

Phona HPP



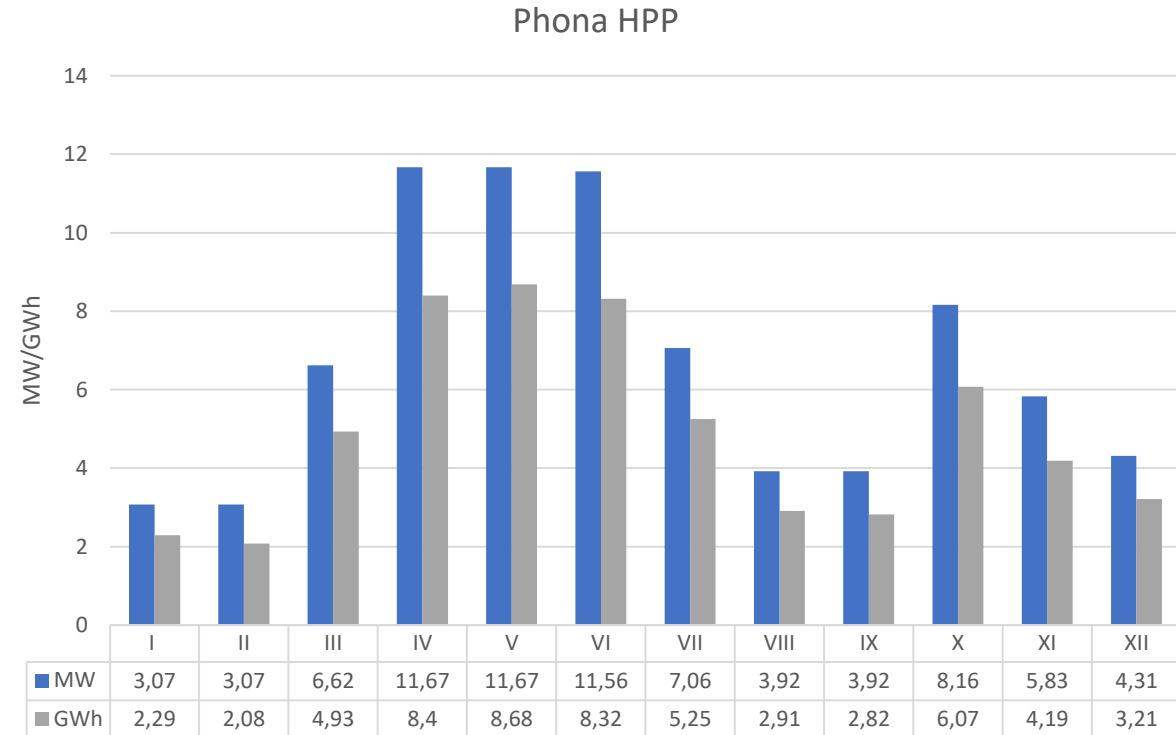
MOU Conditions

- ❑ The initial MOU has been signed between the Government of Georgia and Hereti Energy LLC in January 20, 2017. The MOU extension process is ongoing.
- ❑ Elevations defined in the MOU:
 - Phona HPP on the River Kabali – 505.0-312.0 m.a.s.l.

