

BEFORE
THE NATIONAL ELECTRIC POWER REGULATORY AUTHORITY (NEPRA)

TARIFF PETITION

FOR
DETERMINATION OF EPC STAGE GENERATION TARIFF

FOR
40.80 MW KOTO HYDROPOWER PROJECT

February 2020

Pakhtunkhwa Energy Development Organization
(PEDO)

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Glossary

BOOT	Build, Own, Operate and Transfer
COD	Commercial Operations Date
CPI	Consumer Price Index
CPP	Capacity Purchase Price
CPPA	Central Power Purchasing Agency
Cusec	Cubic Foot per second
DSRA	Debt Services Reserve Account
EPC	Engineering, Procurement and Construction
EPP	Energy Purchase Price
GOP	Government of Pakistan
GOPb	Government of Punjab
GoKP	
GST	General Sales Tax
GWh	Giga watt hours=1000,000 kWh
IA	Implementation Agreement
IDC	Interest During Construction
IPP	Independent Power Producer
IRR	Internal Rate of Return
ISO	International Organization for Standardization
KHPP	KOTO Hydropower Project
KIBOR	Karachi Interbank Offered Rate
Km	Kilometer=1000 meters
kV	Kilovolt =1000 volts
Kva	Kilovolt Ampere
Kw	Kilowatt=1000 watts
kWh	Kilowatt hours
LIBOR	London Interbank Offered Rate
LOI	Letter of Interest
LOS	Letter of Support
LV	Low Voltage
m³/s	Cubic meters per second or cumecs
MAF	Million Acre Feet
PESCO	Peshawar Electric Supply Company
MVA	Megavolt Ampere=1000kVA
MW	Megawatt=1000kW
MWh	Megawatt hours=1000kW h
NEPRA	National Electric Power Regulatory Authority
NPV	Net Present Value
NTDC	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 40.80 MW KOTO 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 40.80 MW KOTO 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

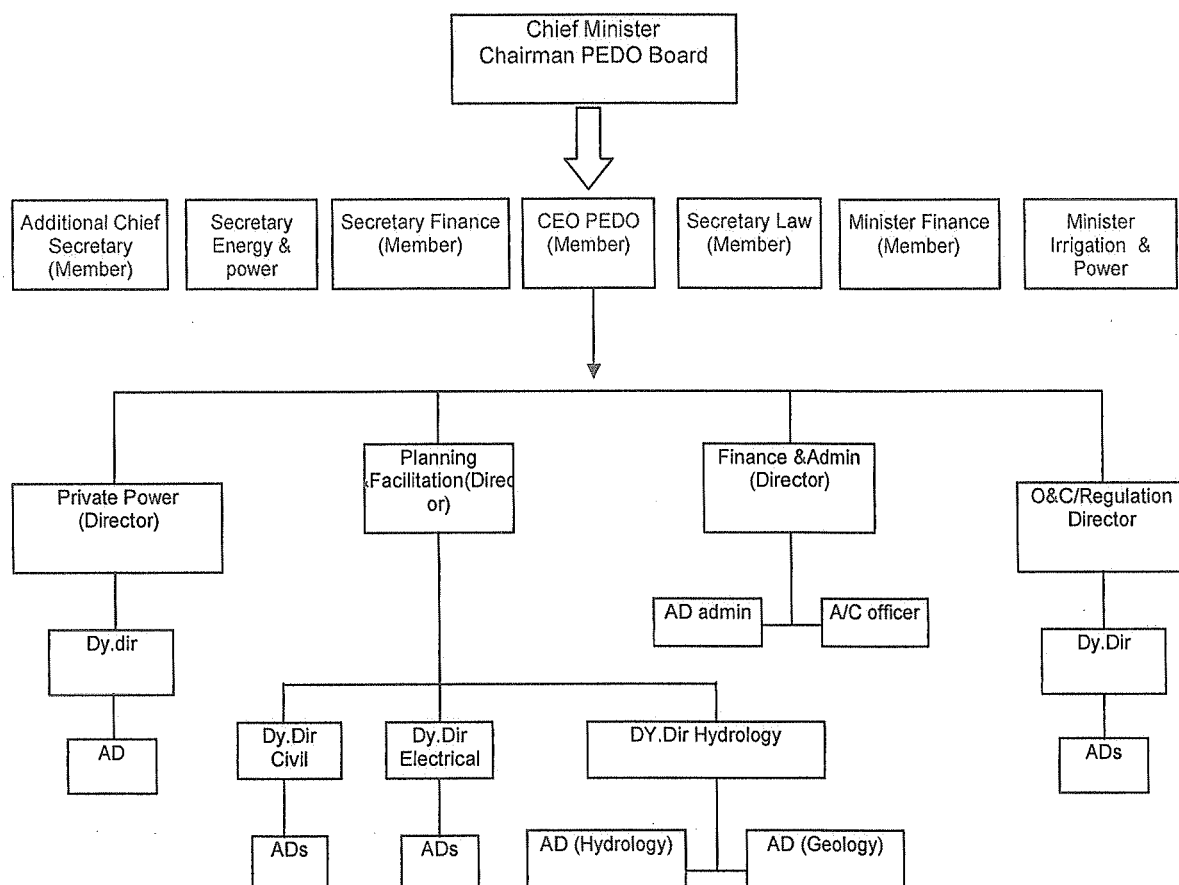
The Provincial Government has entrusted a dynamic role to PEDO, which is mainly oriented towards private sponsors participation in power sector projects besides developing projects in public sector. PEDO has established a dedicated Directorate to provide one window facility to private sponsors.

