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**BEFORE**

**THE NATIONAL ELECTRIC POWER REGULATORY AUTHORITY**

**TARIFF PETITION**

**FOR**

**DETERMINATION OF EPC STAGE GENERATION TARIFF**

**FOR**

**11.80 MW KARORA HYDROPOWER PROJECT**

**NOV 30, 2019**

**PAKHTUNKHWA ENERGY DEVELOPMENT ORGANIZATION**

**(PEDO)**

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## Glossary

<b>BOOT</b>	Build, Own, Operate and Transfer
<b>COD</b>	Commercial Operations Date
<b>CPI</b>	Consumer Price Index
<b>CPP</b>	Capacity Purchase Price
<b>CPPA</b>	Central Power Purchasing Agency
<b>Cusec</b>	Cubic Foot per second
<b>DSRA</b>	Debt Services Reserve Account
<b>EPC</b>	Engineering, Procurement and Construction
<b>EPP</b>	Energy Purchase Price
<b>GOP</b>	Government of Pakistan
<b>GOPb</b>	Government of Punjab
<b>GST</b>	General Sales Tax
<b>GWh</b>	Giga watt hours=1000,000 kWh
<b>IA</b>	Implementation Agreement
<b>IDC</b>	Interest During Construction
<b>IPP</b>	Independent Power Producer
<b>IRR</b>	Internal Rate of Return
<b>ISO</b>	International Organization for Standardization
<b>KHPP</b>	Karora Hydropower Project
<b>KIBOR</b>	Karachi Interbank Offered Rate
<b>Km</b>	Kilometer=1000 meters
<b>kV</b>	Kilovolt =1000 volts
<b>Kva</b>	Kilovolt Ampere
<b>Kw</b>	Kilowatt=1000 watts
<b>kWh</b>	Kilowatt hours
<b>LIBOR</b>	London Interbank Offered Rate
<b>LOI</b>	Letter of Interest
<b>LOS</b>	Letter of Support
<b>LV</b>	Low Voltage
<b>m<sup>3</sup>/s</b>	Cubic meters per second or cumecs
<b>MAF</b>	Million Acre Feet
<b>PESCO</b>	Peshawar Electric Supply Company
<b>MVA</b>	Megavolt Ampere=1000kVA
<b>MW</b>	Megawatt=1000kW
<b>MWh</b>	Megawatt hours=1000kW h
<b>NEPRA</b>	National Electric Power Regulatory Authority
<b>NPV</b>	Net Present Value
<b>NTDC</b>	National Transmission and dispatch Company

O&M	Operation and Maintenance
PKR or Rs.	Pakistani Rupees
POE	Panel of Experts
PPA	Power Purchase Agreement
ROE	Return on Equity
USC or ¢	United States Cent
USD or US\$	United States Dollar

Before the National Electric Power Regulatory Authority

**1. PETITION**

Under Rule 3 of the National Electric Power Regulatory Authority (Tariff Standards and Procedure) Rules, 1998, for determination of tariff for the 11.80 MW Karora Hydropower Project In accordance with the NEPRA (Tariff Standards and Procedure) Rules 1998, read with Mechanism for Determination of Tariff for Hydropower Projects and SRO 763 (1)/2018 dated June 19, 2018 providing benchmarks for determination/approval of the EPC Stage Reference Tariff and its Adjustment/Indexation provisions and other terms and conditions for the Project.

Pakhtunkhwa Energy Development Organization (PEDO)

  
PETITIONER

**2. THE PETITIONER**

The Petitioner is Pakhtunkhwa Energy Development Organization (PEDO) for its 11.80 MW Karora Hydropower Project. Pakhtunkhwa Energy Development Organization (PEDO), since its inception in 1986, has been instrumental in identifying and exploiting hydel potential in Khyber Pakhtunkhwa. The organization is under the administrative control of Energy and Power Department of Provincial Government and is governed by the Board of Directors. PEDO has so far identified a number of promising hydel potential sites of more than 6000 MW capacity, which can be developed in a systematic manner either through Public sector or Private sector.

**2.1 Objectives of the Organization**

- Prepare comprehensive plan for development of the power and energy resources of the province.
- Frame schemes related to Generation, Transmission and Distribution of power, construction, maintenance and operation of powerhouses.
- Advisory body for the Government of KP in power sector matters regarding hydropower development.
- Conducting feasibility studies, surveys of hydel potential sites etc.
- Implementation of Provincial Hydel Power Policy to promote private sector investment in generation, transmission and distribution of power.

