TARIFF PETITION

FOR

1.875 MW SHISHI HYDROPOWER PROJECT

Submitted To:

National Electric Power Regulatory Authority

Nepra Tower, Attaturk Avenue (East)
Sector G-5/1, Islamabad

Submitted By:

Pakhtunkhwa Energy Development Organization

Plot 38, Sect B-2,
Phase 5, Hayatabad, Peshawar

Table of Contents

1. PETITIONER PROFILE

1.1 PAKHTUNKHWA ENERGY DEVELOPMENT ORGANIZATION

Khyber Pakhtunkhwa, province of Pakistan is blessed with huge hydropower potential. This potential remained a focus of interest to private investors and international funding agencies. Most of the mega hydel projects of Pakistan including Tarbela, Warsak and Ghazi Barotha hydropower stations are located in Khyber Pakhtunkhwa ("KPK").

Pakhtunkhwa Energy Development Organization ("PEDO"), since its inception in 1986, has been instrumental in identifying and exploiting the hydel potential in KPK. The organization is under the administrative control of the Energy and Power Department, Government of Khyber Pakhtunkhwa ("GoKPK") and is governed by the Board of Members. In 1993, it was converted to an autonomous body under the 1993 Act and renamed as "Sarhad Hydel Development Organization " In 2013, the name of organization was changed to "Pakhtunkhwa Hydel Development Organization" later on, in 2014 was again renamed as "Pakhtunkhwa Energy Development Organization" through passage of Pakhtunkhwa Energy Development Organization Act 2014.

1.2 OBJECTIVES OF PEDO

- Prepare a comprehensive plan for the development of power and energy resources of the province
- Construction, Maintenance, and Operation of powerhouses
- Advisory body for the Government of KPK in power sector matters regarding hydropower development
- Conducting feasibility studies, surveys of power potential sites
- Implementation of Provincial Power Policy to promote private sector investment in generation, transmission, and distribution of power

1.3 PEDO AS DEVELOPER

Some of the major projects by PEDO either constructed or in the process are listed down:

S.No.	Name of Project	Capacity (MW)	Status
1.	Malakand-III HPP	81	Completed
2.	Pehur HPP	18	Completed
3.	Reshun HPP	4.2	Completed
4.	Darral-Khwar HPP	36.6	Completed
5.	Shishi HPP	1.875	Completed
6.	Ranolia HPP	17	Completed
7.	Machai HPP	2.6	Completed
8.	Jabori HPP	10.2	Under-Construction

9.	Karora HPP	11.8	Under-Construction
10.	Koto HPP	40.8	Under-Construction
11.	Lawi HPP	69	Under-Construction
12.	Kalkot -Barikot HPP	47	Under-Construction
13.	Patrak-Sheringal HPP	22	Under-Construction
14.	Balakot	300	Under-Construction
15.	Gorkin-Matiltan HPP	84	Under-Construction

PEDO has carried out feasibility studies of no. of projects and have issued LOIs in the private sector as well.

1.4 AUTHORIZED REPRESENTATIVE

Authorized representative for the purposes of this tariff petition are:

- **Mr. Muhammad Zakir**
  Resident Engineer, Shishi HPP
  Pakhtunkhwa Energy Development Organization
  Plot 38, Sect B-2, Phase-5, Hayatabad, Peshawar
  E-mail: zakirkhan61@yahoo.com

- **Syed Ibrahim Ahmad**
  CEO
  M/S Nasir Absar Consulting (Private) Limited
  Office # 1, Second Floor, VIP Square,
  I-8 Markaz, Islamabad
  Contact No.: +92 51 8732237
  E-mail: ibrahim@nasirabsar.com

- **Sheikh Muhammad Ali**
  Senior Partner
  M/S Rasikh Consilium
  1-C, LDA Apartments, 55 Lawrence Road
  Lahore
  Contact No.: +92 42 36282594
  E-mail: ali@rasikh.pk

2. PROJECT DESCRIPTION

Shishi Hydropower Plant ("the Project"), located at Darosh, Chitral, was executed by PEDO and funded through the Annual Development Program of Government of KPK, Power Department.

The main objective of the Project was to install 3 No.s Hydro-electric turbo generating sets of 625 kW replacing the old generating plant of 300 kW capacity of the same locality to meet the electricity demand of the lower Chitral area. The electricity generated is being provided to the public of Darosh Town as well as other surrounding villages i.e. Ayoun Town, Bumbureth, Rumber, Birir, Chitral Town, Koghuzi, Arandu, Kalas, Shoghore and Garam Chasma.

2.1 BACKGROUND

The project was originally approved by Provincial Development Working Party in a meeting held on 25-04-1996. The implementation of the project was scheduled through the provincial Annual Development Plan in 1996. However, due to financial constraint sufficient allocation/releases could not be made during 1996-97, 1997-98, 1998-99, 1999-2000. Consequently, not only the project was delayed but it resulted in enhanced project cost due to abnormal escalation of market prices and devaluation of Pak Rupee. Due to abnormal escalation of market prices and devaluation of Pak Rupee, the PC-I was revised and approved.

S.No.	Milestone	Date
1.	First PC-I	25-04-1996
2.	Second PC-I	03-01-2003
4.	Approved PC-I	13-10-2005
5.	Start of Construction Work	10-05-2004
6.	Commercial Operation Date	18-12-2009
7.	Generation License	04-09-2013

An agreement was signed on 14-02-2002 effective from 20-12-2001 between Sarhad Hydel Development Organizations ("SHYDO") now PEDO and Peshawar Electric Supply Company ("PESCO or Power Purchaser") for the purchase of power from Reshun Hydel Power Station at 33kV Judilasht Chitral sub-station. The billing rate agreed was Rs. 1.40/kWh on take and pay basis.

