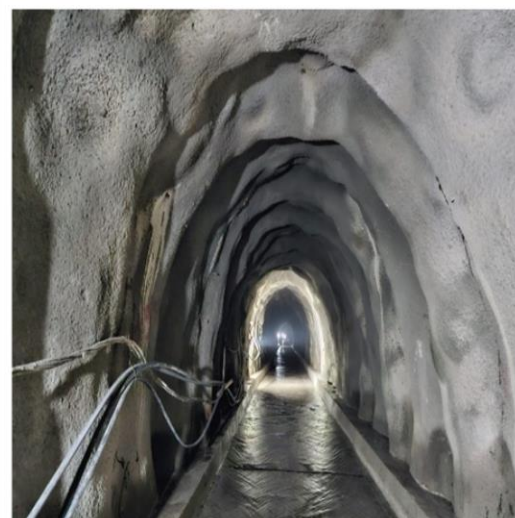


MULTI ENERGY DEVELOPMENT PVT. LTD.
LANGTANG KHOLA HYDROELECTRIC PROJECT
(20 MW)
PROGRESS REPORT



SUBMITTED TO
Department of Electricity Development
Gyaneshwor, Kathmandu

October 2025

MULTI ENERGY DEVELOPMENT PVT. LTD.

Shree Krishna Sadan – 6th Floor, New Baneshwor-10,
Kathmandu, Nepal.

Tel.: +977-1-4781891, 4786030

Email: info.medl@rmgroup.com.np, langtangkhola@gmail.com

Langtang Khola Hydroelectric Project (20 MW)



Progress Report

October 2025

Contact Details:

Head Office:

Shree Krishna Sadan, New Baneshwor-10,
Kathmandu Metropolitan City,
Kathmandu, Province No. 3, Nepal.
Tel.: 01-4781891, 4786030

Site Office:

Gosainkunda Rural Municipality-5,
Syfrubesi
Rasuwa, Bagmati Province, Nepal.
Tel.: 9851204202

Table of Contents

1 CHAPTER – 1	PREAMBLE	1
1.1	Background.....	1
1.2	The Employer.....	1
1.3	The EPC-F Contractor	1
1.4	Civil Contractor	1
1.5	Contractors for Site Infrastructures.....	1
1.6	Key Dates and Milestones.....	2
1.7	Access to the Site	2
2 CHAPTER – 2	TECHNICAL FEATURES OF THE PROJECT	3
2.1	Salient Features of the Project	3
3 CHAPTER – 3	PROGRESS DETAILS.....	9
3.1	Progress Summary	9
3.2	Local Contractors Engaged at Site (Sub-Contractors).....	10
3.3	Contract Status	10
3.4	Major Activity on this month.....	11
3.4.1	Head Works	11
3.4.2	Tunnel Works.....	14
3.4.3	Powerhouse and Switchyard	19
3.4.4	Hydromechanical Works.....	21
3.4.5	Electromechanical Works	23
3.4.6	132 KV Single Circuit Transmission line (From Langtang Khola HEP Powerhouse to Chilime Hub (GIS Substation)).....	27
	Photos of the Damages made due to heavy rainfall and landslide on 28 th September, 2024	32

LIST OF ABBREVIATIONS

BDR	Basic Design Report
B/C	Benefit-to-Cost
CWTW	Chongqing Water Turbine Works Co. Ltd.
DFO	District Forest Office
DoED	Department of Electricity Development
EIA	Environmental Impact Assessment
EPC-F	Engineering Procurement Construction & Financing
FC	Financial Closure
HEP	Hydroelectric Project
IEE	Initial Environmental Examination
IRR	Internal Rate of Return
KV	Kilo Volt
LKHEP	Langtang Khola Hydroelectric Project
MoFE	Ministry of Forest and Environment
MoU	Memorandum of Understanding
MW	Mega Watts
NEA	Nepal Electricity Authority
PH	Power House
PPA	Power Purchase Agreement
RCOD	Required Commercial Operation Date
RoE	Return on Equity
SD10	Survey and Design Institute of Sinohydro Bureau 10
TOR	Term of Reference