**2.2 Role of PEDO**

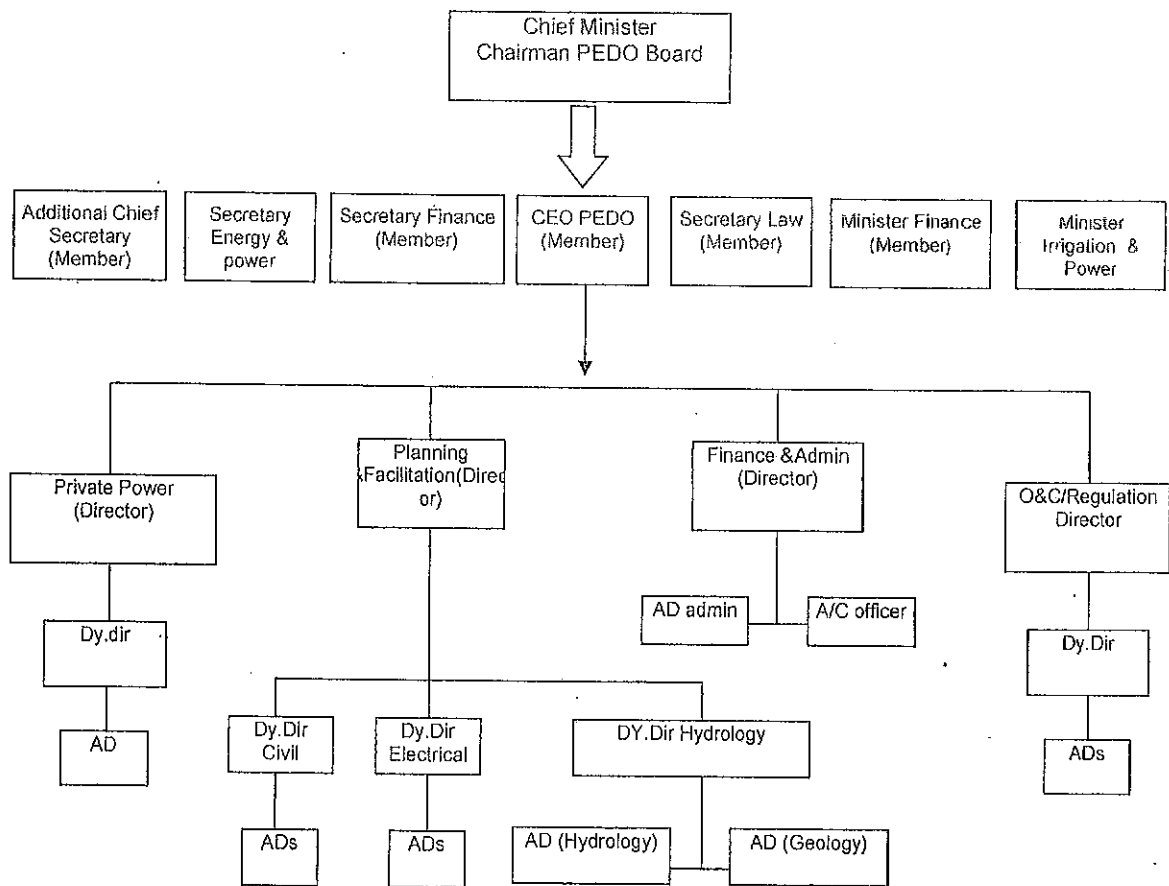
The Provincial Government has entrusted a dynamic role to PEDO, which is mainly



oriented towards private sponsors participation in power sector projects besides developing projects in public sector. PEDO has established a dedicated Directorate to provide one window facility to private sponsors.

### 2.3 PEDO Organization

An eight (8) member Board of Directors under the chairmanship of the Chief Minister of Khyber Pakhtunkhwa governs affairs of PEDO. The members include Minister Energy & Power, Minister Finance, Additional Chief Secretary, Secretary Irrigation & Power, Secretary Finance, Secretary Law and Chief Executive Officer PEDO. The head office of the Organization is at Peshawar.



### 2.4 Achievements by PEDO

PEDO, with the assistance of GTZ (German Agency for Technical Cooperation), has compiled a Master Plan for rural electrification in the Northern mountainous areas of KP with particular emphasis on those areas which were not connected to the National Grid System. The Master Plan entails a total potential of more than 6000 MW that has been identified for public

and private sector development. The hydropower potential sites are mainly located in the Northern districts of K.P i.e. Chitral, Dir, Swat, Indus Kohistan and Mansehra.

### 2.5 Small Hydel Potential Sites

The Master Plan envisages small scale potential sites having total capacity of about 240 MW, comprising 53 hydel potential sites. These sites are suitable for regional supply to isolated communities in the mountainous areas of KP. The district wise breakup of sites is as follows:

Sr. No.	Region	Nos. of Sites	Power Potential (MW)
1	Upper Chitral	12	80
2	Lower Chitral	10	68
3	Kohistan	4	6
4	Swat	5	5
5	Mansehra \ Vest	2	19
6	Kaghan Valley	3	13
7	Dir	17	50
<b>TOTAL:</b>		53	241

### 2.6 Medium /Large Hydropower Systems

During field investigations, some very attractive sites of medium and large hydropower potential were also identified by PEDO.

Sr. No.	Name of Project   Location	Capacity (MW)	Remarks
1.	Kandiah System, Kohistan a. Karang Scheme, 454 MW b. Kaigah Scheme, 548 MW	1002	Private sector is developing these sites under Federal Power Policy
2.	Swat System, Swat a. Upper Scheme AI, 101 MW b. Middle Scheme BI, 410 MW c. Lower Scheme CI, 148 MW	659	-do-
3.	Spat-Gah, Kohistan a. Upper Scheme 200 MW b. Middle Scheme 550 MW c. Lower Scheme 500 MW	1250	WAPDA has undertaken the feasibility study through KfW, Germany
4.	ChorNala System, Kohistan a. Scheme C-II, 700MW b. Scheme C-L 650 M\ V c. Scheme K-II, 150MW	1500	-do-
5.	Kunhar River System, Mansehra a. Naran, 215 MW b. SukiKinar, 840 NW	865	Private sector is developing these sites under Federal Power Policy

## 2.7 Feasibility Studies Completed

Out of the identified sites, PEDO has completed feasibility studies of the following potential sites. These schemes are in various stages of implementation.