Another agreement for swapping of the distribution network of Booni/Drosh between SHYDO and PESCO was signed. The agreement also stated that "*Energy generated at Shishi hydel station will be sold to PESCO as and when required by PESCO @ Rs. 1.40/kWH on the same terms & conditions as agreed on the case of purchase of power from Reshun Powerhouse*".

Through the letter by PESCO dated 17-09-2008 SHYDO has accepted the sale of power @ Rs. 3 per kWh.

Further, through the minutes of the meeting held on 20-02-2010 regarding tariff issues of Shishi, Reshun and Pehur hydropower houses of SHYDO, it was agreed between the parties (PESCO & SHYDO) that *"the purchase of power from Shishi Powerhouse will be made @ Rs. 3.00 kWh under the same agreement presently enforce till the proper tariff if determined by NEPRA"*.

PEDO, on 19-10-2012, submitted the generation license application to NEPRA. The generation license was issued by NEPRA on 04-09-2013 for a period of 26 years from the date of its issuance.

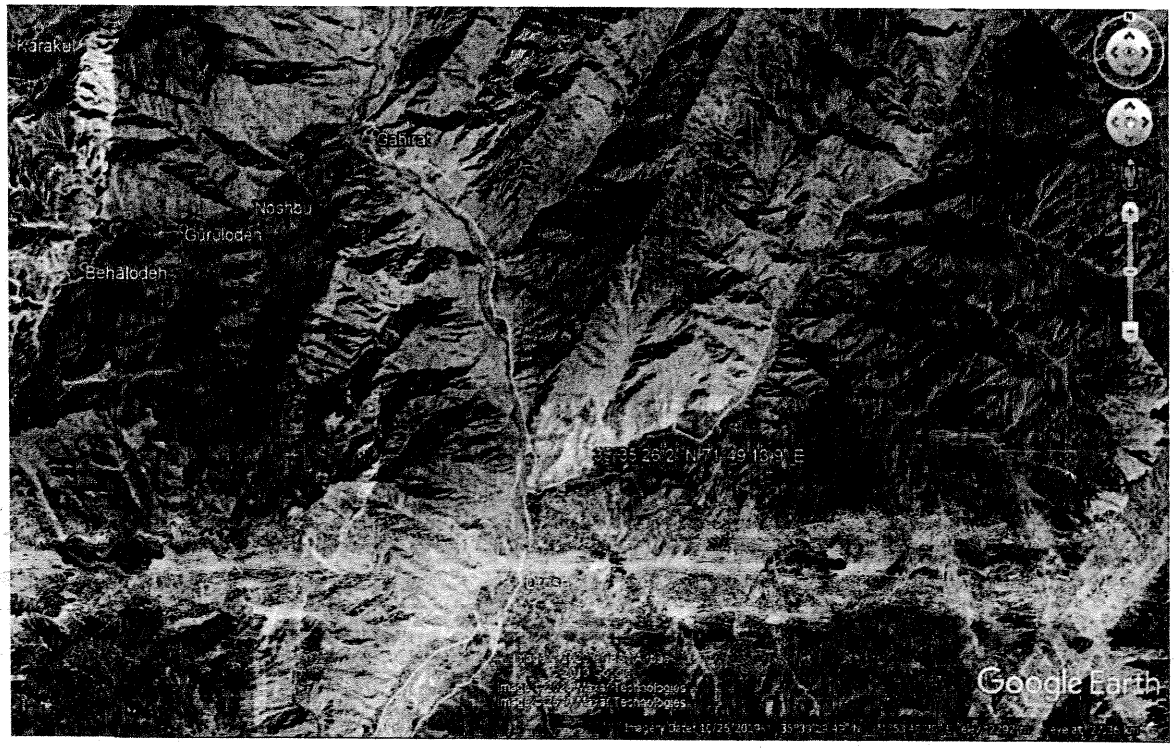
PESCO being the power purchaser is purchasing the electricity since the Commercial Operation Date. Billing is continuously being charged to PESCO, PESCO has been regularly making the payments however since 2017 the arrears are being booked.

2.2 LOCATION

The region Lower Chitral is part of Chitral District which is the northernmost district of Pakistan located between 71°-12' to 73°-15' East and 35°-15' to 36°-55' North in high mountain ranges of Hindukush with deeply cut valleys.

The project area is located in lower Chitral near Darosh town, which is the first major town on main Peshawar to Chitral road just after crossing Lowari top in district Chitral. The Project is located at Shishi river, a left tributary of Chitral river near Darosh town. The area falls under the district administration of Chitral town. The intake is located approx. 100m downstream of the mouth of purit Gol a left tributary of Shishi river.

The powerhouse is located on the right bank of Shishi river approx. 1.2 km upstream of the confluence with Chitral river. The scheme is located at an elevation of 1385masl at the intake and 1300masl at the powerhouse giving a gross head of 85m.



2.3 SALIENT FEATURES OF PROJECT

Salient features of the Project are as follows;

Project Location		
Location		Darosh Town, Chitral, KPK
Name of Stream		On shishi river, left tributary of chitral river near darosh town
Weir	Latitude Longitude	35°35'52.1" N 71°51'15.1" E
Powerhouse	Latitude Longitude	35°35'26.2" N 71°49'13.9" E
Access Route To Site		
Peshawar – Shishi via Swat Expressway and N-45		280km (8h 29 min)
Construction Period		55 Months
Surface Geological Features		Metamorphic rocks consisting of Shales's Slates, Schist's, dolomites, sandstones and quartzites dominated by the intrusion of Tirich Mir Granite
Technical Features		
Design Discharge		3.0 m^3/s
Gross Head		85.6 m
Net Head		84.7 m
Installed Capacity		1.875 MW
Plant Factor		90%
Type of Turbine		Francis Turbines, 600 rpm
No. of Units		3 * 625
Annual Gross Energy Generated based on 90% with 365 days		14.782 GWh
Auxiliary Load		2%
Operational Hours per annum		7884
Annual Net Electrical Output @90% PF		13.038 GWh
Plant Life		30 years
Project Cost		
EPC Cost		PKR 298.374 Million
Non-EPC Cost		PKR 32.346 Million
Total Project Cost		PKR 330.720 Million
Project Financing		
Debt		-
Equity		PKR 330.720 Million
WACC		13.75%