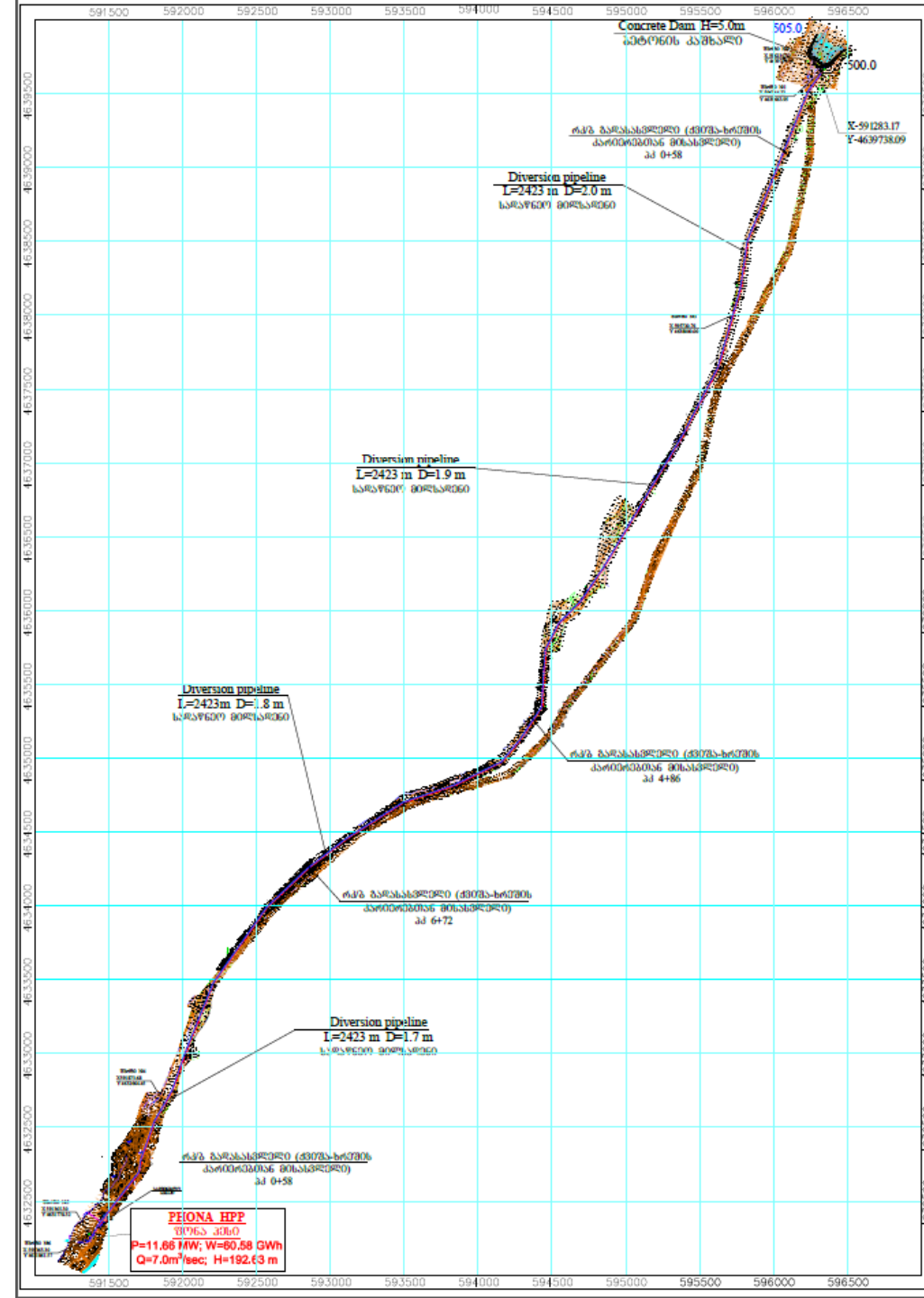
Key Technical Parameters

- Installed Capacity – 11.66 MW
- Average annual generation – 60.58 GWh
- Regulation Type – Run-off-the-river
- Average water discharge – 7.0 m³/sec
- Head - 192.63 m
- Dam Height – 5.0 m
- Diversion Type - Pipeline
- Diversion details – Pipeline – D=1.7m; 1.8m; 1.9m; 2.2m; L=9692.0 (2423; 2423; 2423, 2423) m