1 CHAPTER – 1 PREAMBLE

1.1 Background

Langtang Khola hydroelectric Project (LKHEP) area is located in Gosainkunda Rural Municipality ward no. 5 (Previous Syaphru VDC), Rasuwa District, Bagmati Province, Nepal. The proposed headworks site is decided about 20 m below the confluence of Langtang and Chopche Khola with principal headrace tunnel alignment passing through the left bank and powerhouse being located on the left bank of the Bhotekhosi River. Geographically, the headworks is located at latitude of 28°09'06.55"N and 85°22'7.07"E, whereas the powerhouse is located just downstream of the confluence of Langtang Khola with Bhotekhosi River with latitude as 28°09'49.58"N and Longitude as 85°20'26.86" E.

1.2 The Employer

Multi Energy Development Pvt. Ltd. is the developer of Langtang Hydroelectric Project (20 MW), situated at Rasuwa district. Multi Energy Development Pvt. Ltd. obtained the survey license for the project on 2069/12/09. After, feasibility level investigation was concluded and the Power Purchase Agreement (PPA) was signed with Nepal Electricity Authority (NEA) on 2072/09/29 for 10 MW and on 2074/07/16 for additional 10 MW.

The inhouse technical team of Multi Energy Development Pvt. Ltd. are responsible for detailed engineering and design as well as procurement of works and construction supervision.

1.3 The EPC-F Contractor

The Employer has identified Chongqing Water Turbine Works (CWTW) as the Contractor appropriate party to execute and implement Langtang Khola HEP in an EPC-F modality. LKHEP and CWTW have signed a contract agreement in EPC-F modality on 5th May 2017. The contract has been terminated by the Employer under the clause 15.2 of Condition of Contract due to CIVID-19 pandemic.

1.4 Civil Contractor

After the termination of EPC-F contract with CWTW, the Employer has completed the Civil Construction Contract. The elected Civil contractor is M/S Waiba Infratech Pvt. Ltd.

1.5 Contractors for Site Infrastructures

LKHEP has engaged several local contractors for pre-construction activities such as track opening and slope protection works for Access Road, excavator and tractor hire, stone soling and improvement of Access Road, construction of motorable bridge, etc. Some of the local contractors employed at site are:

- **Bridge Construction**
 - Laligurans/Waiba/Ganapati J/V
- **Road Access and Gabion Works**
 - Shrinkhala Nirman Sewa Pvt. Ltd.
 - Suresh Nirman Sewa
 - Suryakunda Nirman Sewa
 - L.I.K. Engineering Services Pvt. Ltd.
 - Gupche Nirman Sewa
 - Ganapati Nirman sewa

- Talkharka Nirman Sewa
- Rasuwa Construction P. Ltd.
- Construction of Semi-Permanent Camp Facilities
 - Laharepauwa/ Bhotekoshi Nirman Sewa

1.6 Key Dates and Milestones

S/N	Activity	Key Dates
1.	Survey License from DoED for 10MW	2069 Chaitra 9
2.	EIA Report Approval (10 MW)	2072 Chaitra 5
3.	Generation License obtained for 10 MW	2072 Ashwin 19
4.	Registration in Department of Industry for 10MW	2070 Chaitra 17
5.	Power Purchase Agreement (PPA) signed for 10 MW	2072 Poush 29
6.	Theoretical Consent from DoED for 20 MW	2073 Ashwin 5
7.	Financial Closure with Bank Consortium (10 MW)	2073 Mangsir 29
8.	Connection Agreement with NEA (20 MW)	2073 Falgun 20
9.	Power Purchase Agreement (PPA) signed for additional 10 MW	2074 Kartik 16
10.	Contract Agreement signed with CWTW in EPC-F modality	2074 Baisakh 22
11.	S-EIA Report Approval (20 MW)	2074 Chaitra 22
12.	EPC-F Contractor's Site Mobilization	2075 Ashwin 15
13.	Project Completion	2077 Chaitra 31
14.	Required Commercial Operation Date (RCOD)	2076 Chaitra 30 (10 MW) 2078 Shrawan 3 (+10 MW) 2081 Asar 16 (20MW)
15.	Financial Closure with Bank Consortium for additional 10MW	2075 Bhadra 20.
16.	Generation License for Additional 10MW	2075 Aswin 04
17.	Approval Final Basic Design Report	19 th December 2018
18.	Advance Payment Guarantee	5 th May 2019
19.	Contractor Mobilization	12 th August 2019
20.	Survey License for Transmission line	2076 Poush 11
21.	Generation License for Transmission Line	2081 Shrawan 17
22.	Contract Termination with CWTW	14 th January 2021
23.	Re Tender Civil Construction Contract (ITEM Rate Contract)	26 th Feb 2021
24.	Re Tender HM Contract	17 th Feb 2022
25.	EM contract	22 th Feb 2022
26.	Transmission line contract	11 th August 2023