Operations & Maintenance Cost	
O&M per Annum	PKR 20 Million

2.4 PROJECT DESCRIPTION

2.4.1 GENERAL ASPECTS

The scheme is a runoff river hydropower plant which is partly using an existing headrace power channel of the operating small hydropower station of 300 kW. The intake consists of a tyrolean weir as a diversion structure and a gravel spill. A 60m connecting power channel leads to the existing power channel the headrace is a 3805m long rectangular head race power channel including 2805m of improved but existing power channel and it ends in a sandtrap, and connects to the forebay. From forebay, a 225 m long penstock pipe takes water to the powerhouse. The tailwater is discharged through a short channel back into the Shishi river. The main design data of the scheme are:

P = 1875 kW

Q = 3.0 m^3/s

H = 85.6 m

2.4.2 HYDROLOGY

In Shishi river catchment no gauging station is existing from 1987 onwards low flow analysis was carried out using the results derived from the existing small hydel station at shish of 300kW. The only existing gauging station with a long series of records is located in Chitral town.

Due to the fact that this project is using the headrace of the existing power plant (300kW) the design discharge was limited by the structures of this canal e.g. covered portions of canal and aqueducts.

The design discharge for the turbines is 3.0 m^3/s taking improvement of the existing structures under consideration. Considering some irrigation water to be released over the length of the canal the mean annual minimum discharge at the intake is not be less than 3.2 m^3/s.

2.4.3 FLOODS

For the construction of the intake, the flood with a return period of 10 years is considered to estimate the diversion measures. The specific discharge for these floods was fixed to 200l/s km^2, which works out a flood of 130m^3/s considered for dimensioning of diversion and coffer dam.

2.4.4 GEOLOGY

The general geological conditions were derived from literature and were completed by own field inspection results. The Chitral valley is situated in a sequence of metamorphic rocks

consisting of shale's, slates, schists, greenstones, phyllites, marbles, dolomites, sandstones, conglomerates and quartzites dominated by the intrusion of Tirich Mir Granite.

Intake Weir

The new 3m high weir was constructed. Both abutments consist of metashichts forming a narrow valley, the rock was stable and good for the foundation. just above the metaschists the "Red Series" with shales and thinly bedded schists begins, forming unstable slopes. They are being evolved in the structures. On the right slope, however, loose stony overburden creates some rockfall against which the structures (intake, gravel, spill, sandtrap) is protected by concrete roofs inclined towards the river.

Spilling Structure – Sandtrap

The two-chamber sandtrap, the spilling structure and the upper part of the canal are protected against rockfill, some loose, endangered blocks are removed along the right slope.

Canal

Shortly before the round neck of the canal at its end upstream of the existing powerhouse the new canal is cutting through a morphological small saddle in which a 5m ditch is excavated.

Along the new canal centerline, the small existing canal was widened, however, not created difficulties what excavation and slope stability are concerned.

Penstock, Powerhouse & Tailrace

The supported penstock has been fixed points at all bends and also near the thalweg due to the change of angle of the penstock pipe. The powerhouse is situated just upstream of the confluence of shishi river with the Chitral river. The tailrace is 10m long, a spilling structure is constructed from the forebay directly in the side valley.

2.4.5 LAYOUT OF POWER STATION

The Shishi river hydropower plant is designed to produce electricity for the electrification of lower Chitral.

Power output	:	1875 kW
Rated Head (net)	:	84.7m
Design Discharge	:	3.0m^3/s
Annual Gross Energy Generation	:	14.782GWh

Intake:

In general, two types of intakes were proposed. First, the lateral intake is unlimited to the quantity of water to be diverted and second the tyrolean weir which has its limitation in this

respect. Tyrolean weir should be introduced in the river with high bedload therefore the tyrolean weir was selected. The design data is as follow:

Design discharge for bottom rack	3.5 m^3/s
Design flood (100-year return period)	1215 m^3/s
Flood during construction (for the elevation of cofferdam)	130 m^3/s
Inclination of bottom rock	14.4

Weir:

The weir consists of cyclopean concrete with an expansion joint between the overspill and bottom rack section. To avoid cracks during seismic hazards, constructional reinforcement has been applied. The overspill section has a width of 11.6 m while the bottom rack section has 7m.

Bottom Rack:

The trash rack is constructed out of strong material. Big boulders rolling down during floods were considered not to damage the bottom rack. Therefore, protection out of used railway rails is installed at a distance of approx. 50cm over the inclined rack.

The bars of the rack has a clearance of 20mm between the bars, so that gravel with bigger size do not enter the collection main.

There is no service bridge foreseen due to the danger of big boulders coming down. It is, however, expected that the rack easily can be cleaned walking over the downstream part of the bottom rack. In the case of the overflowing collection main, the spilling gate in the flushing bay can be opened until the downstream part of the rack becomes dry. Then the serviceman will be able to remove the stones and wooden pieces which are pinched between the bars.

The rack has been installed in such sections that it can be removed by manpower only.

Flushing Bay:

To clean the area in front of the bottom rack a spilling gate downstream in flow direction is foreseen. During high discharge, the spilling gate can be opened, and the bed load settled in front of this area can be flushed out hydraulically.