Sr. No.	Project / Location	Capacity (MW)	Remarks
1.	Daral Khwar HPP, Swat	36	Under implementation through ADB Loan
2.	Ranolia HPP, Kohistan	17	-do-
3.	Pehur HPP, Swabi	18	Under construction by PEDO
4.	Summar Gah HPP, Kohistan	28	Suitable for private sector
5.	Batal Khwar HPP, Swat	8	Suitable for private sector
6.	Matiltan HPP, Swat	84	Under public sector tendering stage
7.	Khan Khwar HPP, Besham	72	Picked up by WAPDA for implementation
8.	Duber Khwar HPP, Kohistan	130	
9.	Allai Khwar HPP, Batagram	120	

## 2.8 Hydropower Projects Completed

PEDO, after successful completion of following four small and medium size hydel projects with its own resources is planning to launch number of small, medium and large hydropower projects in view urgency for combating energy crises in the country.

### Projects Completed by PEDO

Sr. No.	Name of Scheme	Location	Capacity in MW
i	Malakand-III HPP	Malakand	81
ii	Pehur HPP	Swabi	18
iii	Shishi HPP	Chitral	1.8
iv	Reshun HPP	Chitral	4.2
<b>Total Installed Capacity</b>			<b>105</b>

These projects are not only contributing towards the reduction in load shedding but also generating annual revenue of Rs. 2 to 3 billion for the province.

Besides the above completed Hydropower Projects, PEDO is implementing following projects with the assistance of Asian Development Bank (ADB) for the development of Hydropower Potential in Khyber Pakhtunkhwa Province which will be completed within three years;

## 2.9 Projects under construction:

Sr.No	Name of Scheme	Location	Capacity in MW
i	Daral Khwar HPP	Swat	36.6
ii	Ranolia HPP	Kohistan	17.0
lii	Machai HPP	Mardan	2.60
<b>Total Capacity</b>			<b>56.20</b>

Under the same loan, PEDO has conducted feasibility studies of additional/ following three projects with the total capacity of 62.80 MW. Construction works on these projects is underway and will be completed in the next one to two years.

## 2.10 Projects under construction

Sr.No	Name of Scheme	Location	Capacity in MW
i	Koto HPP	Dir Lower	40.8
ii	Karora New HPP	Shangla	11.8
lii	Jabori HPP	Mansehra	10.2
<b>Total Capacity</b>			<b>62.80</b>

The Honorable Chief Minister has issued special directives for the implantation of hydel projects to address the acute energy crises in the country. In this regard, PEDO prepared an ACTION PLAN which has been approved by the Provincial Government of Khyber Pakhtunkhwa, under which PEDO will construct the following eight (8) Hydel Projects having an installed capacity of 593 MW.

## 2.11 Construction Projects

Sr.No	Name of Scheme	Location	Capacity in MW
1	Matiltan HPP	Swat	84
2	Koto HPP	Dir	40.80
3	Karora HPP	Shangla	11.80
4	Jabori HPP	Mansehra	10.2
5	Lawi HPP	Chitral	69
<b>Total Capacity</b>			<b>215.80</b>

In addition to construction projects PEDO has also completed feasibility study of the following 13 Hydel Power Projects with potential of 1322 MW under the same ACTION PLAN. The PC-IIs for feasibility studies of thirteen projects has been approved by POWP, the selection of consultant is in process and the feasibility study will be completed during the next two to three years. The construction of these projects will be achieved during the period 2011-2021.

## 2.12 Projects under Feasibility Studies

Sr.No	Name of Scheme	Location	Capacity in MW
1	Gahrit-SwirLasht HPP	Chitral	377
2	Jamshail-Toren More HPP	Chitral	260
3	Toren More – Kari HPP	Chitral	350
4	LaspurMarigram HPP	Chitral	230
5	ArkariGol HPP	Chitral	99
6	Istaru-Buni HPP	Chitral	72
7	Mujigram Shogo HPP	Chitral	64.26
8	BarikotPatrak HPP	Dir	47
9	PatrakShringal HPP	Dir	22
10	ShigoKach HPP	Dir	102
11	Ghor Band HPP	Shangla	20.6
12	Nandihar II HPP	Batagram	12.3
13	Naram Dam HPP	Mansehra	188
14	Balakot HPP	Mansehra	300
15	Shushai-Zhendoli HPP	Chitral	144
16	Shogo Sin HPP	Chitral	132
17	Batakundi HPP	Mansehra	99
<b>Total Installed Capacity</b>			<b>2519.16</b>

In order to facilitate the private sector, PEDO has also conducted Pre-Feasibility study of 10 raw sites in various districts of Khyber Pakhtunkhwa province having capacity and these sites have been offered to private sector for development.