2.3 PEDO Organization

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
TOTAL:		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 I 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.	PehurHPP, 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.	MatiltanHPP, 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, Batagrarn	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
Total Installed Capacity			105

These projects are not only contributing towards the reduction in load shedding but also generating annual revenue of Rs. 2 to 3billion 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
iii	Machai HPP	Mardan	2.60
Total Capacity			56.20

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
iii	Jabori HPP	Mansehra	10.2
Total Capacity			62.80

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
Total Capacity			215.80

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
Total Installed Capacity			2519.16

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 SALIENT FEATURES OF THE PROJECT

Project	Koto Hydropower Project
Location	Timergara (District Lower Dir) Khyber Pakhtunkhwa, Pakistan
WGS 84 Coordinates	Weir (E 3101099, N 1182723)
River	Panjhora
Type	Run-of-River
Purpose of Project	To add badly needed affordable electricity to the National Grid

Hydrology	
Catchment Area	3,977 Km ²
Full Reservoir Level (FRL)	807 masl
Mean Monthly Flow	38.66 m ³ /s to 180.34 m ³ /s
Design Flow (Q ₃₀)	126 m ³ /s for power yield
Flood Discharge (Q ₁₀₀ Year)	2558 m ³ /s
Flood Discharge (Q ₁₀₀₀ Year)	4470 m ³ /s
Flood Discharge (Q _{10,000} Year)	6466 m ³ /s
Diversion Dam	
Type	Low height concrete diversion weir Ogee, Overflow weir
Weir Top Elevation	814 masl
Ogee Crest Elevation	807 masl
Total height of weir	12.5 m
Length of overflow section	174.10m
Height of overflow section	5m
Size of Stilling Basin	34 m X 203.10 m
Design flood (Q ₁₀₀₀ Year)	4470 m ³ /s
Bridge Length	128.46 m
Access Road Length	270 m
GATED SECTION	
No. of Under Sluices	4 Nos.
Size of each Under Sluice	4.5 m X 3 m
No. of piers	5
Intake	
Type	Side intake-Gate controlled
Gate Size	6 m X 2.5 m
Nos. of gates	4
Box Channel	
Conduit Length	2488 m
No. of Conduit	4 Nos.
Conduit size	3.20 m X 3.50 m (Rectangular)
SLOPE	1:500
Sand Trap	
Size of sand trap	202m x 67m
Nos. of chambers	6 Nos.
Particle size to be settled	0.2mm
Pressure Conduit	
Conduit Length	165m
Nos. of Conduit	3 Nos.
Power Tunnel	
Length	1,761m
Type	Horseshoe, Reinforced concrete lined
Diameter (Equivalent)	7m (area=40.24 m ²)
Tunnel slope	1:500
Tunnel invert level	784.58 masl
Adit length	230m
Surge Shaft	

Height	32m
Type	Circular, Reinforced concrete lined
Diameter	28m
Access Road Length	921m
Pressure Shaft	
Type	Steel Lined
Vertical Length	20.70m
Horizontal Length	154.14
Diameter	6m
Thickness	16 to 25mm
Tailrace	
Type	Rectangular concrete channel
Length	48m
Power Facilities	
Powerhouse Type	Surface
Dimensions	68.75m X 31m X 31.2m (L x W x H)
Gross Head	47.73m
Net Head	38.63m
Installed Capacity	40.8 MW
Nos. of Units	3 Nos.
Plant Factor	57.3%
Transmission Facilities	
Transmission Line	132 KV - 9 KM (to 66 KV Temergara grid station)