Gravel Spill, Connection Canal and Sand trap:

The gravel spill has one compartment only. At the downstream end, a flushing gate is provided to allow a pilling with higher intensity, therefore, the downstream gate is closed during the flushing procedure and the regulation gate at the upstream part of the gravel sill is being opened only for a small discharge.

The gravel spill was constructed out of hammer dressed rubble masonry mainly.

To calibrate the quantity of water in case of more than 3.5 m^3/s are diverted through the bottom rack, an overspill is installed. In case of a flood of 100-year return period water from

the river can enter through the overspill, therefore, the regulation gate at the downstream part of the gravel trap has a limited opening.

Connection Canal:

From the gravel spill approx.132m long canal is built to connect the intake structure with the existing canal. This canal is covered with an inclined R.C.C slab over the whole length to protect the canal against falling stones and high floods.

The canal walls are constructed out of hammer dressed rubble masonry. The foundation is of P.C.C and the top slab out of RCC.

Sand trap:

The sand trap has two chambers to reduce the settling length and to provide flushing facilities by total evacuation of one chamber without interruption of the discharge for the turbines. Therefore, in each chamber, two gates for closing, one downstream and one upstream are being installed. Two flushing gates are covering the two spilling openings. The spilled water is discharged through a pipe back in the riverbed.

The sand trap is constructed mainly out of R.C.C. inside surface is plastered with very fine plaster with a finishing to smoothen the surface.

Power Canal:

Open Canal: the sidewalls of the existing canal have been raised by 50cm where ever the canal is found open, where the slope of the mountain for bids to construct a service path on the hillside in an economical manner, the canal is covered by R.C.C slab. As said, along the open portions a footpath of at least 1.0m width is constructed on the hillside with a level 0.3m below the crest of the canal wall.

Covered Canal: the portions of the existing canal which are covered, remains as they are. Wherever the overburden on the R.C.C. slab is found thin, a refill to a thickness of 0.5m was required. Joints have been sealed by putting an additional slab on top.

The existing openings get proper walls with a height of 1m to save this opening as inspections and maintenance holes.

The covered portions of the canal operate as a pressure canal.

Aqueducts:

Five aqueducts have been improved by raising the side walls by 0.3m and constructing each with 4m cross beam on top of the aqueducts to stiffen the construction. In few cases, the supports are rehabilitated, and additional ones are required. All construction is done in R.C.C.

New Canal:

Some decameters upstream the existing forebay the new canal starts. The new canal with a rectangular cross-section has a width of 1.8m and a depth of 1.6m. the sidewalls of the

canal are constructed out of rubble stone masonry on a foundation on P.C.C. Inside, the canal is plastered to assure water tightness and to smoothen the surface. The length of the new canal is approx. 1200m.

Forebay:

The power canal ends in forebay with the dimensions 6m x 13m. Out of the forebay, the penstock starts with bell mouth. To avoid the entrance of trash, the bell mouth is protected by a trash rack which can be cleaned manually. In case of reduced stopped generation, the surplus water is discharged by an overspill to the spillway. Due to the limited space available, the forebay was constructed out of R.C.C. only.

Spillway:

The spillway is discharging the surplus water of the forebay as well as the flush cleaning water of the canal. Two alternatives to spillway were investigated. Both of them were tendered and the lowest bid was considered.

The first alternative was a concrete construction of an open spillway ending in a stilling basin in a side valley of Shishi Valley, discharging the wastewater back into the river.

The second alternative proposed a steel pipe of dia 0.5m ending in a bell mouth at the stilling basin. The wastewater is discharged in the side valley.

Penstock:

The penstock leading from the forebay ends at the powerhouse in a manifold the total length is 232m. The penstock is designed for $3m^3/s$ at full load and has a diameter of 1.35m. the diameter of the penstock was worked out keeping the following in view. For moderate heads as a guideline, the velocity in the penstock should not exceed 5m/s since else wise.

Powerhouse:

The substructure and superstructure of the powerhouse was designed keeping in view the following as per the preliminary turbine layout.

i. Main operating conditions
ii. Principal dimensions of the turbine and their erection, dismantling and support requirements
iii. The weight and dimensions of the generators
iv. Sizes, weights, and positions of auxiliary equipment
v. Power station crane requirements, loads clearances etc.
vi. The control room, administration, and other accommodation requirements
vii. Foundation characteristics
viii. Loading-bay layout

The size of the powerhouse has been based on the space requirements of three crossflow turbines.

The three generators with the block transformers of 800 kVA each is made to run in parallel through a common bus bar operating at 11 kV. Four 11kV overhead transmission lines are emanating from the common bus bar to transmit energy to:

Drosh	11/33 kV Substation
Drosh	11 kV Distribution System
Lavi	11 kV Distribution System
Shishi	11 kV Distribution System

The 11kV switchboard consists of seven circuit breakers for the generator block transformer and line feeders, and a fuse cut out for the voltage transformer and station supply transformer.

Interconnection:

The Power Generated by the Project is being dispersed to the load center/ring of PESCO by connecting it to 33 KV Drosh grid station of PESCO through 11 KV feeder (measuring about 4 km) on ASCR Rabbit Conductor.