## 2.13 PETITION FEE

The applicable fee for the tariff petition payable under NEPRA Rules adjusted for CPI is paid along with this Petition

## 3. Project

### 3.1 PROJECT INTRODUCTION

Karora Hydropower Project will use the water resources of the Khan Khwar River for power generation. It will comprise four main components, viz., Weir, Intake Structure, Power Tunnel, Power channel, Sand trap and Powerhouse. The Weir will be located near Kuz Kana Village on the Khan Khwar River. The Power House and outlet portal of the Power Tunnel will be located at Settlement Mareen, Village Raniel about 9 km downstream of the Weir structure.

River bed elevation is 1005 masl and weir crest elevation is 1020.6 masl, as a result dam height is 8 m. The maximum operating reservoir elevation is 1011 masl. Reservoir capacity (at Elev. 1013) is 22,521 m<sup>3</sup>. Tunnel length is 2,960 m long and power channel length is 430 m. The design hydropower capacity is 9.3 MW. Two bridges were required, one at weir site and other at power house site, plus access roads were established for excess to project construction sites.

### **3.2 Project Objectives**

The project objective is to generate 9.3 MW (enhanced to 11.80 MW) of electricity on a least cost basis to meet the increased energy demand. The main objectives of the Karora Hydropower Project are to assist the government of Pakistan (GoP) in its efforts to:

- 1) Develop domestic energy resources and reduce load-shedding in a cost-effective and environmentally sustainable manner, thereby supporting the country's long-term energy development objectives.
- 2) Reinforce and complement the reform program for the power sector.
- 3) Strengthen the Water and Power Development Authority's (WAPDA) and Sarhad Hydel Development Organization (SHYDO)/PEDO capability to address environmental and resettlement issues related to hydropower projects and
- 4) Further rationalize the use of non-renewable resources.

### **3.3 Environment, Resettlement and Mitigation Measures for Adverse Effects**

The proposed Karora HPP is a run-of-river scheme, about 300m upstream of Kuz Kana village on Khan Khwar River. The proposed Weir site is located near Kuz Kana Village on the Khan Khwar River. The power house is located near village Ranial.

Karora Hydropower Project is located in tectonically and seismically critical zones of convergence between Indo-Pakistani and Eurasian continental plates. More than ninety percent of severe earthquakes of Pakistan and adjoining countries are located within this Orogenic belt.

The lands in the project areas are mainly proprietary and used for cultivation. Before flood it was estimated that the project will use 64,321 kanals of private land, out of which 68.4% of cultivated, 9.3 % forest/grazing, 21.8 % uncultivated/waste and 0.5 % of residential land that is likely to be consumed by the Project. By and large this is the proprietary land. Only 1 house is falling in project area and needs relocation.

After flood, the project is estimated to consume equivalent sum of land as before flood but land use status have been changed from agricultural to waste land. Statistic tells that out of 64,32 kanals, 40 % is agricultural land, forest/grazing land is 3.11% and 34.2% is waste land consumed after flood, which was 44%, 9.33% and 21.8% respectively before flood.

Before flood, about 139 shade trees and 65 fruit trees (204 trees) lie in project area and have to be cut. General Flora of the project area includes Drawa, Deodar, Pine, Poplar, Chir, Bakain, Pear, Persimmon and Walnut.

After flood, numbers of trees have been reduced from 204 to 155 (112 shades trees and 43 fruit trees) because flood washed away numeral of plantation.

Maize and wheat are staple food of locals. Wheat and maize production is about 200 kg and 160 kg/kanal respectively as derived from census survey analysis.

No air quality monitoring data is available for the project area. However, no major sources of air pollution, viz., industries, exist in the project area except for road traffic in the valleys of Khan Khwar River and other nullahs. Due to presence of ample plantation, the quality of air is good. Quality of air along roads is impaired to some extent.

The main surface water resource of the Project area is the Khan Khwar River besides spring water. In general water of the nullah/river and springs are safe for consumption but the potable water would require appropriate treatment, before use for drinking by non-local construction crew.

The socio-economic environment of the project area is a mixture of rich and poor with a low percentage of middle income groups. People are relying for their earning from small agricultural land holdings and/or providing services on daily wages.

Before flood, number of micro hydel generators and water mills exist in between reservoir to power house area; they will face water shortage during low flow season. So, they will be provided with adequate river water to run their micro hydel generators/ water mills.

Now in post – flood condition there is no such diversion or usage exists. But in near future, it will quite possible that local people will rebuild their disrupted structures. So, they will be provided with adequate river water to run their micro hydel generators/ water mills.

It is recommended that the proprietary land should be compensated in cash in accordance with the market rates currently prevailing in the area. The villages of the nearby project will be facilitated with proper drainage and sewerage systems. The project area will be rehabilitated after the completion of project.

Before flood, the total environmental cost comes to about Rs. 14.806 million, when land acquisition is limited to the reservoir retention level of El 1013 m.

After flood, with change in land use status and reduced number of trees total environmental and resettlement cost comes about Rs.13.567 million. But figure 14.776 (say 14.8) million rupees are recommended because land use status can be changed when project being executed.

Arrangement would be made for release of some water from the weir for downstream reach because it might be possible that all micro hydel generators and water mills will be restored.

