
		1. Earthing details – Earthing with SVL at
		switchyard end & earthing without SVL at
		transformer end.
		2. OD - 110 to 115 mm,
		3. Conductor size – Single core 400 mm ²
		<i>4. Weight – 11.5 to 11.75 Kg/m approx.</i>
		5. Center to center distance – 110 -120 mm
		6. Distance between cables – 88 mm
		7. Size of existing cable tray - Width – 650
		mm, Height – 65 mm & width 450 mm,
		Height -65 mm.
		Number of runs of existing & proposed
		Cubic per cubic tray
		≈ 01 no run of cable in tray size $450x65$ mm
		Strengthening of cable racks & trav will be
		done and provision is made in the tender
	UIVN Ltd. is required to submit the	Cross Section drawing of existing OFC cable
	colored cross-sectional drawing along with	& XLPE cable are enclosed as annexure 4 (A
	various dimensions (in mm) of existing oil	& B).
	filled cable showing insulation, conductor,	, ,
4	oil filled areas, sheath, armoring etc.	
	Further, cross sectional drawing of	
	proposed XLPE cables is also to be	
	furnished covering aforesaid descriptions	
	and details of bending radius.	
	UJVN Ltd. is required to justify why the	As per annexure – 5 enclosed.
	Aluminum Conductor Cable has not been	
	taken in place of copper along with cost	
	benefit analysis for the same	
	substantiating w.r.t. 1 ² R losses and other	
	techno-commercial reasoning. Moreover,	
5	agon for proposing the 1C X 400 Sa mm	
	size XI PF Armoured Conner Power cable	
	& not the lesser size and also furnish cable	
	sizing calculation sheet in support of its	
	proposal duly considering the relevant	
	parameters of voltage drop. I^2R losses, fault	
	current etc.	
	UJVN Ltd. is required to confirm	Protection philosophy of entire system
6	regarding existing and proposed	remains similar except oil pressure
	protection philosophy for the underground	differential protection which shall be
	220 kV oil filled cables along with	replaced by differential protection (Current

	justification for proposing protection	based) with provision CTs & differential
	philosophy	protection relays.
	UJVN Ltd. is required to furnish copy of	Pressure gauge are installed on line on each
	last oil pressure test done for each run of	cables. Hourly pressure reading of each
	220 KV oli fillea power cable. Further,	cables is noted in log book.
7	UJVN Lta. is required to confirm whether	As per the record available, no oil pressure
	any test/inspection has been carried out	testing is done since last 25 years.
	(2) a) of LEBC (MVT) Begulations 22	f applies have not how carried out due non
	(2) e) of UERC (NITT) Regulations, 2021 for substantiating the need for additional	of cubies have not been curried out due non availability of sarvice support
	canitalization	uounuonny of service support.
	TIIVN TIIVNI is required to confirm	Sheath poltage limiter (SVI) is a surge
	regarding significance of earthing link box	protective device connected between the
	with SVL and earthing link box without	metallic shield/sheath and ground on
	SVL and also furnish justification for	specially bonded cables to limit shield/sheath
	using such arrangement.	over voltage surges during system
	0	transients. SVL is required only on one side
8		for human safety/ protection.
		The purpose of installing a SVL on one side
		is likely to offer additional protection to cable
		against voltage surges & humans that may
		occur from switchyard side due to feeder,
		lightening, short circuit current on
		switchyard equipment.
	UJVN Ltd. is required to furnish details	Mulsifyre system is provided for fire
	regarding fire detection and protection	protection for the existing cables whereas
	system aeployea/to be aeployea for	alarming system by neat sensing wire
9	existing/proposed cables. (viz. LHS cable,	throughout the whole length is also provided.
	lj ung)	of cable callery
		The same system shall be provided on the
		XLPE cables system.
	UJVN Ltd. is required to confirm	Piano wire is heat sensing wire to detect the
10	regarding usage/significance of Piano	heat at existing cable, racks & trays for
	wire.	alarming prior to any fire.
	UJVN Ltd. is required to confirm	The cables shall be grounded with help of link
	regarding the existing earthing/bonding	boxes to be provided on either side. Each
11	arrangement in the cable and furnish	cable shall be separately grounded as per
	proposed earthing/bonding arrangement	prevailing practice for HV cables.
	along with reasoning for the same.	Lackages have been observed from the not
	of faults occurred in the existing Cables	heads of some terminations. Oil is cleaned
12	nost year 2002 i e year in which OEM had	from time to time
12	recommended for the renlacement of the oil	OEM recommended for replacement of the
	filled 220 kV Cables.	oil filled cables in 2002.
	UJVN Ltd. is required to submit the details	Spare cables were not used in place of main
12	of usage of spare cable during the fault in	cables since the pressure drop in main as well
13	the main cables since the commissioning of	as in spare cables have been observed. Other
	the project.	type of faults did not occur in the cables.
14	UJVN Ltd. is required to submit the	For indoor terminal, special arrangements
	reasons for considering the per unit	needs shall be made for removal taking safety