Generation at 50% provision



Phona HPP Scheme



Key Technical Parameters

NAME OF THE HPP – PHONA HPP	UNIT	DIMENSION
INSTALLED CAPACITY	11.66	MW
AVERAGE ANNUAL GENERATION	60.58	GW/h
CAPACITY USAGE RATIO	59.29	%
DESIGN WATER DISCHARGE	7	m ³ /sec
MAXIMUM HEAD	209.28	m
MINIMUM HEAD	205.35	m
TRANSMISSION LINE TYPE (220,110,35)	35	kV
TRANSMISSION LINE LENGTH	5	km
HYDROLOGICAL DATA		
WATER CATCHMENT AREA	119.31	km ²
AVERAGE FLOW	5.68	m ³ /sec
FLOOD ONCE IN 10 YEARS (FLOW)	974	m ³ /sec
FLOOD ONCE IN 100 YEARS (FLOW)	285.5	m ³ /sec
FLOOD ONCE IN 1000 YEARS (FLOW)	405.9	m ³ /sec
SEISMICITY		
PEAK GROUND ACCELERATION (5%)	0.3-04	PGA
PEAK GROUND ACCELERATION (2%)	0.4-05	PGA
PEAK GROUND ACCELERATION (1%)	0.5-06	PGA

Key Technical Parameters

RESERVOIR		
NORMAL SUPPLY LEVEL (NSL)	505.00	NSL
SPILLWAY		
TYPE	-	
SPILLWAY CREST ELEVATION	505.00	m.a.s.l
FLOOD (FLOW) 5%	132	m ³ /sec
RESERVOIR ELEVATION IN RELATIONS WITH 5% PROVISION	806.21	m.a.s.l
SPILLWAY LEVEL AT PMF, M.A.S.L.	107.3	m ³ /sec
WATER INTAKE		
CREST ELEVATION	505.00	m.a.s.l
TYPE AND NUMBER OF INTAKE GATES	1	
GATE DIMENSIONS (W X H)	2.4x1.65	m
DE-SANDER DIMENSIONS (W X H)	4.0x5.15	m
SLUICE		
TYPE AND NUMBER	1	
DIMENSIONS (W X H)	4x3	m
HEADRACE PIPELINE		
PIPELINE DIAMETER D	2.0-1.7	m
TOTAL PIPELINE LENGTH	9800	m

Key Technical Parameters

POWERHOUSE		
HPP TYPE	Above-ground	
POWERHOUSE DIMENSIONS	43.0x19.0x16.6	m
AGGREGATE HALL ELEVATION	291.01	m.a.s.l
PENSTOCK CROSS SECTION D=0.54	0.38	m ²
TURBINE AXIS ELEVATION	295.11	m.a.s.l
OUTLET CHANNEL		
CHANNEL DIMENSIONS	2.0x1.6	m ²
LENGTH OF THE CHANNEL FROM DIFFUSER TO THE RIVER	20	m
DIFFUSER GATE DIMENSIONS	2x1.6	m
CREST ELEVATION OF THE OUTLET CHANNEL	293	m.a.s.l
TURBINE/GENERATORS		
TURBINE TYPE	Pelton	

Key Technical Parameters

DESIGN DISCHARGE FOR EACH	3.5	M ³ /SEC
RATED CAPACITY ON THE DESIGN LOAD	5.83	MW
MAXIMUM CAPACITY	5.97	MW
NOMINAL ROTATION NUMBER	1000	R/h
NOMINAL ACTIVE CAPACITY OF THE GENERATOR	5.91	MW
NOMINAL SIMULATED CAPACITY OF THE GENERATOR FOR EACH (COS = 0.85)	6.86	MWA
SYNCHRONIC SPEED	428.6	r/min
TRANSFORMERS		
NUMBER AND TYPE		
MAXIMUM VOLTAGE	6.5/10.5	kV
NOMINAL CAPACITY	3.54	kVA