It is concluded that the project activities at some components will have adverse effects of low-to-medium level at local environment while the overall environmental impact rating is low-adverse, as before flood.

There would be trained staff at the project site for environmental management and monitoring. SHYDO(PEDO) as the Implementing Agency will develop its internal capacity to implement and monitor the measures in the environmental management and monitoring plan by hiring two consultants one as supervisory consultant (Environmental and Resettlement Specialist) another part - time consultant for external monitoring.

### **3.4 EXECUTING AND FINANCING AGENCIES**

Executing Agency (EA) for implementation of the Project is Pakhtunkhwa Energy Development Organization (PEDO) of KP Province headed by Chief Executive Officer, PEDO. The Authorized Representative of EA is the Project Director, Karora Hydropower Project (PEDO), assisted by the MC.

The project is being financed by the Government of Khyber Pakhtunkhwa from its own resources. 80% of project cost is being funded by HDF (Hydel Development Fund, KPK Provincial Government). And 20% ADP (Annual Development Program, KPK Provincial Government).



### 3.5 *Project Implementation Arrangements*

Executing Agency : **Pakhtunkhwa Energy Development Organization (PEDO)**

Consultants : A Consortium of:  
**PAKISTAN ENGINEERING SERVICES (PVT.) LTD. &  
DEVELOPMENT & MANAGEMENT CONSULTANTS**

in association with:

**Nippon Koei Co. Ltd., Japan**

### 3.6 *SALIENT FEATURES*

Following are the key parameters of the Project.

<b>Location</b>	Karora (District Shangla), Khyber Pakhtunkhwa, Pakistan
UTM Co-ordinates	43 S, Easting = 3177700.00 m Northing = 1191566.00 m
River	Khan Khwar
Type	Run-of-River
Purpose of Project	Supply electricity to National Grid
<b>Hydrology</b>	
Catchment Area	235 km <sup>2</sup>
Normal Reservoir Level	1013.00 masl
Design discharge for Power	9.75 m <sup>3</sup> /s
Selected design flood for Weir	1000 years frequency
Flood Discharge (Q <sub>100</sub> )	826 m <sup>3</sup> /s
Flood Discharge (Q <sub>1000</sub> )	1196 m <sup>3</sup> /sec
<b>Diversion Weir / Dam</b>	
Type	Ogee Type
Crest level	1019.50 masl
Crest of flow section	1013.00 masl
Length of Weir	58.0 m
Design Flood	1000 years frequency
Flood discharge	1196 m <sup>3</sup> /s
Surcharge due to design Flood	5.09 m
Total Height of Weir	13.5 m above river bed

Stilling Basin	USBR Type I
Size of Basin	47.8 x 19.0 m
Intake gate size	Vertical lift gate 3.35 x 2.23 m
Embedded Channel design	25% extra over discharge (8.00 m <sup>3</sup> /s)
Size of embedded Channel	3.2 x 2.1 m
Water level in embedded channel El:	1012.58 masl
<b>Connecting Channel (BOX Section)</b>	
Design discharge	11.70 m <sup>3</sup> /s
Invert Level	El: 1010.90 masl
Water level at start	El: 1012.70 masl
Bed Width	3.2 m
Flow depth	1.8 m
Side slope	Vertical
Bed slope	1.0 in 500 m
Free board	0.3 m
Flow velocity in channel	2.37 m / sec
Total Length	400 m
<b>Sand Trap (Two Chambers)</b>	
Limit particle size	0.2 mm
Average velocity in chamber	0.2 m/ s
Length of chamber	75.0 m
Length of U/S transition	8.0 m
Length of D/S transition	10.5 m
Free board	0.6 m
Size of chamber at start	B = 5.5 m, D = 8.1 m
Size of chamber at end	B = 5.5 m, D = 10.25 m
Inlet gates	Two lift gate with hoisting (2.1m x 2.4m)
Outlet gates	Two lift gate with hoisting (2.3m x 4.2)
<b>Flushing arrangement</b>	Two rectangular gates (0.8m x 0.8m)
Flushing discharge	2.34 m <sup>3</sup> /s i.e., 25% of design discharge
<b>Spillway Section</b>	Overflow type
Crest level of spill section	EL: 1013.0 masl
Length of spill section	12.0 m
Surcharge due to design flood	5.09 m
Head losses in Sand trap	0.002 m

### Headrace Channel (Rectangular Section)

Design discharge	9.75 m <sup>3</sup> / s
Invert Level	El: 1004.50 masl
Water level at start	El: 1012.106 masl
Size of Channel	3.2 x 2.1 m
Bed slope	1.0 in 1000 m
Free board	0.3 m
Flow velocity in channel	1.45 m / sec
Total Length	100 m

### Aqueduct

Design discharge	9.75 m <sup>3</sup> /s
Dimensions of turf	3.2 x 2.1 (B x D)
Free board	0.30 m
Bed Slope	1.0 in 1000 m

### Intake Portal

Invert elevation at start	EL: 1004.50 masl
Invert elevation at Tunnel inlet	EL: 1004.50 masl
Water level at intake	EL: 1012.106 masl
Freeboard	0.60 m
Min: submerged provided	3.25 m