1.7 Access to the Site

There are two principal access to the project area from Kathmandu is

- I. Kathmandu-Galchhi-Bidur-Betrawati-Dhunche-Syaphrubesi-Project site (134 km)
- II. Kathmandu-Kakani-Bidur-Betrawati-Dhunche-Syaphrubesi-Project site (127 km)

2 CHAPTER – 2 TECHNICAL FEATURES OF THE PROJECT

2.1 Salient Features of the Project

General

- Name of Project **Langtang Khola Hydroelectric Project**
- Installed Capacity **20.0 MW**
- Location **Syaphrubesi ward no.5, Rasuwa District**

1	Project Location		
	Development Region		Central Development Region
	Province		Bagmati
	District		Rasuwa
1.1	Intake Site		Syaphrubesi VDC
			Goisaikunda Rural Municipality
1.2	Powerhouse Site		Syaphrubesi VDC
			Goisaikunda Rural Municipality
1.3	Geographical Co-ordinates		
	Latitude		28°09'05'' N to 28°09'45'' N
	Longitude		85°22'15'' E to 85°20'34'' E
2	General		
	Name of River		Langtang Khola
	Nearest Town		Syaphrubesi Bazar
	Type of Scheme		ROR Hydro
	Full Reservoir Level (FRL)		1615.50 masl
	Turbine Center Level		1409.70 masl
	Normal Tailwater Level		1410.67 masl
	Gross Head		204.83 m
	Net Rated Head		195.66 m
	Installed capacity		20 MW
	Average Annual Energy after Outage		119.15 GWh
3	Hydrology		
	Catchment Area		573 sq.km
	Catchment Area at Powerhouse		3554 sq.km
	Design Discharge (at 40% PoE)		12 m ³ /s
	Average Flow		29.24 m ³ /s
	Minimum monthly flow		6.25 m ³ /s

4	Weir		
	Type		WES Overflow Concrete Weir
	Crest Elevation		1615.50 masl
	Length of weir		31.76 m
	Width of weir		21.09 m
	U/S Slope		1V: 2H
	U/S Height		3 m
	U/S Apron Level		1612.50 masl
5	Intake		
	Type		Side Intake
	Intake Gate		6 nos 1.5m x 1.5m
	Invert Level		1612.25 masl
6	Approach Culvert		
	Number		2 nos.
	Length		~59.8 m and ~43.6 m (considering only after expansion joint)
	Size (B x H)		3.4 m x 2.5 m and 3.0 x 2.5 m
	Slope		~1V: 38H and ~1V: 27.7H (considering only after expansion joint)
7	Gravel Trap		
	Type		Hopper, Intermittent flushing
	Length		7.5 m
	Width		13.0 m
	Flushing Gate		Vertical Gate (2 nos. 1.2m x 1.2m)
8	Undersluice		
	Gate Type		Radial Gate
	Width		3 m
	Height		3 m
	Invert Level of Undersluice Gate		1608.00 masl