Phona HPP BoQ & Cost Estimate

#	Structure	Works to be performed	Unit	Quantity	Unit Price, USD	Total Cost, USD
1	Reinforced concrete dam with spillway and stilling basin; Length - 50m. Height 5m.	Earth Works	m ³	2,450.00	\$ 4.00	\$ 9,800.00
		Back fill	m ³	8,500.00	\$ 4.00	\$ 34,000.00
		Concrete and Reinforced Concrete B7.5	m ³	2,285.00	\$ 80.00	\$ 182,800.00
		Concrete and Reinforced Concrete B40	m ³	1,500.00	\$ 170.00	\$ 255,000.00
		Reinforcement	t	151.00	\$ 670.00	\$ 101,170.00
		Metal Structures	t	16.00	\$ 2,500.00	\$ 40,000.00
2	Reinforced concrete water intake, B=4.0m, with racks and lock gates	Earth Works	m ³	120.00	\$ 5.00	\$ 600.00
		Back fill	m ³	120.00	\$ 4.00	\$ 480.00
		Concrete and Reinforced Concrete B22.5	m ³	243.00	\$ 130.00	\$ 31,590.00
		Reinforcement	t	9.70	\$ 670.00	\$ 6,499.00
		Metal Structures	t	10.00	\$ 2,500.00	\$ 25,000.00
3	Horizontal silt basin, B=5.2m, L=40.0m and intake basin (forebay) B=5.2m, H=5.0m, L=3.0m	Earth Works	m ³	420.00	\$ 4.00	\$ 1,680.00
		Back fill	m ³	420.00	\$ 4.00	\$ 1,680.00
		Concrete and Reinforced Concrete B7.5	m ³	360.00	\$ 80.00	\$ 28,800.00
		Reinforcement	t	14.40	\$ 670.00	\$ 9,648.00
		Metal Structures	t	3.00	\$ 2,500.00	\$ 7,500.00
4	Fish way	Earth Works	m ³	50.00	\$ 4.00	\$ 200.00
		Back fill	m ³	-	\$ 4.00	\$ -
		Concrete and Reinforced Concrete B7.5	m ³	20.00	\$ 80.00	\$ 1,600.00
		Reinforcement	t	0.80	\$ 670.00	\$ 536.00

Phona HPP BoQ & Cost Estimate

5	Head Unit: Sluice	Earth Works	m ³	84.00	\$ 4.00	\$ 336.00
		Back fill	m ³	84.00	\$ 4.00	\$ 336.00
		Concrete and Reinforced Concrete B22.5	m ³	172.00	\$ 130.00	\$ 22,360.00
		Reinforcement	t	6.90	\$ 670.00	\$ 4,623.00
		Metal Structures	t	3.00	\$ 2,500.00	\$ 7,500.00
6	Diversion Pipeline, GRP D=2.0-1.7m; L=9692m	Earth Works	m ³	61,740.00	\$ 4.00	\$ 246,960.00
		Back fill	m ³	39,496.00	\$ 4.00	\$ 157,984.00
7	Reinforced Concrete Bridges for crossing the pipeline, 3 pieces	Earth Works	m ³	150.00	\$ 4.00	\$ 600.00
		Back fill	m ³	150.00	\$ 4.00	\$ 600.00
		Concrete and Reinforced Concrete B40	m ³	60.00	\$ 170.00	\$ 10,200.00
		Reinforcement	t	2.40	\$ 670.00	\$ 1,608.00
8	Reinforced Concrete support for diversion pipeline bending sections	Earth Works		200.00	\$ 4.00	\$ 800.00
		Concrete and Reinforced Concrete B40	m ³	5.00	\$ 170.00	\$ 850.00
9	Diversion Pipeline, GRP D=2.0, 1.9, 1.8, 1.7, 1.0m; L=9692m			9,862.00	\$ 295.00	\$ 2,909,290.00
10	Pipeline crossing the motorway with the length of 50.0m, opening width 4.0m, concrete well with locking valve	Concrete and Reinforced Concrete B40	m ³	5.00	\$ 80.00	\$ 400.00
		Reinforcement	t	0.20	\$ 670.00	\$ 134.00
		Metal Structures	t	-	\$ 2,500.00	\$ -
11	Powerhouse, W=43.2m, B=18.9m, H=16.6m	Earth Works	m ³	1,129.00	\$ 4.00	\$ 4,516.00
		Back fill	m ³	600.00	\$ 4.00	\$ 2,400.00
		Concrete and Reinforced Concrete B40	m ³	1,100.00	\$ 170.00	\$ 187,000.00
		Reinforcement	t	44.00	\$ 670.00	\$ 29,480.00
		Metal Structures	t	15.00	\$ 2,500.00	\$ 37,500.00
		E&M	MW	11.66	\$ 350,000.00	\$ 4,081,000.00