<b>Spillway section</b>	Ogee, Overflow sharp crested at EL: 1013.0 masl
Length of spillway section	28.45 m
Surcharge due to design discharge	0.34 m

### Power Tunnel

Type	Inverted U-Shape
Height and Width	2.50 m and 2.30 m
Invert elevation of tunnel at U/S	EL: 1004.525 masl
U/S Water level at design discharge	EL: 1010.90 masl
Flow area	5.536 m <sup>2</sup>
Bed slope	1.0 in 240 m
Average flow velocity	1.77 m / s
Equivalent diameter of Tunnel	2.65 m
Length of Tunnel	2976 m
Bed level at Surge tank	EL: 991.690 masl
Total loss in Tunnel	3.33 m

### Surge Tank

Type	Simple Surge tank
Maximum surge level	EL: 1022.7 masl
Minimum surge level	EL: 996.9 masl
Diameter of surge tank	5.5 m
Height of surge tank	33.0 m

### Penstock

Material	Alloy Steel (ASTM A516 Gr.70)
Invert level	EL: 992.5 masl
Total length	362 m
Diameter (Main / Branch)	1.8/1.275 m
Thickness	12 ~16 mm
Manifold Thickness	22 mm
Average velocity	3.83 m/s
Gross Head	151 m
Head losses	3.9 m
Invert level at Powerhouse	EL: 859.7 masl

### Power Facilities

Powerhouse	Surface Powerhouse
Size of Powerhouse	38 x 14 m
Turbine type	Horizontal Francis
Units	Two
Turbine Design Discharge	4.875 m <sup>3</sup> / s
Turbine Capacity	6.36 MW
Generator Capacity	6.14 MW
Gross Head	151 m
Net Head	142.00 m
Net Head losses	9 m
Installed Capacity	11.8 MW
Average annual energy	71.39 GWh
Plant Factor	69.06 %

### Tailrace Channel

Type	Rectangular Concrete channel
Dimensions	3.0 x 2.5 m
Average velocity	1.74 m / s
Length of Channel	20.0 m
Freeboard	0.30 m

### **Switchyard**

Size of Switchyard area 56m x 42.5 m

### **Transmission Line**

Transmission Line 10 Km Double Circuit 132 KV transmission line running on Twin Bundle Rail Conductor from Karora power plant to Besham Qila connecting Karora power plant with National grid as per NTDC recommendations

### **Employer's Colony**

Overall Area 7651 m<sup>2</sup>(including roads and parks)

#### **Access Roads**

Permanent Access to Power house & Switchyard L= 350m(Approx.), Total Width=5.0m, Roadway Width= 3.70m

Temporary Access to Tunnel Outlet & Surge Tank L= 1425m (Approx.), Total Width=5m Roadway Width= 3.70m

Access Bridge to Power house & Switchyard L= 81m, Total Width=5m, Clear Width=3.7m, Spans=3x27m, Piles= 20 No 25m long and 760mm diameter.

#### 4. Project Funding and Cost Estimates

Financial analysis of the project has been carried out on the following basis:

- Total cost of the project is estimated to be USD 48.528 Million including allocation of USD 2.12 million for transmission line which shall be paid to NTDC/PESCO for laying 132 km transmission line
- Debt equity ratio is taken as 70:30
- Project financed through local loan (Sponsors loan provided by PEDO)
- ROE is taken as 16%
- O&M annual amount considered 2.0 % of Capital Cost minus IDC although budget calculations indicated it to be APPROX. 2.3 % of Capital Cost. This has been done to keep the tariff as low as possible
- Interest rate 8% (KIBOR)
- Spread over interest 2.5% over KIBOR (as per benchmarks SRO 2018)
- Construction time 30 months
- Levelized tariff Rs. 15.4744 per KWh (US cents 9.6715 /kWh)
- Despatch on Take & Pay basis. Provision of Must-Run arrangement in the Energy Purchase Agreement
- Agreement year-Concludes when annual benchmark energy has been generated or 12 months whichever is later. Additional energy over and above benchmark to be sold at 10%

##### 4.1 Project Capital Cost

The total project cost is given below :

##### Total Project Cost

Project Budget- Karora Hydropower Project

Contract Capacity -11564 kW

Description	Budgeted amount-USD
EPC Contract (Comprises of provisional sum of Rs. 522.60 million or USD 5.29 million local cost Rs.1922.33 million or USD 19.44 and foreign cost USD 18.69 million. Conversion rate used to convert local cost into USD is USD 1= PKR 98.80 i.e. the rate used at the time of EPC signatures	38,168,190.000
Land	384,000

Customs Duties (adjustable as per actual-assumed at 7% of 70% foreign cost )	915,904.000
Withholding Tax on local Services (included in EPC)	
<b>Total Infrastructure Cost</b>	<b>39,468,094</b>
<b>Project Management Unit</b>	<b>692,209.363</b>
Management Consultant	852,755.000
Insurance during Construction included in EPC	-
Spares (included n EPC)	
<b>Total of Services</b>	
Total CAPEX without IDC	<b>41,014,058.363</b>
Financing Fee (Project financed by PEDO)-	-
Interest during Construction	5,464,067.376
Contingency	2,050,702.918
<b>Total Project Cost</b>	<b>48,528,828.657</b>