	Number of openings		2 nos.
9	Settling Basin		
	Type		Hopper, Open surface
	Number of Basins		2 nos.
	Effective Length		70.0 m
	Total width of basin (Internal)		18.0 m
	Width of one compartment		8.5 m
	Height in rectangular section		8 m
	Side slope of compartment		1V: 1.07H
	Flushing System		Intermittent
	Longitudinal slope of Flushing Channel		1:50
	Flushing Culvert (L x H)		1.2 m x 1.2 m
10	Trash Passage		
	No. of Openings		1 no.
	Width		2.0 m
	Height		1.25 m
	Gate type		Vertical Gate
	Invert level of Trash Passage Gate		1614.75 masl
11	Headrace Tunnel		
	Type		Inverted D-shape
	Finish Size (W x H)		3.4 m x 3.5 m
	Start Invert Level		1604.5 masl
	Length		2900 m
	Thickness of concrete lining		0.25 m
12	Surge Tank		
	Type		Underground inclined surge tunnel
	Inner Diameter		4 m
	Effective Depth		36.92 m
	Upsurge Level		1626.75 masl

	Down surge Level	1600.52 masl
13	Adit Tunnel	
	Type	Inverted D-Shape
	Finish Size (W x H)	4 m x 4 m
	No. of Adit Tunnel	1 Nos
	Length of Adit 1	147.00 m
14	Upper Penstock Tunnel	
	Type	D-Shape
	Finish Size (W x H)	3.3 m x 3.3 m
	Length	57.60 m
	Penstock Pipe Diameter	2.0 m
	Slope	1V in 18H
15	Inclined Pressure Shaft	
	Type	Circular
	Finish Size (W x H)	3.3 m
	Length	191.20 m
	Penstock Pipe Diameter	2.0 m
	Slope	50% with horizontal
16	Lower Penstock Tunnel	
	Type	D-Shape
	Finish Size (W x H)	3.6 m x 3.2 m
	Length	174.83 m
	Penstock Pipe Diameter	2.0 m
	Slope	1 in 20
17	Powerhouse	
	Type	Surface
	Size (L x W)	35 m x 11.60 m
	Height	18.60 m
	Turbine Axis Level	1409.70 masl
	Length of Tail pool	25.83 m
	Tailrace Channel Type	Rectangular Box culvert

	Tailrace Channel Length	74.67 m
	Bottom Width	3 m
	Side Slope	Vertical
	Height of the Channel	2.93 m (normal water depth: 2m)
	End Tailrace Invert Level	1409.14 m
	Tailrace Water Level	1410.67 m
18	Turbine	
	Type	Francis, Horizontal
	Number	2
	Rated Output Capacity per Unit	10.356 MW
	Turbine Axis Level	1409.70 masl
	Net Head	195.66 m
	Discharge per Unit	5.75 m ³ /s
	Efficiency	93.9%
19	Governor	
	Type	Electronic with PID control
	Adjustment for Speed Drop	Between 0-5%
20	Generator	
	Type	Synchronous, 3 Phase
	Rated Output Capacity per unit	11,764 kVA
	Power Factor	0.85
	Generation Voltage	11 kV
	Frequency	50 Hz
	No. of Units	2
	Excitation System	Brushless excitation system
	Efficiency	97.5%
21	Transformer	
	Type	Oil immersed, Single Phase, 50 Hz
	Rated Capacity	13 MVA
	Voltage ratio	11/132 kV

	No. of Units	2
	Vector Group	Ynd11
	Frequency	50 Hz
	Efficiency	99%
22	Transmission Line	
	Voltage Level	132 kV single circuit
	Length	4.5 km
	Conductor Type	ACSR Bear
	From	Langtang Khola HPP switchyard
	To	NEA's Chilime Hub

3 CHAPTER – 3 PROGRESS DETAILS

3.1 Progress Summary

S/N	Project Activity	Status/Progress	Remarks
	ACCESS ROAD		
1	Syaphrubesi to Powerhouse Site	<ul style="list-style-type: none"> • 500.0 m (Out of 500.0 m) road construction works – Completed. • Gabion works/Slope protection completed. 	
2	Powerhouse to Headworks site	<ul style="list-style-type: none"> • 3.0 Km (out of 3.0 Km) road construction works – Completed. • Gabion works/Slope protection – Ongoing. 	
3	Adit Portal access road	<ul style="list-style-type: none"> • Completed • Gabion works/Slope protection – Ongoing. • Repair and Maintenance: Ongoing 	
4	PROJECT CAMP	<ul style="list-style-type: none"> • Designing and Planning – Lot 1 Completed • Construction: Completed 	
5	BRIDGE OVER BHOTEKOSHI RIVER	<ul style="list-style-type: none"> • Civil works on Abutments – Completed. • Bailey Bridge superstructure installation – Completed. • River training and protection works at Abutments – Completed. 	
6	ADMINISTRATIVE WORKS	<ul style="list-style-type: none"> • Supplementary EIA - Approved from Ministry of Forest Environment (MOFE) • Power Purchase Agreement Signed for 20 MW • Generation License - Completed • Forest Clearance - 100 % Completed • Land Acquisition – 100 % Completed 	
7	MAIN CONSTRUCTION ACTIVITIES	<ul style="list-style-type: none"> • Site Mobilization of Contractor- 17th March 2021 • Completed the Camping works for contractor. • Construction power electrical pole erection and wire stringing completed. • Connection Approval for Construction power - Completed • MoU with Kalikjung Brigade has been completed to start explosive work at site. • Adit Tunnel excavation – 100% completed • Head Race Tunnel excavation – Breakthrough on 13th August. • Head race tunnel Adit U/S excavation- 1+091.10 chainage completed (100 % completed) • Head race tunnel Adit D/S excavation – 2+896.80 (100 % completed) • Horizontal penstock outlet tunnel excavation- 100% completed • Headworks construction- 98% completed • Underground works- 98% completed • Powerhouse construction- 100% completed • Hydromechanical works- 100% completed • Electromechanical works- 98% completed • Transmission line- 78.24% completed 	

S/N	Project Activity	Status/Progress	Remarks
8	OTHER ACTIVITIES	<ul style="list-style-type: none"> River survey for Physical Hydraulic Modelling - Completed. Hydro Lab has done the Physical Hydraulic Modelling. Final model run for Physical Hydraulic Modelling completed Detailed design works- 100% completed 	

3.2 Local Contractors Engaged at Site (Sub-Contractors)

1.	Excavator hire for access road excavation	Gupche Nirman Sewa Syphru-8, Rasuwa.	Falgun 30,2073	Completed	
2.	Excavator hire for access road excavation	Rasuwa Constuction P. Ltd, Kathamandu	Falgun 2074	Completed	
3.	Excavator hire for access road excavation	Gupche Nirman Sewa Syphru-8, Rasuwa.	Falgun 2074	Completed	
4.	Excavator hire for access road excavation	Talkharka Nirman Sewa Baudha, Kathamandu	Jestha 2075	Completed	
5.	Damage Repair and Rehabilitation of Pasang Lyhmu Highway along the Access Road	Gupche Nirman Sewa Syphru-8, Rasuwa.	Jestha 2075	Completed	
6.	Construction of Semi-Permanent Camp facilities	Laharepauwa/ Bhotekoshi Nirman sewa Rasuwa	18 th Dec 2018	Completed	

3.3 Contract Status

S.N.	Contract Title	Contractor/Consultant	Date of Contract Signing	Status	Remarks
1.	Construction of Motorable Bridge over Bhotekoshi River	D Laligurans/Waiba/Ganapati J/V	July 4, 2017	Completed	
2.	Stone Masonry works for maintenance of access road	Shrinkhala Nriman Sewa Pvt. Ltd. Bidur-4, Battar, Nuwakot.	Ashwin 6, 2074	Completed	
3.	Gabion works for Maintenance of access road	Suresh Nirman Sewa Syphru-5, Rasuwa.	Sep 11, 2017	Completed	
4.	Gabion works for Maintenance of access road	Suryakunda Nirman Sewa Syphru-5, Rasuwa.	July 17, 2017	Completed	
5.	Stone Masonry works for maintenance of access road	L.I.K. Engineering Services Pvt. Ltd. Manmaiju,Kathmandu.	August 17, 2017	Completed	
6.	Excavator hire for access road excavation	Gupche Nirman Sewa Syphru-8, Rasuwa.	Falgun 30,2073	Completed	