7. CAPITAL COST OF PROJECT		
	Project Components	<p>The Hydropower scheme is divided into the following main groups:</p> <ul style="list-style-type: none"> • Preliminary Works • Civil works • Hydro-Mechanical Equipment • Electrical Equipment • Transmission System • Detail Design of Civil and E&M works • Project Administration Cost and PEDO's Overheads • Security Charges
		<p>vi. Despite proper Geological survey the unforeseeable & unfavorable geological conditions cannot be ignored as has been experienced at almost all locations of the project components such as Powerhouse, Tunnel and Weir sites in Northern areas (Duber Khwar, Khan Khwar&AllaiKhwar Hydropower Project). This aspect has been kept in mind during costing of the project.</p> <p>Vii. The Project area lies in District Lower Dir which has remained extremely sensitive security risks location. The government of Khyber Pakhtunkhwa has recently circulated instruction for making separate provision for security arrangement in all PC-I. The above factors warranted revision.</p>

8.	Annual Operating and Maintenance Cost After Completion of the project	Annual operation & Maintenance cost has been worked out @ 1 % of the total project costs which comes to Rs. 246 million. This costs also covers the overhauling of the plant after every ten years. The operation budget however required 355 million
9	Financial Plan and Mode of Financing	The Government of Khyber Pakhtunkhwa will finance the project with following financing parameters; <ul style="list-style-type: none"> • 10% through provincial ADP • 90% through Hydel Development Fund/Foreign Investment
10	PROJECT BENEFITS AND ANALYSIS	
i.	Employment Generation (Direct & Indirect)	<p>The Project is expected to create employment opportunity during construction and operation phase of the project directly as shown under.</p> <p>A. Pre-Construction Phase</p> <p>Management 190 Person Months</p> <p>Engineers 280 Peron Months</p> <p>Direct Staff 800 Person Months</p> <p>Indirect Staff 100 Person Months</p> <p>B. Construction Phase</p> <p>Management 700 Person Months</p> <p>Engineers 1500 Peron Months</p> <p>Direct Staff 3500 Person Months</p> <p>Indirect Staff 5000 Person Months</p> <p>C. Post Construction Phase</p> <p>Approximately 20 persons, a schematic management diagram shall be developed.</p>
ii.	Main Environmental Impacts in pre and post flood conditions	<p>Negative Impacts:</p> <p>The matters of concern are as follows:</p> <ul style="list-style-type: none"> • Stability of the slopes and soil erosion during excavation for the structures, particularly the power tunnel, disposal of excavated material and blasting at quarry areas. • Surface water quality of the Panjkora River may get contaminated with debris and soil material during excavation, construction of cofferdams, wastewater disposal from the construction camps and from batching plant and machinery washing yard, and spillage of oils and obnoxious chemicals. • The construction activities will affect the air quality and cause noise related hazards, which will be of concern, especially at the Power house where some settlements are close to the construction