*PKR/USD = 160*

#### **4.2 Break Up of Capital Cost**

Following are the breakup of cost estimates:

- a) **EPC cost:** EPC Contract has been awarded to M/s GRC based on the competitive bidding carried out in accordance with the PPRA rules and the bids were evaluated by the Management Consultants and the team member of PEDO . Detailed EPC Contract along with the terms and conditions of implementation, payment terms etc. is attached. EPC Contract Comprises of provisional sum of Rs. 522.60 million or USD 5.29 million local cost Rs.1922. 33 million or USD 19.44 and foreign cost USD 18.69 million. Conversion rate used to convert local cost into USD is USD 1= PKR 98.80 i.e. the rate used at the time of EPC signatures . It comprises of USD 2.12 million allocated for transmission line. In case, Power Purchaser arranges for construction of transmission line from its own resources, the amount shall be paid to Power Purchaser and the EPC price, Project budget, CAPEX and tariff shall be adjusted accordingly. There is a provisional sum of USD 5.29537 (not considered for budget for tariff purposes,)The EPC also covers spare parts , tests on completion insurance during construction, site security, port handling and inland transportation etc. The price covers all taxes imposed on the contractor on account of this contract
- b) **spare parts:** Spare parts have been covered under the EPC Contract and the details are provided The sole purpose of this is to provide un-interrupted power supply to the utility in particular and consumers' at large.

### 4.3 Customs Duties

An amount of USD 0.915 million (adjustable as per actual at COD based on documentary evidence has been considered). 7% of 70% of foreign cost has been considered for budgeting purposes

**Land purchase and infrastructure development** "Land purchase cost" covers the payment of the cost of land to the owner of the land/property along with stamp duty and registration fees, the fees of the lawyers, as well as the cost of fill to level the site for construction purposes and compensation to be paid for land, build up houses, trees and agriculture/cultivation loss. An area of 267 Kanals has been acquired for an amount of Rs.61.50 million or USD 0.384 million

### 4.4 Project Management Unit (PMU)

This cost covers the project establishment for the preconstruction as well as employer's cost during construction. The amount considered under this head is USD 0.692 million. The details are provided in the annexures.

#### **Insurance During Construction**

This insurance is required for coverage of risks during construction period. This area is covered under EPC. This means a saving of USD 1.15 million (USD 0.384 Per annum) or 1% as per benchmarks 2018.

**Management Consultancy Cost** This cost covers feasibility update/upgrade, bid level design, tender document, bid evaluation, contract negotiations as well as complete construction management and services during defect liability period. The amount considered is USD 0.853 million (contract attached)

- c) **Financing Charges and Fees** No Financing fee has been considered as the entire loan amount has been provided by PEDO as Sponsors loan. This provides a saving of approx.USD 0.40 million (2% of the loan amount) as per benchmarks 2018
- d) **Interest during Construction (IDC)** Interest during construction is calculated based on KIBOR (8%) Plus 2.5%. for a period of 30 months. The estimated amount is USD 5.464 million. The drawing schedule is attached herewith. The amount of IDC shall be adjusted as per actual for the following variation
- e) Percentage of drawdown of funds
- f) Change in Construction period for any force majeure acknowledged by power purchaser and approved by Authority

### 4.5 Contingency

A sum of USD 2.050 million or 5% CAPEX without IDC has been considered). This is needed to cover unforeseen expenses mainly resulting from delays etc.



## 5. Financial Assumptions

Debt (Sponsor loan) forms 70% of the total project cost. Interest rate for debts is based on six months average of KIBOR, with premium i.e. 2.5, which is in accordance with NEPRA benchmarks 2018. (KIBOR 8% , spread 2.5%) . The Return on equity has been assumed as 16% which is very reasonable considering the size of project and the fact that financing is arranged by PEDO from its own resources and hence no financing cost has been incurred. Discount rate for the purpose of computation of levelized tariff is 10% has been applied. Details are given in Table below

### 5.1 Financial Assumptions for tariff computation

	Value
Plant Price EPC US\$ Million	3.23
<b>Financial Assumptions</b>	
Debt	70%
Equity	30%
Six Month KIBOR	8%
Premium for Rupee Loan	2.500%
ROE	16%
Withholding Tax on Dividends	7.5%
Discount Rate	10.00%
Financing Fee	0
Insurance (during construction)	0
Insurance ops	1%
Emergency parts	0
Customs Duties	7%
Variable O & M Rs./kWh	0.4630
Fixed O & M , Rs/KWh	1.860
Plant Capacity MW (net)	11.564
Hours Run	24
Days Operated	328.50
Exchange Rates	
Rs/US\$	160

## 6. Technical Assumptions

The plant operation is assumed round the clock for 328.50 days a year and the remaining 36.50 days cater for routine and emergency plant shutdowns. Annual energy output is computed based on these figures. Auxiliary consumption of 2% is considered. Forced outage hours are equivalent of 14.5 days or 348 hours in a year

## 6.1 Capital Structure

The debt and equity component is computed as 70:30 in the tariff model as provided in the policy. The capital structure is shown below

### Project Capital Structure

Capital Structure	US\$ Million
Equity	14,5586
Debt	33,9702
Project Capital Cost	48,5288
Debt Equity Ratio	70:30

## 6.2 CAPEX Disbursement

The CAPEX disbursement is based on the assumption of 30 months COD period. The percentage disbursement of different components of CAPEX will change as per EPCC contracts.