	dismantling cost of indoor terminal more than the outdoor terminal. Further, UJVN Ltd. is required to clarify whether the dismantled 220 kV indoor & outdoor terminals would be put in scrap or can be re-used.	of equipment into consideration at transformer end as termination is directly mounted above transformer. Both types of existing terminals cannot be re used.
15	<i>UJVN Ltd. is required to submit unit-wise</i> <i>monthly Peak Load of each GT for last 5</i> <i>years in MW.</i>	As per annexure – 6 enclosed.
16	UJVN Ltd. submitted that the Degasification plant has not been operational for last 25 years which has been installed to centrifuge & top-up the oil in order to maintain the desired oil pressure in the cables. UJVN Ltd. also submitted that the oil pressure in the existing cables is less than the desired pressure of 1.5-2 Kg/Cm2. In this regard, UJVN Ltd. is required to submit the justification that why the Degasification plant has not been repaired in the last 25 years. UJVN Ltd. is required to furnish the refurbishment cost for Degasification plant and the cost of oil required annually for topping up.	Repairing of pot head and degasification plant was taken up with OEM under O&M activities of Chibro Power House. M/s Showa Electric Wire and Cable Co Ltd, Japan The OEM was requested for inspection through Tomen Corporation, New Delhi, the liasionary representative in India. After inspection by their engineers on 18.11.1998, M/s Showa Electric Wire and Cable Co Ltd, Japan submitted the offer through M/s Tomen Corporation, New Delhi on 04.03.1999 for repair of 220 KV cable followed by another revised offer on 16.10.2002 for supply of new degasification plant and spares amounting to Rs. 90.00 Lacs. The offer could not be processed within the validity period of the offer. M/s Tomen Corporation, New Delhi was again requested to extend the validity of the submitted offer on 11.09.2002. In response, M/s Tomen Corporation, New Delhi vide their letter dated 18.10.2002 submitted the revised offer with the condition that further life guarantee of the existing 220 kV oil filled cables shall not be accountable to OEM in view of the fact that the manufacturer's warranty had expired long back. Therefore, all other options were explored to repair the degasification plant but could not succeed.
17	UJVN Ltd. submitted that the tender for "Replacement of 220 kV oil filled cable by new XLPE cable (3850 meters-07 length of 550 meters long for 02 units with 01 spare) was invited in year 2007 which was cancelled on account of quality & reasonability of rates received from the bidders. UJVN Ltd. is required to submit the reason for not re-inviting the tender during the last 15 years if the necessity of works were recognized in year 2007. Further, UJVN Ltd. is required to submit the details of generation loss occurred since	UJVN Ltd. has been exploring the possibilities to repair the de-gasification plant and incipient leakage of oil being observed from the termination at the pot head as well as merits and de-merits of replacement with XLPE cables since the last attempt. Ultimately, possibilities to with the existing cables become null. Since, use of XLPE has been proven a reliable solution in due course especially for the underground powerhouse like Chibro which took considerable time to decide in totality keeping each factor in to consideration.