		<p>site.</p> <ul style="list-style-type: none"> • Before flood, about 210 trees (140 shade trees and 70 fruit trees) lie in project area and have to be cut. General Flora of the project area includes Drawa, Deodar, Shisham, Poplar, Chir, Draic, Bakain, Apricot, Persimmon, Pear, Peaches and Walnut. • After flood, numbers of trees have been reduced from 210 to 82 (56 shade trees and 26 fruit trees) because flood washed away numeral of plantation. At present general flora after flood of the project area include Shisham, Deodar, Drawa, Poplar, Walnut, Peaches and Pear. Detail of affected trees is given below: <p style="text-align: center;">Detail of affected Trees</p> <table border="1"> <tr> <th rowspan="2">Type of Trees</th><th colspan="2">No. of Trees</th></tr> <tr> <th>Before Flood</th><th>After Flood</th></tr> <tr> <td>Shade Trees</td><td>140</td><td>56</td></tr> <tr> <td>Fruit Trees</td><td>70</td><td>26</td></tr> </table> <ul style="list-style-type: none"> • Before flood, the project will consume 387 kanals of private land; out of which 40.3% of agricultural land and 59.7% of waste land that is likely to be consumed by the project. By and large this is the proprietary land. The lands in the project areas are mainly proprietary. • After Flood, the project will also consume 451 kanals of private land but category of land has been changed. The land which fall in agricultural category before flood now it turns into waste land. Statistic tells that out of 387 kanals 14.2% is agricultural land and 85.8% is waste land which was 40.3% and 59.7% respectively. • Before flood, there was Hydel generator (10 KV)/Water Mill within the vicinity of weir. It would be relocated/compensated because it could be distributed. • After Flood there is no Hydel-generator or water mill which need relocation, because flood clean out the area where it exists. • However, due to relocation of powerhouse and Residential colony the land acquisition requirement has been changed. Now it is assumed that permanent land requirements will be 858 kanals, out of which 256 kanals are agriculture land 602 kanals are waste land & abandoned refugee Camp land. Temporary land required is 26 kanals. 	Type of Trees	No. of Trees		Before Flood	After Flood	Shade Trees	140	56	Fruit Trees	70	26
Type of Trees	No. of Trees												
	Before Flood	After Flood											
Shade Trees	140	56											
Fruit Trees	70	26											

		<p>Positive Impacts</p> <p>Notwithstanding the negative impacts indicated above the project will be beneficial in many areas, particularly in the following manner:</p> <ul style="list-style-type: none"> • The project will provide desperately needed clean and economic hydro power. • Hydropower is a clean and renewable source of energy and avoids contributions to air pollution loads, which would be involved in case of electricity generation through thermal source. Hence it is environment friendly. Thermal power generation plants are known for large variety of toxic emissions i.e carbon dioxide (SO₂), carbon monoxide (CO) and Oxides of Nitrogen (NO_x) etc. • The project will also provide unskilled jobs during the constructional phase and a limited number of jobs in operational as well. This will be a bonus for the men of the area, many of whom are used to travel down country, for the employment. • The creation of reservoir will open the area for tourism which will again be economically beneficial for the local communities in economic terms. • Creation of an impoundment of relatively shallow depth will be helpful for development of fishery. • The reservoir is likely to improve the groundwater conditions.
iii.	Environmental Mitigation	<p>Mitigation Actions</p> <p>As may be seen from the preceding section, the negative impacts from the construction activities are not so critical that they cannot be avoided or at least minimized. What are required in certain cases are good engineering practices. These include:</p> <ul style="list-style-type: none"> • Slope stability and soil erosion preventive measures. • Minimizing contamination of land and water resources from soil, wastewater generated from different activities, oils and chemicals. • Use of vehicles and machinery of good conditions and well-tuned engine that will reduce smoke emissions and noise hazards. • Liberal Water sprinkling at construction sites and haul tracts to abate the generation of fugitive dust. • Use of vehicles and machinery of good conditions and well-tuned engine that will reduce smoke emissions and noise hazards according to permissible limits as fixed by Pak-EPA for noise is 85 dB (A), while the WHO noise guidelines prescribed a limit of 55 dB(A), these limits will be considered in operation phase of the project. • Social disruption of the local communities may be

		<p>minimized by hiring unskilled workforce from the local communities and by avoiding needless interaction of construction crews with locals.</p> <p>As far as the other negative impacts are concerned, the mitigation will be carried out through compensatory actions. These are as follows:</p> <ul style="list-style-type: none"> • Planting of Robina, Poplar, Apple and Apricot/Walnut is preferred for compensation plantation with the cooptation of forest department. • The propriety land will be compensated for in cash in accordance with the market rates that currently prevailing in the area. The average assumed market rate for agricultural land is Rs. 750,000 per kanal and waste land is Rs. 400,000 per kanal, and Temporary land acquisition rate is Rs. 200,000 per kanal. • The proponent will make arrangement during operation of the project for release of water from the Weir meeting the demand of downstream reach of the river, Proponent will ensure the release of water discharge during constructional and operational phase of the project. Arrangement would be made for release of about $7.9 \text{ m}^3/\text{s}$ of water from the Weir for downstream reach because agricultural practices are dependent on the river water.
iv.	Comparing Alternative Power Sources	<p>Alternative</p> <p>In this context, the following options have been considered.</p> <ul style="list-style-type: none"> • No Action. • Alternative Resources of Power Generation, their exploitation status in the country and Alternative Hydropower Generation resources. • Project Design Alternative. <p>Detail of alternative is given in main IEE report's Chapter No. 5</p>
v.	Economic Analysis	<p>The economic analysis of the project has been carried out on the basis of benefits to the overall economy as a consequence of the least cost optimal development of the hydropower potential in the country. For this purpose, the benefits from the proposed combined cycle gas combustion turbine plant have been evaluated in terms of costs foregone for providing an equivalent generation. Other alternative i.e Simple Open Cycle Gas Turbine and slow/medium speed diesel plant have been omitted in PC-I.</p>