2.4.6 CONSTRUCTION PERIOD

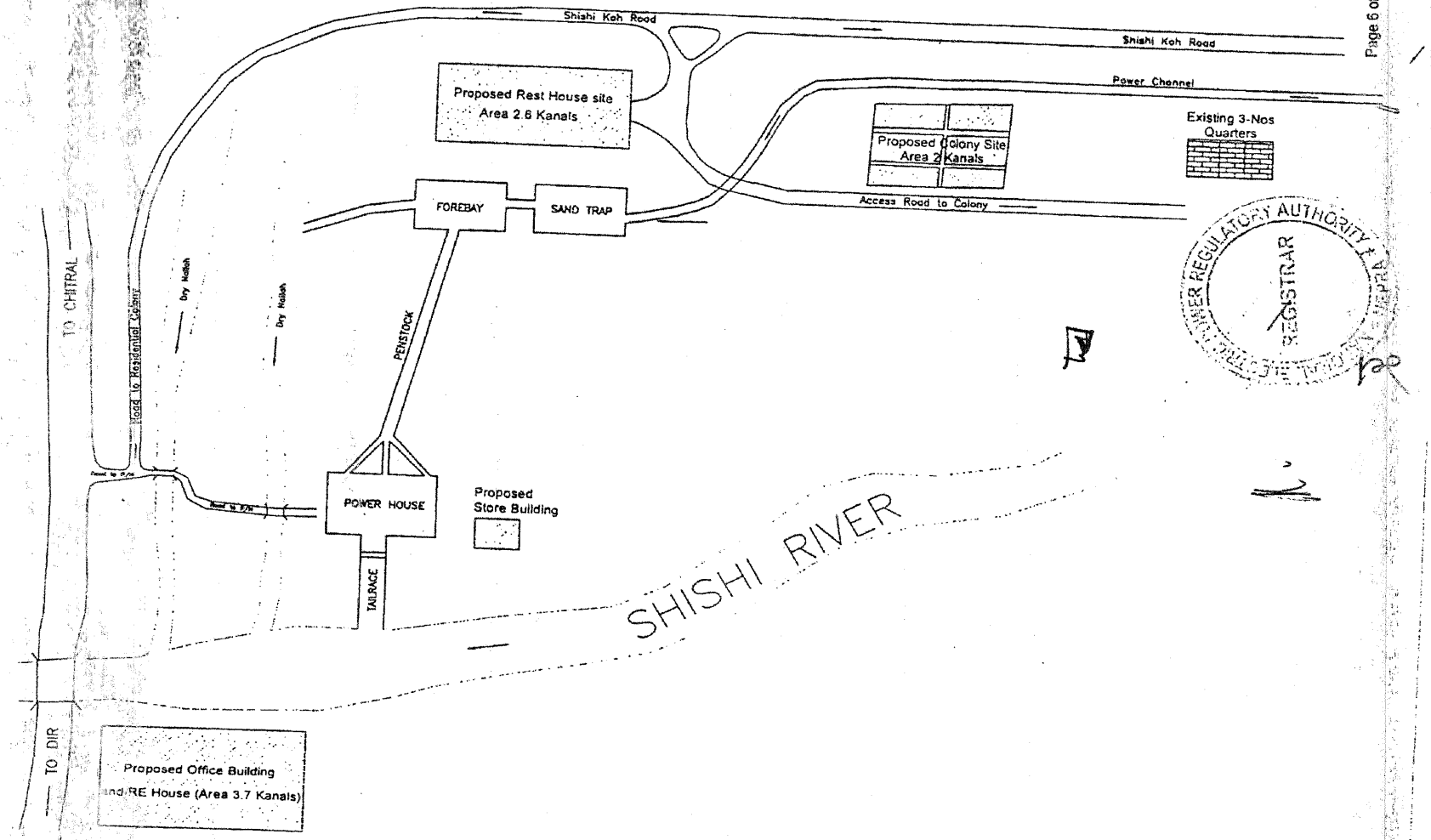
The construction period, at the time of PC-I and Tender documents, was estimated at 48 months, however, the actual construction period was 55 months. The reason for the delay of 7 months is the weather conditions and the delay due to flood.

2.4.7 BENEFITS ASSOCIATED WITH THE PROJECT

The major benefit associated with the Project is the provision of electricity to the nearby villages. Other benefits are discussed below:

- Economical Tariff
- Environmentally Friendly Operations
- Social Up-lift

GENERAL LAYOUT OF SHISHI HPP



3. PROJECT COST

The Project cost is based on actual expenses incurred for civil works, penstock & intake structure gates, electro-mechanical equipment, land acquisition, and owner administration.

A summary of the actual project cost has been presented below;

Table 3-1: Summary of Project Cost

Item	Proposal (PKR Million)
A) EPC Cost:	
Civil Works	182.686
Electro-Mechanical Equipment	115.025
Sub-Total (A)	**297.711**
B) Non-EPC Cost:	
Land Acquisition	6.779
Construction of T&D Line	3.028
Owner Administration	23.202
Sub-Total (B)	**33.009**
Total Project Cost (E+F)	**330.720**

3.1 EPC COST

The EPC cost of the project is divided into civil works and electro-mechanical equipment.

3.1.1 CIVIL WORKS

Total of PKR 182,685,998 have been expensed out under the head of civil works, breakup is provided in Table 3-2: Year-Wise Expenditure for Civil Works. The verified expenditure statement is attached as Annexure.

3.1.2 ELECTRICAL-MECHANICAL EQUIPMENT

An amount of PKR 115,025,060/- have been incurred under this head. The year-wise expenses incurred under the electrical-mechanical head are provided in Table 3-3: Year-Wise Expenditure for Electro-Mechanical Equipment

Table 32: Year-Wise Expenditure for Civil Works (Amount in PKR)