	year 2008 due to fault in oil filled cables of	As such high risk is involved with existing
	those 02 Units whose bids were invited in	OFC cables but any further chance cannot be
	year 2007.	taken up, therefore, UJVN Ltd. is now
		committed to replace the existing cables with
		XLPE to avoid any breakdown resulting in
		generation loss / NAPAF and damages to
		property. No loss has been suffered due to
		these OFC cable as clarified above.
	UJVN Ltd. is required to furnish details of	No expenditure has been incurred in
18	year-wise expenditure incurred on the	maintenance other than monitoring,
	220 kV oil filled cables at Chibro HEP	cleaning and protection.
	UJVN Ltd. is required to confirm	Indoor kit shall be used in inverted portion
	regarding the 220 kV power cable	which is not a standard accessory. Outdoor
10	terminations kits and rationale for using	kit is a standard equipment widely used in
15	specific connectors at GT and switchyard	transmission sector as it is mounted in
	end.	upright position. (Photograph enclosed as
		annexure -7 enclosed)
	UJVN Ltd. is required to confirm whether	UJVN Ltd. confirms that 220 kV oil filled
20	220 kV oil filled cables have been/are being	cables have not been/are not being used in
	used at any of its other power plants.	any of its other power plants.
	UJVN Ltd. is required to furnish the	Expected generation loss shall not be there as
21	details of expected generation loss in MUs	<i>it is proposed to carry out one by one during</i>
	due to execution of the proposed works.	lean season when available discharge will be
		less and units will be available as spare.

9. Further, a discussion was held on 28.08.2023 in the matter in the office of Director (Technical), UERC wherein, the concerned officers of UJVN Ltd. were directed to furnish reply on following points:

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"

- 1. UJVN Ltd. is required to furnish soft copy of the loss calculation sheet for existing OFC cable and proposed XLPE cable in MS-EXCEL format.
- 2. UJVN Ltd. is required to confirm regarding use of earth continuity conductor for the purpose of bonding/earthing of the XLPE cable.
- 3. UJVN Ltd. is required to check and confirm regarding the consideration of losses due to circulating current in the sheath and is also required to recheck the calculation of copper losses.
- 4. UJVN Ltd. is required to confirm whether use of UV rays protection would be used for the XLPE portion which is exposed to sun rays in switchyard area."
- 10. In this regard, UJVN Ltd. vide its letter dated 01.09.2023 submitted that:-

S. N.	Deficiencies	Petition of UJVNL
1	UJVN Ltd. is required to furnish soft copy of the loss calculation sheet for existing OFC cable and proposed XLPE cable in MS-EXCEL format	Desired information is enclosed as annexure-A and soft copy shall be made available.

S. N.	Deficiencies	Petition of UJVNL
2	UJVN Ltd. is required to confirm regarding use of earth continuity conductor for the purpose of bonding/earthing of the XLPE cable	Use of earth cable is not envisaged since it's a small length of single segment without joint. Earthing of sheath is achieved through link box without SVL. Use of earthing cable is more prevalent in longer length of cable having multiple joints. Existing system also does not have earth cable.
3	UJVN Ltd. is required to check and confirm regarding the consideration of losses due to circulating current in the sheath and is also required to recheck the calculation of copper losses	Checked and confirmed in enclosed annexure-A.
4	UJVN Ltd. is required to confirm whether use of UV rays protection would be used for the XLPE portion which is exposed to sun rays in switchyard area	Standard practice shall be adopted using HDPE pipe to protect against UV rays o exposed portion of XLPE cable.

Commission's Observations, Views & Directions:-

- 11. On examination of the Petition and subsequent submissions made by the Petitioner before the Commission, the observation, views and decision of the Commission are mentioned hereunder:-
 - (1) The Petitioner in its Petition has categorically mentioned that "220 kV oil filled cables are in use since commissioning i.e., more than 47 years passed in use. Due to long use and ageing effect, cable insulation has become week. Even at some places upper insulation of cable has been damaged & oil is leaked from cable terminal pot heads". In this regard, the Commission has observed that Chibro Power Plant was commissioned in the year 1975 and since then more than 47 years have elapsed. In fact, a team of officers of the Commission had also visited the site and had observed that the insulation of 220 kV oil filled cables had deteriorated at number of places especially near cable terminations. The Commission is of the view that the technology of oil filled cables is not prevalent as of now and in today's context it is difficult to maintain it besides having several issues of oil leakages and safety over a period of time. The Commission opines that existence of weak elements in the power system pose danger for not only to the reliability

& continuity of the power system but also the same can cause a potential danger/hazard for man & machines in its vicinity.

Therefore, in today's context, it would be prudent to replace existing oil filled cables with trending technology of XLPE cables for which a number of manufacturers and support services are available.