		Economic Analysis is based on shadow prices and transfer payments and as such interest during construction has been excluded in economic analysis.
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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 157,552,095
- 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 1 % of Capital Cost .
- Interest rate 10% (KIBOR)
- Spread over interest 2.5% over KIBOR (as per benchmarks SRO 2018)
- Construction time 48 months
- Levelized tariff Rs. 15.2851 (US cen9.8614 Rs /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- KOTO Hydropower Project

Contract Capacity -39984 kW

Description	Budgeted amount-USD
EPC Contract EPC Contract signed on January 19,2015 comprised of foreign portion of USD 62,454,392 and Pak Rs. 6,216,497,256 which is converted to USD 1= Rs. 102.20 ,Exchange rate at the time of signatures (USD 60,826,783.32)	123,281,175.000
Land	3,406.007

Police Security	1,391,313.000
Customs Duties (adjustable as per actual-assumed at 7% of 70% foreign cost)	3,060,265.2080
Withholding Tax on local Services (included in EPC)	
Total Infrastructure Cost	131,138,760.208
Project Management Unit	611,745.929
Management Consultant (including Independent Engineer for 6 month)	1,709,355.000
Insurance during Construction included in EPC	-
Spares (included in EPC)	
Total of Services	2,321,100.929
Total CAPEX without IDC	133,459,861.137
Financing Fee (Project financed by PEDO)-	-
Interest during Construction	17,419,241
Contingency-5% of total cost minus IDC	6,672,993
Total Project Cost	157,552,095

PKR/USD = 155

4.2 Break Up of Capital Cost

Following are the breakup of cost estimates:

EPC cost: EPC Contract has been awarded to M/s Sarwar & Company JV 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 comprised of foreign portion of USD 62,454,392 and Pak Rs. 6,216,497,256 which is converted to USD 1= Rs. 102.20 ,Exchange rate at the time of signatures (USD 60,826,783.32) . Conversion rate used to convert local cost into USD is USD 1= PKR 102.20 i.e. the rate used at the time of EPC signatures .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

- a) **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 3.060 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

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 0.611 million. The details are provided in the annexures.

Land

Land has been acquired at a cost of Rs. 527,931,146 (converted to USD at Rs. 155= USD1). The details are presented in documents attached with cost estimates.

Police Security

Amount billed by police department under this head is Rs.215,653,542 (converted to USD at Rs. 155= USD1). The details are presented in documents attached with cost estimates.

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 4.92 million (USD 1.23 million 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 1.709 million (contract attached) .*This includes provision of USD 90,000 (USD 15,000 per month for independent engineer)*

- b) **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 2.1 million (2% of the loan amount) as per benchmarks 2018
- c) **Interest during Construction (IDC)** Interest during construction is calculated based on KIBOR (10%) Plus 2.5%. for a period of 48 months. The estimated amount is USD 16.793 million. The drawing schedule is attached herewith. The amount of IDC shall be adjusted as per actual for the following variation:
 - d) Percentage of drawdown of funds
 - e) Change in Construction period for any force majeure acknowledged by power purchaser and approved by Authority

4.4 Contingency

A sum of USD 6.672 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 10 %, 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/MW	3.02
Financial Assumptions	
Debt	70%
Equity	30%
Six Month KIBOR	10%
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	0.172
Fixed O & M . Rs/KWh	1.149
Plant Capacity MW (net)	39.9984
Hours Run	24
Days Operated	328.50
Exchange Rates	
Rs/US\$	155

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	47.2656
Debt	110.2865
Project Capital Cost	157.5521
Debt Equity Ratio	70:30

6.2 CAPEX Disbursement

The CAPEX disbursement is based on the assumption of 48 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	39.9984
Plant Factor	%	57.30
Hours/Day		24
Days		328.50
Net Electrical Output 57.30 % plant factor	GWh	205
Saleable Energy	GWh	180
Water use charges	Rs	0
Variable O&M Cost	Rs/kWh	0.172
Fixed O&M Cost	Rs/kWh	1.149
Operating Insurance %	%	1%
Annual Insurance Cost	\$	1,232,811
	Rs	
	Rs/kWh	1.0579