## 6.3 Debt Servicing Schedule

Debt service schedule is spread over a period of 10 years with equal installments computed on six monthly basis. Mark-up is computed as per financial assumptions using declining balance method. The interest charges are also computed per kWh to be used as a fixed charge for tariff computation.

## 7. Equity Repayment

Return on equity is computed @ 16% per annum

## 8. Operating Costs

Operating costs include fixed and variable cost and are calculated based on financial and technical assumptions. The fixed costs include Operating Insurance, Fixed O&M and Cost of Working Capital. Variable costs include only Variable O&M Per unit costs (Rs/kWh) have been computed based on dependable capacity – the maximum possible energy the plant can deliver per annum.

### Operating costs

Item	Unit	Value
Plant Capacity net	MW	11,564
Plant Factor	%	60,06
Hours/Day		24
Days		328,50

Net Electrical Output 69.06 % plant factor	GWh	71.39
Saleable Energy	GWh	62.962
Water use charges	Rs	0
Variable O&M Cost	Rs/kWh	0.463
Fixed O&M Cost	Rs/kWh	1.860
Operating Insurance %	%	1%
Annual Insurance Cost	\$	381,681
	Rs	61068960
	Rs/kWh	0.9699

## 9. Project Tariff

Tariff is based on EPA based on Take & Pay basis , with **Must Run** provision when the plant is available for despatch barring any constraints on plant as well as grid . The tariff is calculated based on energy sold i.e. 62.962 GWh per annum and the Agreement year shall be construed accordingly. The tariff comprises of

- Fixed O&M
- Operating Insurance
- Return on Equity
- Withholding Tax on Dividends
- Loan repayment
- Interest Charges
- Water Use Charges
- Variable O&M

Tariff computed based on the assumptions indicated above shows that the tariff will be high in the first ten years after COD thereafter it reduces substantially. Initial high tariff allows enough cash for debt repayment during the first 10 years of the tariff period. The leveled tariff is computed using the discount rate as per financial assumptions. Average and levelized tariffs are also calculated at different periods i.e. 1-10 years, 11-30 years and 1-30 years for ready reference. Summarized position is given in Table below

**10. Summary of Tariff**

	Rs/ Kwh	¢/kWh
Average tariff for 1-10 years	18.5364	11.5853
Average tariff for 11-30 years	9.7422	6.0889
Average tariff for 1-30 years	12.6736	7.9210
Levelized tariff	15.4744	9.6715

*Detailed tariff schedule is presented at Annexures*

## 11. Tariff Assumptions

Project financing structure is based on 70:30 debt-equity ratio, although the project has been entirely funded from PEDOs resources. 70% of the project Capital cost is considered to be arranged through sponsor loan and 30% is considered as equity. The proposed Reference Tariff is based on the following assumptions. Any change in any of these assumptions will result in changes in the Reference.

- a) The exchange rates are assumed to be 160 for PKR/USD. Exchange rates variations as per standard EPA shall be accommodated
- b) 100% of Debt has been assumed to be financed through Sponsor loan provided by PEDO
- c) O&M has been considered as 2.0% of Capital cost minus IDC to keep the tariff as low as possible, although budget calculations indicate it should be approx. 2.3%
- d) A constant ROE of 16% per annum is assumed over 30 years.
- e) Custom Duties on the import of plant and equipment (7% of 70% of foreign cost) have been assumed for reference purposes.
- f) No sales tax is assumed, General Sales Tax, and all other taxes and any new taxes shall be treated as pass through items.
- g) The construction period for the purpose of Reference Tariff calculations has been assumed as 30 months from the 'Notice to Proceed' to the EPC contractor. In case the completion of the project takes more than 30 months, IDC shall be adjusted based on the actual time taken for the completion of the project if caused by Force Majeure events acknowledged by Power Purchaser/Authority.
- h) Withholding Tax on dividend @7.5% as required under the Income Tax Ordinance, 2001 is assumed. Any change in the rate of the withholding tax would be pass-through to the Power Purchaser.
- i) No Debt service Reserve Account (DSRA), Maintenance Reserve Account or Contingency Reserve Account or any other Reserve Account has been considered in the tariff model.
- j) During construction period, the timing of debt drawdown may vary from that estimated now; as such, the actual 'Interest during construction' (IDC) will be updated at COD and the Reference Tariff table will be adjusted accordingly. Similarly the adjustments for variations in the assumed benchmark interest rates etc shall be applied.
- k) No hedging cost has been assumed for exchange rate fluctuations during construction
- l) Being a Public Sector project, no Water Use Charges have been considered

### 11.1 Summary

In view of the foregoing submissions and further submissions as may be made during hearing and giving of evidence or in rejoinder to a reply by the Petitioner, the Petitioner respectfully prays that in exercise of its statutory powers under the NEPRA Act read with the Tariff Rules, NEPRA may be pleased to allow the tariff with the calculations, amounts and assumptions set out in the Annexures.



Petitioner  
Through authorized Representative  
Mr. Ijaz Noor Shinwari  
Authorized Signatory

Dated: