Salient Features of Rudi Khola- A SHP(8.8MW)

1 Project Details

Project Name	Rudi Khola-A Small Hydropower Project
Development Region	Western Development Region
District	Lamjung and Kaski
Location of Project Site	PasGaun&MijureDanda VDCs
Water Source at Intake	Rudi Khola-B Tailrace Tapping, ChhedwaKhola Collection and Rudi Khola Collection
Type of Scheme	Cascade &RoR
Access Road	Existing Road 28 km (Pokhara to Thumsikot), Earthen Track 8 km (Thumsikot – Mungribesi), New Track 8km(Mugribesi to Powerhouse)+ Project Road 10 km up to headpond
Installed Capacity	8.8MW
Gross head	298.5 m
Rated Design head	276.89m
Design Discharge	3.72 cumecs

2 Hydrology

Water Source	Rudi Khola-B Tailrace, ChhedwaKhola, Rudi
Catchment Area	Total Catchment area 53.43 Km^2 (Rudi-B Intake 35.3km2 + Chhdewa 9.7km2+ Remainng Rudi Collection 8.43km2)
Average Precipitation	4225 mm/year
100 year Design flood @	
Chhdewa Intake	83 m^3/sec
Environmental Release	0.134 m^3/sec
Design Discharge to Plant	3.72 cumec
Q40%	(Rudi-B Tailrace 2.55m3/s+ Chhedewa 0.68m3/s+ Remaining Rudi Collection 0.49 m3/s)

3 Headworks

3.1 Chheduwa Headworks

Diversion structure	Free flow weir with Side Intake
Length of weir	10.0 m
Weir crest elevation	EL 968.8 msl
Height of weir	1.0 m
Under sluice	1 Vertical Sluice gate
Crest of Sluice	EL 962.26 msl
Size of Sluice gates(B × H)	1.5m × 1.32 m
Size of Intake opening	1.5× 1.25, 2 no.
Crest elevation of Intake	EL 968.05msl

3.2 Rudi Collection

Diversion structure	Free flow weir with Side Intake
Length of weir	13.0 m
Weir crest elevation	EL 939.00msl
Height of weir	3.0 m
Under sluice	1 Vertical Sluice gate
Crest of Sluice	EL 936.65msl
Size of Sluice gates(b × h)	2.5 m × 2.0 m

	Size of Intake opening	2.5 × 1.35 x 3nos
	Crest elevation of Intake	EL 938.00msl
4.	**Gravel Trap**	
	4.1 Chhedwa Collection	
	Canal Type	Rectangular RCC Channel
	Dimension (width × height)	4.2m × 4.3- 6.45m
	Bed Slope	1:10
	Length of Gravel Trap	17.25 m
	Particle to settle	> 5 mm
	4.2 Rudi Diversion	
	Canal Type	Rectangular RCC Channel
	Dimension (width × height)	4.6m × 2.45 – 4.05 m
	Bed Slope	1:10
	Length of Gravel Trap	18.95 m
	Particle to settle	> 5 mm
5	**ChhedwaHydrocyclon)**	
	Type	Hydrocyclon (6 cone)
	Dimension (width × height)	7.00 m × 5.00 ×7.5m
	No. of feeding Cone	6 nos
	Feeding duct	7m * 1.0m * 1.5m
	Bypass pipe	0.75 dia circular pipe
	Trap Efficiency	98%
6	**Collection Pipe**	
	6.1 Chhedwa Collection	
	Conveyance Length	457.0 m
	Type	Mild Steel Welded Pipe
	Diameter	0.75 m Internal dia.
	Thickness of Pipe	8 mm
	Supports	S/M Support with Concrete cap
	6.2 Rudi Diversion	
	Conveyance Length	138.45 m
	Type	RCC Rectangular Box Culvert
	Size (B*H)	1.9 m *1.2m
	Thickness of culvert	0.2 m
7.	**Headrace Pipe**	
	Conveyance Length	4935.00 m
	Type	Mild Steel Welded Pipe
	Diameter	1.5 m Internal dia.
	Thickness of Pipe	8 mm
	Supports	S/M Support with Concrete cap
	Number of Anchor Blocks	75 nos.
	Number of Saddle Supports	99 nos.
	Number of Simple Supports	354nos.
	Number of River Crossing	4 No
8	**Surge Tank and Surge Pipe**	
	Type	Circular Mild steel tank
	Size (DiaX Height)	6 m x 8.05m - 1 nos
	Surge pipe Anchor Block	4 nos
	Surge Pipe (2.5 m dia)	95 m