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	18.3087	11.8120
Average tariff for 11-30 years	9.6251	6.2097
Average tariff for 1-30 years	12.5196	8.0772
Levelized tariff	15.2851	9.8614

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 155 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 1.0% of Capital cost
- 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 48 months from the 'Notice to Proceed' to the EPC contractor. In case the completion of the project takes more than 48 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

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.
Authorized Signatory

Dated:

Project Budget

Project Budget- KOTO HPP
Contract Capacity - 39984kW

Description	Budgeted amount
EPC Contract signed on January 19,2015 comprised of foreign portion of USD 62,454,392 and Pak Rs. 6,216,497,256 which is converted to USD 1= Rs. 102.20 ,Exchange rate at the time of signatures (USD 60,826,783.32)	123,281,175.000
Land -Rs. 527,931,146	3,406,007.000
Police Security-Rs 21,565,3542	1,391,313
Customs Duties (adjustable as per actual-asumed at 7% of 70% foreign cost)	3,060,265.2080
Withholding Tax on local Services	
Total Infrastructure Cost	131,138,760.208
Project Management Unit (as per revised PC-1 January 2017)	611,745.929
Design Review	1,709,355.000
Construction Supervision	
Insurance during Construction included in EPC	-
Spares (included in EPC)	
Total of Services	2,321,100.929
Total CAPEX without IDC	133,459,861.137
Financing Fee (Project financed by PEDO)-	-
Interest during Construction	17,419,241.767
Contingency-5% of CAPEX without IDC	6,672,993.057
Total Project Cost	157,552,095.961
Exchange rate	155

Land Cost

Description	Cost (USD)
LAND and related studies	
Land inclusive of transfer charges-Rs. 527,931,146	3,406,007
Geotech Study	-
Hydrology Study	-
Misc (Travelling related to land)	
Site Security-36 months	-
TOTAL COST OF LAND	3,406,007

Project Development Costs -PMU		in USD	
Description	Estimated Costs-Rs	Estimated Costs-USD	
Salaries/Compensation	61,238,256.000	395,085.52	
others allowances	1,160,000.000	7,483.87	
Feasibility Study (included in MC)			
Tender Document Preparation and Evaluation (included in management consultancy contract)			
IEE Public Hearing / NOC (included in MC)			
Commodities & Services	14,772,393.000	95,305.76	
<i>Travelling allowance ,Postage , POL, office stationary charges , rent for office building , rent for residential building, electricity and miscellaneous charges included</i>			
Purchase of durable goods	15,474,000.000	99,832.26	
<i>includes furniture , vehicles,machiner & equipment and fixtures etc.</i>			
Repair of durable goods	2,150,000.000	13,870.97	
PEDO overheads	25,970.000	167.55	
Total PMU cost	94,820,619.000	611,745.93	

Construction Management Cost

Description	Estimated Costs
Independent Engineer Under PPA - 6 months Prior TO COD-USD 15,000 per month (assumed)	90,000.000
Owners Engineer-design Review & Construction supervision (MC Contract)-Rs 251 million	1,619,355.000
Misc	
Total	1,709,355.000

Calculations for Interest During Construction									
Debt -USD Million	93,421,902.80								
Draw Down Schedule	0-6 months	7-12 months	13-18 months	19-24 months	24-30 months	30-36 months	37-42 months	43-48 months	
Drawn amount-%	20%	10%	10%	15%	15%	10%	10%	10%	
Drawn Amount -USD	18684380.5592	9342190.2796	9342190.2796	14013285.4194	14013285.4194	9342190.28	9342190.28	9342190.28	
Accumulated drawn	18684380.5592	28026570.8388	37368761.1184	51382046.5378	65395331.9571	74737522.2367	84079712.5163	93421902.7959	
KIBOR	10.00%								
Spread	2.50%								
Interest rate	12.50%								
IDC-USD Million	583886.8925								
Accumulated IDC- USD	583,886.89	583886.8925	2663983.9469	3377876.9053	5194683.1662	7562954.9877	10371187.2444	13646877.4633	
IDC on accuated	583,886.89	1204266.7157	130006.0659	211117.3066	324667.6979	472684.6867	648199.2028	852929.8415	
IDC on fresh drawing		875830.3387	1167773.7849	1605688.9543	2043604.1237	2335547.5699	2627491.016	2919434.462	
Accumulated IDC		2,080,097.05	3,377,876.91	5,194,683.17	7,562,954.99	10371187.2444	13,646,877.46	17,419,241.77	
For LIBOR Based Loan									
LIBOR	0.50%								
Spread	4.50%								
Interest rate	5.00%								

Insurance During Construction	
Description	Estimated Costs
Marine DSU Insurance	
Marine Cargo Insurance	
Marine-Third Party Liability	
EAR / CAR DSU Insurance	
EAR/CAR Insurance	
EAR/CAR Third Party Liability	
Terrorism Insurance	
Miscellaneous Other Insurances	
Insurance Advisor's Fee	
Total (all covered under EPC)	-

Financing Fee	
Description	Estimated Costs
Agency Fees	-
Commitment Fees	-
Arrangement Fee	-
WAPDA LC Charges	-
Financial Advisor-	-
Tax Advisor	-
Legal Advisor	-
Legal Advisor-Foreign Council	-
Lenders-Technical Advisor	-
Lenders-Legal Advisor	-
Lenders-Insurance Advisor	-
IFC/ADB Working Fee	-
Out of Pocket Expenses	-
Total (Project developed through PEDO own resources)	-

Spare Parts		
Description	Estimated Costs	Remarks
Spare Parts for Plant	-	Estimates
<i>spares covered in EPC</i>		
Total	-	

Calculations for ROE During Construction									
Debt -USD Million	40,037,958.34								
Draw Down Schedule	0-6 months	7-12 months	13-18 months	19-24 months	24-30 months	30-36 months	37-42 months	43-48 months	
Drawn amount-%	20%	10%	10%	15%	15%	10%	10%	10%	
Drawn Amount -USD	8007591.6682	4003795.8341	4003795.8341	6005693.7512	6005693.7512	4003795.834	4003795.834	4003795.834	
Accumulated drawn	8007591.6682	12011387.5023	16015183.3364	22020877.0876	28026570.8388	32030366.6729	36034162.5070	40037958.3411	
ROE	16.00%								
Spread	0.00%								
Net rate	16.00%								
ROEDC -USD million	320303.6667	320303.6667	1466990.7936	1879029.4305	2910186.8684	4264064.6515	5886404.4905	7798683.3500	
Accumulated IDC - USD	320,303.67	666231.6268	91734.9702	150322.3544	232814.9495	341125.1721	470912.3592	623894.668	
ROEDC on accuated	320,303.67	480455.5001	640607.3335	880835.0835	1121062.8336	1281214.6669	1441366.5	1601518.334	
ROEDC on fresh drawing									
Accumulated ROEDC -USD		1,146,687.13	1,879,029.43	2,910,186.87	4,264,064.65	5886404.4905	7,798,683.35	10,024,096.35	
ROEDC per KWh									
Concession period -years	30								
per annum ROEDC recovery -USD	334,136.55								
saleable energy -GWh	205								
Recovery per KWh -US cents	0.16								

Project Tariff

FINANCIAL

<u>Tariff Details</u>		
Tariff at 57.30 % Plant Factor		
Average year 1-10 (US Cents/KWh)	11.8120	
Average year 1-10 (Rs./KWh)	18.3087	
Average year 11-30 (US Cents/kWh)	6.2097	
Average year 11-30 (Rs./kWh)	9.6251	
Average year 1-30 (US Cents/kWh)	8.0772	
Average year 1-30 (Rs./kWh)	12.5196	
Levelized (1-30) US Cents/kWh	9.8614	
Levelized -Rs./kWh	15.2851	
<u>Loan</u>		
Domestic Loan		
Local Portion in the Debt	100.00%	
KIBOR (six month)	10.00%	
Spread (as allowed by NEPRA)	2.50%	
Reference Interest rate -KIBOR +2.5%	12.50%	
Repayment Period (Years)	10	
Foreign Loan		
Foreign portion in the debt	0.00%	
LIBOR	0.50%	
Spread (as per loan Document)	4.50%	
Reference Interest rate	5.00%	
Repayment Period (Years)	10	
<u>Project (MUSD)-Base Cost</u>		
Equity	47.2656	30%
Debt	110.2865	70%
Total Capital	157.5521	100%