S.N.	Contract Title	Contractor/Consultant	Date of Contract Signing	Status	Remarks
7.	Excavator hire for access road excavation	Rasuwa Constuction P. Ltd, Kathamandu	Falgun 2074	Completed	
8.	Excavator hire for access road excavation	Gupche Nirman Sewa Syphru-8, Rasuwa.	Falgun 2074	Completed	
9.	Excavator hire for access road excavation	Talkharka Nirman Sewa Baudha, Kathamandu	Jestha 2075	Completed	
10.	Damage Repair and Rehabilitation of Pasang Lyhmu Highway along the Access Road	Gupche Nirman Sewa Syphru-8, Rasuwa.	Jestha 2075	Completed	
11.	Masonry Wall, manual rock cutting	Ganapti Nirman Sewa, Bidur, Nuwakot		Completed	
12.	Construction of Semi-Permanent Camp Facilities	Laharepauwa/ Bhotekoshi Nirman Sewa		Completed	

3.4 Major Activity on this month

3.4.1 Head Works: -

- All major construction works at the Headworks have been completed, spillway works remaining.
- Backfilling work is on process.

Overall cumulative headworks progress:- 99% Completed.



Figure: Overall view of Headworks site



Figure: Backfilling work at Headworks site





Figure: Headworks, Intake Upstream



Figure: Weir Downstream Section



Figure: Settling Basin

3.4.2 Tunnel Works: -

Headrace Tunnel (HRT):

Contact grouting has been completed up to the rock trap.

Remaining grouting work is from the rock trap to the surge tunnel portal.

Concrete lining at Adit downstream is completed;

Bulkhead: All concrete works on the 2.5 m opening side are completed; top slab concreting on the closing side remains.

Adit plug of upstream branch is remaining

Cleaning: Completed from Adit upstream to Inlet portal; remaining section is Adit downstream to Surge portal.

Circuit Breaker foundation concrete completed.

Bifurcation structure: Concrete completed up to chainage 1433.5 m; last lift and infill concreting from the 3rd unit bifurcation to outlet portal remain.

Overall cumulative progress of tunnel: - 99%



Figure Shotcrete



Figure: HRT



Figure: Adit Right Wing Concreting



Figure: Bulk Head



Figure: Bulk Head Top Slab

3.4.3 Powerhouse and Switchyard: -

- All major works completed.
- All civil works, including sump pit drilling, are 100% completed.
- Auxiliary Transformers foundation concrete completed.

Overall cumulative progress of Powerhouse: - 100%



Figure- Overall View of Power House



Figure: Powerhouse



Figure: Internal View of PowerHouse

3.4.4 Hydromechanical Works: -

All hydromechanical works at the Langtang Khola Hydroelectric Project have been completed. The erection of the bulkhead gate has also been successfully completed. With this, CBM has fulfilled its scope of work except for the remaining railings, shading, and gate commissioning activities. Painting works are currently in progress.

Overall Cumulative Progress of Hydromechanical Works: - 99%





Figure – Bulkhead gate Erection completed.



Figure- Painting Work is being carried out

3.4.5 Electromechanical Works: -

1. 250KVA Diesel generator erection and commissioning completed.
2. Water cooling unit, water supply unit, LOS, and OPU erection and piping works completed.
3. NIFPS Commissioning work completed.
4. Dry test of switchyard ongoing.
5. FAT of 132kV GIS Line Bay for receiving end side.
6. Configuration and testing of HEROS panels for system control and monitoring.
7. Functional and cooling tests of 132 kV equipment, including circuit breakers (CB), current transformers (CT), potential transformers (PT), isolators, and LOS/JOS systems.
8. Dry testing of generators prior to synchronization.
9. Signal verification of the cooling system, hydraulic system, LOS, and MV switchgear panels to ensure proper communication and interlocks.
10. Time adjustment of wicket gate and Main Inlet Valve (MIV) opening and closing operations for smooth system coordination.