Phona HPP BoQ & Cost Estimate

12	Support wall, L=150.0m	Earth Works	m ³	150.00	\$ 4.00	\$ 600.00
		Back fill	m ³	150.00	\$ 4.00	\$ 600.00
		Concrete and Reinforced Concrete B7.5	m ³	300.00	\$ 55.00	\$ 16,500.00
		Reinforcement	t	12.00	\$ 670.00	\$ 8,040.00
		Metal Structures	t	0.80	\$ 2,500.00	\$ 2,000.00
13	Tailrace channel at 293.0m elevation, L=150m	Earth Works	m ³	-	\$ 4.00	\$ -
		Back fill	m ³	-	\$ 4.00	\$ -
		Concrete and Reinforced Concrete B7.5	m ³	130.50	\$ 55.00	\$ 7,177.50
		Reinforcement	t	6.75	\$ 670.00	\$ 4,522.50
		Metal Structures	t	0.75	\$ 2,500.00	\$ 1,875.00
14	Emergency pipeline GRP D=1.0m, L=160.0m, with valve	Earth Works	m ³	360.00	\$ 4.00	\$ 1,440.00
		Back fill	m ³	200.00	\$ 4.00	\$ 800.00
		Concrete and Reinforced Concrete B7.5	m ³	4.80	\$ 55.00	\$ 264.00
		Reinforcement	t	0.20	\$ 670.00	\$ 134.00
		Metal Structures	t	0.80	\$ 2,500.00	\$ 2,000.00
15	Arrangement of New roads	Earth Works	km	1.50	\$ 100,000.00	\$ 150,000.00
16	35 kV transmission Line, 3.8km		km	3.80	\$ 70,000.00	\$ 266,000.00
17	Substation, 35/10 kV		piece	1.00	\$ 60,000.00	\$ 60,000.00
18	Total Construction Cost					\$ 8,967,013.00
19	Contingencies (15%)					\$ 1,345,051.95
20	Design Works, Management and Supervision (7%)					\$ 627,690.91
Total Cost						\$ 10,939,755.86

Phona HPP Financial Analysis

Investment (USD Mln. Excluding VAT)	10.90	
Duration of construction (years)	3	
Annual Generation	GWh	MWh
Capacity	60.6	60,580.0
Financial data in USD "000000"	1,000,000.0	
Currency	USD	
Project year	2018	
Taxes		
Profit tax	15%	
Property tax	1%	
VAT	18%	
Prices USD/kWh		
4 month (Summer price)	0.03	
Average annual Price growth rate	0.000	
8 month (Winter price)	0.06	
Average annual Price growth rate	0.0%	
Carbon credit	0.0399	
Carbon credit price	0.000	
Operating cost site		
Administration and Office other exp	2.50%	
O&M	2.50%	
Salary	3.00%	
Technical losses and own consumption	3.00%	
Sales distribution		
4 month (Summer generation)	43%	
8 month (Winter generation)	57%	
Capital structure		USD "000000"
Total investment	100%	10.90
Debt	70%	7.63
Equity	30%	3.27
Debt		
Amount	9.59	
Interest rate	6%	
Maturity (years)	10	
Discount rate		
Cost of equity	15%	
Cost of debt	6%	
WACC	8.07%	

Phona HPP Financial Analysis

Results

Project NPV	11.90
Equity NPV	3.36
Project IRR	17.5%
Equity IRR	27.3%
Payback (years)	8