- (2) With regard to the use of 1CX400 sqmm XLPE cable, the Commission has observed that it appeared to be oversized. The Petitioner has attempted to respond to the query of the Commission. In this context, the Commission opines that consideration of safety margins is essential for any system which is planned to operate for longer period of time for ensuring safety & reliability of the system, however, one of the important aspects with detailed engineering is avoidance of oversizing of assets beyond the industry expected safety margins for the same as it has a huge financial impact on the project. Therefore, the Commission is of the view that the Petitioner should make its utmost endeavor for optimizing the cable size.
- (3) With regard to the protection aspects of the 220 kV cable system, the Petitioner has submitted that differential protection shall be provided for the 220 kV XLPE cables. In this context, the Commission opines that the Petitioner should ensure that the protection system proposed by it conforms to CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2010, CEA (Safety requirements for construction, operation and maintenance of electrical plants and electric lines) Regulations, 2011 & CEA (Measures relating to Safety and Electricity Supply) Regulations, 2023 and amendments thereof w.r.t. underground cabling system from the electrical and fire safety point of view.
- (4) With regard to the installation of XLPE cables at Chibro Power Station, the Commission opines that XLPE cables works fine with underground systems however, at places where the XLPE cable are exposed to the UV radiations the insulation of XLPE cables deteriorate exponentially over period of time. In this regard, the Commission has observed that the outer layer of the existing 220 kV oil filled cables is 'PVC Jacket' which is resistant to UV radiations.

Therefore, the Commission directs the Petitioner to provide appropriate arrangements for protecting the XLPE insulation from UV radiation especially near the termination at switchyard end which is a zone exposed to UV radiations.

- (5) With regard to the earthing, bonding and arrangement of cables on cable trays for the proposed 220 XLPE underground cabling system, UJVN Ltd. is required to carefully evaluate the various options available for underground cabling system as per its site conditions in accordance with relevant IS/IEC standards and deploy a suitable solution so that safety, longevity and efficiency of underground cabling system is ensured and maintained.
- (6) With regard to the provisions of Regulations 22 (2) e) of UERC (MYT) Regulations, 2021 for substantiating the need for additional capitalization, the Petitioner has submitted that it has not carried out any test/inspection of degasification plant and oil of cables due to non-availability of service support. In this regard, the Commission opines that oil filled cables are not prevalent in today's context in power plants and the same have been replaced by XLPE cables. Therefore, the availability of necessary service support for maintenance, testing & inspection are not readily available, which remains to be a challenge with oil filled cables.
- 12. Based on the above discussion, the Commission grants in-principle approval for the proposed works. The in-principle approval is being granted subject to the following:
 - The Petitioner should go for the competitive bidding to obtain the most economical prices from the bidders.
 - (2) The Commission may verify/check the proposed works to be executed by the Petitioner at any point of time during/post execution of the works from the perspective of Quality, Optimum utilization of resources, Benefits accrued from the proposed investments etc.
 - (3) The Petitioner should comply to the following CEA Regulations and amendments thereof and should ensure the compliance of relevant standards followed by execution of the Project with due diligence:

- a) Central Electricity Authority (Safety requirements for construction, operation and maintenance of electrical plants and electric lines) Regulations, 2011.
- b) Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2010.
- c) Central Electricity Authority (Measures relating to Safety and Electricity Supply) Regulations, 2023.
- (4) The Petitioner must submit the detailed sanctioned letter from the Financial Institution to the Commission as soon as they get approval from the Financial Institution.
- (5) All the loan conditions as may be laid down by the funding agency in their detailed sanction letter should be strictly complied. However, the Petitioner is directed to explore the possibility of swapping the loan with cheaper debt option if any, available in the market etc.
- (6) The Petitioner shall, within one month of the Order, submit a letter from the State Government or any such documentary evidence in support of its claim for equity funding agreed by the State Government or any other source in respect of the said works.
- (7) On completion of the project, the Petitioner shall submit the completed cost of each of the works alongwith copy of measurement book & as built drawings and financing of the project.
- (8) The cost of the project and servicing on the same shall be allowed in the Annual Fixed Cost of the Petitioner after the assets are capitalized and subject to prudence check of the cost incurred.

Ordered accordingly.

(M.K. Jain) Member (Technical) (D.P. Gairola) Member (Law) /Chairman (I/c)