Heads	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Total
Civil Work (Original)	2,922,279	8,275,922	27,009,116	22,635,321	11,526,634	6,625,499	2,769,114	-	81,763,885
Additional Items of Civil Work	-	-	-	889,919	422,526	-	-	-	1,312,445
Improvement / E/Building	-	211,066	738,248	-	-	244,274	-	-	1,193,583
Construction of Road	-	-	-	-	600,114	778,169	340,772	-	1,719,055
Culvert of Dry Nullah	-	-	-	461,509	-	319,858	-	-	781,367
De-Silting of Channel	-	-	-	168,126	81,220	100,145	-	-	349,491
Penstock & Gates	-	-	-	10,638,409	3,742,588	7,786,646	2,554,613	-	24,722,256
Conduit	-	-	-	-	157,410	1,099,211	-	-	1,256,621
Water Supply	-	-	-	-	143,082	-	430,697	-	573,779
Protection Wall	-	-	-	-	-	1,988,312	-	-	1,988,312
Clearance of Material	-	-	-	-	-	-	497,656	-	497,656
Protection Wall Spill way	-	-	-	-	-	-	604,670	-	604,670
Contingency	-	-	38,900	105,323	273,650	346,000	296,000	-	1,059,873
Construction of Office & Residential Building	-	-	-	-	-	-	-	64,863,000	64,863,000
Total	2,922,279	8,486,988	27,786,264	34,898,607	16,947,224	19,288,114	7,493,522	64,863,000	**182,685,998**

Table 33: Year-Wise Expenditure for Electro-Mechanical Equipment (Amount in PKR)

Heads	1998-99	1999-2000	2000-01	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	Total
Electro & Mechanical	-	-	-	-	-	18,984,000	14,238,000	47,460,000	30,305,485	4,037,575	115,025,060
Total	37,850	1,500	9,050	120,994	60,080	18,984,000	14,238,000	47,460,000	30,305,485	4,037,575	**115,025,060**

3.2 NON-EPC COST

3.2.1 LAND ACQUISITION

An amount of PKR 6,778,829/- has been expensed out under the head of land acquisition. A total of 40 kanals has been acquired for the project.

Table 3-4: Land required for Project Component

Component	Area (Kanal)
Civil Structure (Intake, Power Canal, etc)	32
Residential Colony (Engr. Guard, Storage)	4
Site Office	4
Total	**40**

Table 3-5: Year-Wise Expenditure for Land Acquisition

Year	Amount (PKR)
1998-99	1,015,615
2004-05	1,349,745
2005-06	603,490
2006-07	282,625
2007-08	1,515,759
2008-09	958,000
2009-10	1,053,585

3.2.2 CONSTRUCTION OF TRANSMISSION LINE

The cost of constructing the transmission line was PKR 3,028,395.

3.2.3 OWNER ADMINISTRATION

The cost incurred under this head was PKR 23,202,084. The cost is for the period of 12 years and has been expensed out under different heads e.g. payroll, Vehicles, Furniture, Stationery, Rent, Head Office charges, etc. Year-wise break-up is provided in table 3-6:

Table 3-6: Year-Wise Expenditure for Owner Administration (Amount in PKR)

Heads	1996-97	1997-98	1998-99	1999-2000	2000-01	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	Total
Pay & Allo. Head	162,021	365,633	348,435	353,552	28,126	965,551	1,205,028	1,434,961	1,420,413	1,575,808	1,688,601	1,531,750	11,079,879
P/Employee Head	17,244	43,300	53,200	46,400	3,600	157,500	242,500	325,000	164,032	-	28,000	-	1,080,776
Furniture Head	-	-	49,450	-	-	-	-	122,760	17,865	-	-	-	190,075
Rep. Fur Head	-	-	-	-	-	-	850	300	1,700	-	2,250	-	5,100
Machinery Head			37.850		9,050	79,730	45,800	24,800	44,100	191,100	9,320	3,750	445,500
Rep-Mach Head				1,500		41,264	14,280	43,048	19,560	52,915	33,890	11,280	217,737
Vehicles Head	1,663,680	-	-	-	-	-	-	-	-	-	-	-	1,663,680
Rep. Vehicle Head	55,935	38,736	73,599	33,779	42,821	79,757	108,351	77,075	133,691	156,533	97,847	62,680	960,804
Stationery Head	11,608	7,418	88,261	8,461	18,675	35,109	19,644	37,022	22,430	36,741	45,276	28,160	358,805
N/Paper Head	2,036	5,849	5,261	4,191	1,106	8,952	6,046	4,641	7,683	7,771	5,387	2,741	61,664
Pri-Charges Head	-	-	-	-	-	-	-	3,650	9,440	3,890	-	-	16,980
E/Charges Head	-	-	-	-	-	-	860	9,138	8,497	14,908	5,964	14,638	54,005
T/Phone Head	-	-	4,102	1,100	-	23,585	33,211	52,046	40,249	58,448	62,838	36,167	311,746
Rent Office	-	-	-	-	-	-	42,000	84,000	70,000	105,000	84,000	56,000	441,000
Consultancy & Services	-	-	-	-	-	39,500	39,200	-	-	39,000	-	-	117,700
Postage Head	-	-	72	331	-	1,266	337	565	1,428	1,270	649	380	6,298
POL Head	66,993	76,220	82,324	66,611	32,265	128,925	185,820	245,956	278,924	425,760	381,635	148,024	2,119,457
Advert. Charge Head	25,916	-	11,058	-	-	63,940	-	21,574	16,619	49,642	20,597	22,025	231,371
T.A. Head	34,746	58,599	38,125	45,013	16,870	21,760	73,010	96,142	38,270	166,550	172,579	-	761,664
H&C Head	-	-	828	-	-	1,702	1,898	1,012	1,065	1,278	1,422	-	9,205
Medical Head	-	-	1,371	12,108	1,820	31,496	18,198	13,931	37,585	42,829	73,573	30,473	263,384
B/Charges Head	-	-	-	-	-	-	520	-	-	-	1,020	-	1,540
Others Head	21,411	11,476	4,778	5,870	2,375	22,498	6,067	24,444	5,677	16,255	34,145	16,467	171,463
Head Office Charges (1%)												2,632,251	2,632,251
Total	2,061,590	607,231	798,714	578,916	156,078	1,702,535	2,043,620	2,622,065	2339228	2,945,698	2,748,993	4,596,786	**23,202,084**

3.3 FINANCING PLAN

The Project is funded through the Annual Development Plan of Government of Khyber Pakhtunkhwa. All funds were provided to PEDO for the development of the Project. Two PC-1 were approved and funds were released. The details are:

Description	Amount (PKR)
Expenses from funds of first approved PC-1 (13-10-2005) for the construction of Project	265,857,366
Expenses from funds of second approved PC-1 (11-04-2011) for the construction of office & residential buildings	64,863,000
Total Project Capital Cost	**330,720,366**

No amount has been received in the form of debt from any bank and/or any financial institution.