	Surge Pipe (1.5m dia)	25.5 m
	Operating level of ST	924.6 msl
	Static Level of ST	938.5msl
	Upsurge Level of ST	944.4msl
9	**Penstock Pipe**	
	Type	Welded Surface Penstock
	Length	978 m
	Pipe Material	Mild steel confirming to IS 2062-B
	Size of Pipe	1.35 m, 8 - 10 mm and 1.25 m, 12 - 20 mm
	Supports	S/M Support with Concrete cap
	Number of Anchor Blocks	15 nos. (including Y, B, T and those on Surge tanks)
	Number of Saddle Supports	47 nos.
	Number of Simple Supports	34 nos.
10.	**Power house**	
	Type	Surface with outdoor substation
	PH dimension (b × l)	20.5 X 30.5 m
	Height of PH building	14.9 m (uptoroof top Level)
	PH Floor level	EL. 639.31msl
	Turbine Center Level	640.5 m
11.	**Tailrace**	
	Type	Rectangular RCC
	Size (width x height)	2 m X 1.95 m
	Length	84.75 m
	Tailrace canal bed level	EL 636.39 -935.85msl
	Bed Slope	1 in 250
12.	**Turbine**	
	Number of Units	2
	Type of Turbine	Pelton
	Shaft Arrangement	Horizontal
	Rated discharge for each turbine	1.86 m^3/s
	Rated Head	276.89 m
	Rated Output for each unit	4840 kW
	RPM	500
	Rated Efficiency	91%
	Speed Governor	Electro-Hydraulic
	CL of Turbine	EL 640.50 msl
13.	**Generators**	
	No of units	2
	Generator Type	3 ph AC Synchronous
	Excitation	Brushless excitation
	Rated Voltage	6.3 kV
	Power Factor	0.85
	Layout	Horizontal
	Rated Output	5176.5 kVA
	Rated Frequency	50 Hz
	Rated Efficiency	96%
14.	**Power Transformer**	
	Type	Step Up

Capacity	12000 kVA
Quantity	1
Number of Phases	3 ph, 50 Hz
Type of Cooling	ONAN
Voltage Ratio	
Primary (LV Side)	6.3 kV
Secondary (HV Side)	33 kV
Rated Efficiency	99%
Connection /Vector Group	YNd11

15. Station Supply Transformer

Type	Indoor Type
Capacity (Indoor)	200 kVA
Voltage Ratio Indoor	6.3/0. kV
Number of Phases	3 ph, 50 Hz
Type of Cooling	ONAN
Voltage Ratio outdoor	33/0.4 kV
Connection /Vector Group	Dyn11

16. Transmission Line

Transmission line	33kV Single circuit line from Rudi-A PH to MugriSub station.
Transmission Length	3.8 km 33kV line up to Mugri S/S
Interconnection Substation	33 kV substation @ Mugri Substation.
Line Conductor	ACSR, 100 mm^2

17. Power and Energy

Installed Capacity	8.8 MW
Deemed Generation	50.28 GWhr (at PH after 5% Outage and loss)
Total Contract Energy for PPA	46.89 GWhr
Dry Season Salable Energy (four months)	8.82 GWh
Wet Season Salable Energy (eight months)	38.07 GWh

18. Construction Period 2.5 years (April 2016 to October 2018)

19. Financial Indicators

Base Cost of the Project	NRs 1355.062 million (without IDC)
Loan/Equity Ratio	75:25
Loan Interest Rate	11%
Total Cost of Project with Financing	1500.599 million (With Interest During Construction)
IRR	15.2%
B/C Ratio	1.36
RoE	25.3%
Simple Payback Period	5.7 years
Cost per kW (with IDC)	US $ 1648 (1 US $ = NRs. 100)