Overall Cumulative Progress of Electromechanical works: - 98%



Figure: Switch Gear Panel





Figure: EM equipment installations inside powerhouse

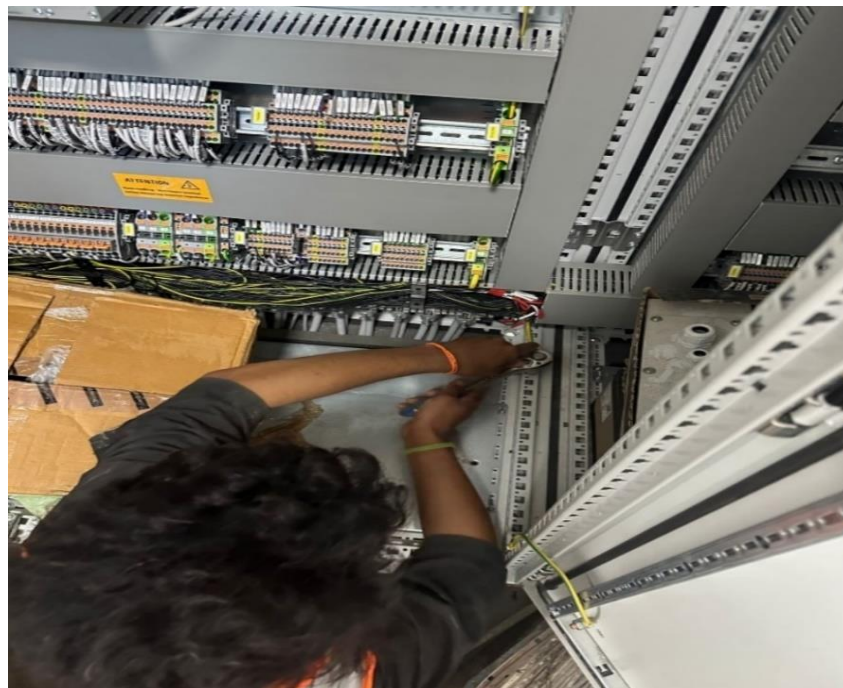


Figure: HEROS panel termination completed



Figure- Dry Test



Figure- Switchyard

3.4.6 132 KV Single Circuit Transmission line (From Langtang Khola HEP Powerhouse to Chilime Hub (GIS Substation)):

- Contract signing of Transmission line works on 11th August 2023 with Royal Construction Company Pvt. Ltd.
- Contract signing on 13th November 2024 for the Procurement, Erection, and Installation Works of Transmission Line Towers, Conductors, Hardwares, Line Materials and all Required Accessories with Continental Trading and Contracting Company Pvt. Ltd.
- Initiated the process to revise the existing MoU with Sanjen Jalavidhyut Company Limited (SJCL) for the temporary power evacuation of LKHEP exclusively through the 11 kV transmission line to Chilime Substation at Syafru, following NEA's technical concerns regarding the Chilime Hub connection.
- Factory Acceptance Test (FAT) of tower body, hardwares, fittings, and insulators.
- Powerhouse L/O link work completed
- Procurement of tower and line materials ongoing.
- Erection of transmission towers for AP-1, AP-7, AP-8, AP-9, AP-10, AP-11, AP-13, AP-14, and AP-16 has been completed.
- Erection of transmission towers for AP-15 is on process.
- Percentage wise progress of Foundation works of Transmission Line Tower Stations
- AP01 – 100%
- AP02- 80%
- AP03- 100%
- AP04 - 100%

- AP05 – 100%
- AP06 - 100%
- AP07 - 100%
- AP08 - 100%
- AP09 - 100%
- AP10 - 100%
- AP11 - 90%
- AP12 - 50%
- AP13 - 100%
- AP14 – 100%
- AP15 – 100%
- AP16 – 100%
- AP17 – 20%

Overall cumulative progress of transmission line works: - 86%



Figure- Foundation work



Figure: Completion of AP1 erection



Figure: Completion of AP10 erection



Figure – Complete Erection of Tower

Photos of the Damages made due to heavy rainfall and landslide on 28th September, 2024



Figure: Damage of Access



Figure: Contractor's Camp Washed Away



Figure: Damage of Transmission Line Network