3.3.1 EQUITY

PEDO invested all the amount PKR 330,720,366 in the project received from Provincial Government.

4. TARIFF & COST OF OPERATIONS

The Reference Tariff is composed of the following components:

Reference Tariff = Variable O&M + Fixed O&M + Depreciation Charge + Return on Investment

4.1 OPERATION & MAINTENANCE COST

An average expense of PKR 16.15 million per annum has been spent during the years 2009-2019. The cost included salaries, the salary cost of O&M contractor, security staff, generation license fee, purchase of spare parts, purchase of mechanical equipment, furniture, repair of a vehicle, POL, Flood damages, AM&R, etc. the detail actual statement of O&M expense has been provided in Annexure.

The annual O&M cost for onward years is estimated at PKR 20 Million keeping in view the inflation factor. The cost has been allowed to other hydropower projects of similar nature.

O&M Cost

S.No.	Item Description	1-10 (Years)	11-30 (Years)
1.	O&M (PKR million per annum)	16.15	20
2.	O&M Component (PKR/KWh)	1.233	1.527

4.1.1 FIXED O&M

The Fixed O&M Component is assumed as 50% of O&M cost i.e. PKR 10 million per annum. This cost is translated in terms of KWh as follows:

Fixed O&M Cost

S.No.	Item Description	1-10 (Years)	11-30 (Years)
1.	Fixed O&M (PKR million per annum)	8.08	10
2.	Fixed O&M Component (PKR/KWh)	0.617	0.763

4.1.2 VARIABLE O&M

The variable O&M component is taken at 50% of the total O&M cost i.e. PKR 10 million per annum for the year 11-30. This cost is translated in terms of KWh as follows:

Variable O&M Cost

S.No.	Item Description	1-10 (Years)	11-30 (Years)
1.	Variable O&M (PKR million per annum)	8.08	10
2.	Variable O&M Component (PKR/KWh)	0.617	0.763

4.2 WATER USE CHARGES

The Water Use Charges will be paid to the Government of KPK, if applicable. These charges are not considered in the calculation of tariff however, it shall be allowed as pass-through item.

4.3 DEPRECIATION CHARGE

Depreciation charge is calculated for the life of the project i.e. 30 years with the project cost of PKR 330.720 Million.

Depreciation Charge

Item Description	Amount
Total Capital Cost (PKR Millions)	330.720
Project Life (Years)	30
Depreciation per Annum (PKR Million)	11.024
Depreciation per kWh	0.842

4.4 RETURN ON INVESTMENT

100% of the project cost is injected by PEDO as part of the equity. The return for the project is calculated based on the following guidelines and precedents available for the hydropower:

1. **National Electric Power Regulatory Authority (Benchmarks for Tariff Determination) Guidelines, 2018 dated 19th June 2018**

   "6. Capital Structures:

   (3) For Hydel Projects, Debt: Equity shall be approved in the range of 80:20 to 75:25

   (4) In case of a capital structure with equity exceeding 30% of total capital cost, the Authority shall treat equity in excess of 30% of total capital cost as debt."

2. **Tariff Determination of 2 MW Birmogh Golen Hydro Power Project dated May 21, 2018**

   "The Authority has observed that there is no aspect of debt repayment in this project, therefore allowing a debt servicing component is not justified, however, in such a case tariff can be calculated by including a depreciation charge and a rate of return in capital investment commensurate to that earned by other investments of comparable risks."

   "The Authority considers that normally, for determination of tariff, debt-equity ratio of 80:20 to 70:30 is considered optimal for projects falling under the cover of a Policy. However, for the purpose of calculating the overall cost of capital, the Debt: Equity ratio of 70:30 claimed by the Petitioner is reasonable."

   "Based on the aforementioned, the Authority hereby allows the cost of capital of 9.41% to the Project based on ROE of 17% on 30% assumed Equity, cost of debt of KIBOR+0% on 70% assumed debt."

For the purposes of calculating the Weighted Average Cost of Capital (WACC), debt-equity ratio has been taken at 70:30. The WACC has been calculated by using the cost of equity and the cost of debt. The cost of equity is taken as 17% as allowed to other hydropower projects and the cost of debt is taken as KIBOR + 0%. The KIBOR as of December 2009 was 12.35%.

Weighted Average Cost of Capital

Cost of Equity	17.00%	Amount of Equity (PKR Million)	99.216
Cost of Debt	12.35%	Amount of Debt (PKR Million)	231.504
WACC	**13.75%**	Total Capital	330.720

The Return on Investment is calculated on the balance amount of capital cost after deducting the depreciation charge of the year. The detail calculation is presented below:

Return on Investment (Amount in PKR Million)

Period	Opening Balance	Depreciation	Balance	ROI Per Annum	ROI Per KWh
1	330.72	-	330.72	45.458	3.471
2	330.72	11.024	319.70	43.942	3.355
3	319.70	11.024	308.67	42.427	3.239
4	308.67	11.024	297.65	40.912	3.124
5	297.65	11.024	286.62	39.397	3.008
6	286.62	11.024	275.60	37.881	2.892
7	275.60	11.024	264.58	36.366	2.777
8	264.58	11.024	253.55	34.851	2.661
9	253.55	11.024	242.53	33.336	2.545
10	242.53	11.024	231.50	31.820	2.429
11	231.50	11.024	220.48	30.305	2.314
12	220.48	11.024	209.46	28.790	2.198
13	209.46	11.024	198.43	27.275	2.082
14	198.43	11.024	187.41	25.759	1.967
15	187.41	11.024	176.38	24.244	1.851
16	176.38	11.024	165.36	22.729	1.735
17	165.36	11.024	154.34	21.214	1.620
18	154.34	11.024	143.31	19.698	1.504
19	143.31	11.024	132.29	18.183	1.388
20	132.29	11.024	121.26	16.668	1.273
21	121.26	11.024	110.24	15.153	1.157
22	110.24	11.024	99.22	13.637	1.041
23	99.22	11.024	88.19	12.122	0.926
24	88.19	11.024	77.17	10.607	0.810
25	77.17	11.024	66.14	9.092	0.694
26	66.14	11.024	55.12	7.576	0.578
27	55.12	11.024	44.10	6.061	0.463
28	44.10	11.024	33.07	4.546	0.347
29	33.07	11.024	22.05	3.031	0.231
30	22.05	11.024	11.02	1.515	0.116

4.5 CALCULATION BASIS FOR TARIFF

In addition to the facts and assumptions provided in foregoing paragraphs, the following have been taken into account while calculating the tariff. Changes in any of these assumptions could result in an adjustment to Reference Tariff.

i. This proposal and the resulting Reference Tariff are calculated on the basis of the actual expenses.

ii. Auxiliary load of 2% has been used.

iii. The Tariff has been calculated based on Annual Net Electrical Output of 13.038 GWh.

iv. A construction period of 55 months.

v. The tariff has been discounted at 10%.

vi. The debt-equity ratio is taken as 70:30 for the purposes of calculating the WACC.

vii. The tariff has been calculated for the period of 30 years starting from the COD.

viii. Water Use Charges have been considered as Pass-Through item.

ix. The cost of working capital has not been claimed or included in the project cost.

x. Any tax on the income of the Company from the sales of electricity to Power Purchaser, general sales tax and all other corporate taxes will be treated as pass-through items.

xi. Hydrological risk is to be borne by the Power Producer as already agreed in the agreement with the Power Purchaser.

4.6 REFERENCE TARIFF TABLE

Summary of the Reference Tariff Levelized for 30 years is shown below:

Reference Tariff Table	
Component of Tariff	**Levelized Tariff PKR/KWh**
Variable O&M	0.671
Fixed O&M	0.671
Depreciation Charge	0.846
Return on Investment	2.536
Levelized Tariff	**4.723**

Reference Tariff Table For 1.875 MW Shishi Hydropower Plant

Period	Variable O&M	Fixed O&M	Depreciation Charge	ROI	Total
	Rs./kWh	Rs./kWh	Rs./kWh	Rs./kWh	Rs./kWh
1	0.619	0.619	0.846	3.486	5.571
2	0.619	0.619	0.846	3.370	5.454
3	0.619	0.619	0.846	3.254	5.338
4	0.619	0.619	0.846	3.138	5.222
5	0.619	0.619	0.846	3.022	5.106
6	0.619	0.619	0.846	2.905	4.990
7	0.619	0.619	0.846	2.789	4.873
8	0.619	0.619	0.846	2.673	4.757
9	0.619	0.619	0.846	2.557	4.641
10	0.619	0.619	0.846	2.441	4.525
11	0.767	0.767	0.846	2.324	4.704
12	0.767	0.767	0.846	2.208	4.588
13	0.767	0.767	0.846	2.092	4.471
14	0.767	0.767	0.846	1.976	4.355
15	0.767	0.767	0.846	1.859	4.239
16	0.767	0.767	0.846	1.743	4.123
17	0.767	0.767	0.846	1.627	4.007
18	0.767	0.767	0.846	1.511	3.890
19	0.767	0.767	0.846	1.395	3.774
20	0.767	0.767	0.846	1.278	3.658
21	0.767	0.767	0.846	1.162	3.542
22	0.767	0.767	0.846	1.046	3.425
23	0.767	0.767	0.846	0.930	3.309
24	0.767	0.767	0.846	0.814	3.193
25	0.767	0.767	0.846	0.697	3.077
26	0.767	0.767	0.846	0.581	2.961
27	0.767	0.767	0.846	0.465	2.844
28	0.767	0.767	0.846	0.349	2.728
29	0.767	0.767	0.846	0.232	2.612
30	0.767	0.767	0.846	0.116	2.496
Average	**0.718**	**0.718**	**0.846**	**1.801**	**4.082**
Levelized Tariff	**0.671**	**0.671**	**0.846**	**2.536**	**4.723**

5. INDEXATIONS

The following indexation shall be applicable to the tariff:

Indexation applicable to O&M: The local part of O&M cost will be adjusted on account of inflation (CPI). The foreign component of O&M shall be indexed to the USD exchange rate variation and US CPI. Quarterly Adjustment for local inflation and exchange rate variation will be made on 15th July, 15th October, 15th January & 15th April respectively on the basis of the latest available information with respect to CPI (notified by the Federal Bureau of Statistics).

6. REQUEST SOUGHT

In the circumstances and light of the facts and ground stated above it is respectfully prayed that instant proposal may kindly be accepted with the project cost and the resultant levelized tariff of PKR 4.723/KWh may be determined.

Annexures:

1. Abstract of year wise expenditure for the project
2. Statement of head wise expenditure for the period ended 01-07-1996 to 28-05-2010
3. Year-wise expenditure since operation
4. Agreement with PESCO