Capital Cost (Including Soft Costs)-US \$ Million

Equity	47.2656
Debt	110.2865
Total Capital Cost	157.5521
Return on Equity	0.1600
Exchange Rate	155.00

40.80 MW KOTO HYDROPOWER PROJECT

RETURN ON EQUITY & EQUITY REDEMPTION

Equity invested -US \$ Million	47.266
Return on Equity	16.0%
Amount of Equity Returned p.a -US \$	7,562,500.61
Net Saleable Energy Generation-GWh	180.63
Return on Equity-US Cents /KWh without redemption	4.187

Year	Return on Equity-Cents/KWh	Equity Redemption-US \$ Million	Remaining Equity-US \$ Million	Return on Equity-After Redemption	Redemption Value - Cents/KWh
1	4.187	0	47.266	4.187	0
2	4.187	0	47.266	4.187	0
3	4.187	0	47.266	4.187	0
4	4.187	0	47.266	4.187	0
5	4.187	0	47.266	4.187	0
6	4.187	0	47.266	4.187	0
7	4.187	0	47.266	4.187	0
8	4.187	0	47.266	4.187	0
9	4.187	0	47.266	4.187	0
10	4.187	0	47.266	4.187	0
11	4.047	1.576	45.690	4.047	0.785
12	3.908	1.576	44.115	3.908	0.785
13	3.768	1.576	42.539	3.768	0.785
14	3.629	1.576	40.964	3.629	0.785
15	3.489	1.576	39.388	3.489	0.785
16	3.349	1.576	37.813	3.349	0.785
17	3.210	1.576	36.237	3.210	0.785
18	3.070	1.576	34.661	3.070	0.785
19	2.931	1.576	33.086	2.931	0.785
20	2.791	1.576	31.510	2.791	0.785
21	2.652	1.576	29.935	2.652	0.785
22	2.512	1.576	28.359	2.512	0.785
23	2.372	1.576	26.784	2.372	0.785
24	2.233	1.576	25.208	2.233	0.785
25	2.093	1.576	23.633	2.093	0.785
26	1.954	1.576	22.057	1.954	0.785
27	1.814	1.576	20.482	1.814	0.785
28	1.675	1.576	18.906	1.675	0.785
29	1.535	1.576	17.331	1.535	0.785
30	1.396	1.576	15.755	1.396	0.785

40.80 MW KOTO Hydropower Project

Analysis for the Operation & Maintenance Charges

Amount of O&M p.a- US \$ (2% of capital cost)	1,575,520.96
Allocation for Fixed O&M	1,339,192.82
Amount of Fixed O&M p.a- US \$	1,339,192.82
Allocation for Variable O&M	200,878.92
Amount of Variable O&M p.a- US\$	200,878.92

Variable O&M	
Net Saleable Energy Generation-GWh	180.63
Amount of Variable O&M p.a- US \$	200,878.92
Variable O&M (Cents /KWh)	0.111
Year	Variable-O&M Cents /KWh
1	0.111
2	0.111
3	0.111
4	0.111
5	0.111
6	0.111
7	0.111
8	0.111
9	0.111
10	0.111
11	0.111
12	0.111
13	0.111
14	0.111
15	0.111
16	0.111
17	0.111
18	0.111
19	0.111
20	0.111
21	0.111
22	0.111
23	0.111
24	0.111
25	0.111
26	0.111
27	0.111
28	0.111
29	0.111
30	0.111

Fixed O&M	
Mean Annual Energy Generation-GWh	180.63
Amount of Fixed O&M p.a- US \$	1,339,192.82
Fixed O&M-(Cents/KWh)	0.741
Year	Fixed-O&M Cents /KWh
1	0.741
2	0.741
3	0.741
4	0.741
5	0.741
6	0.741
7	0.741
8	0.741
9	0.741
10	0.741
11	0.741
12	0.741
13	0.741
14	0.741
15	0.741
16	0.741
17	0.741
18	0.741
19	0.741
20	0.741
21	0.741
22	0.741
23	0.741
24	0.741
25	0.741
26	0.741
27	0.741
28	0.741
29	0.741
30	0.741

40.80 MW Karora HPP**Executive Summary****TECHNICAL**

Installed Capacity (MW)		40.8
Annual Plant Factor		57.30%
Days in a year		365
Scheduled and forced outage days		36.5
Saleable energy		180.6
Mean annual energy generation potential (GWh)		204.79
Auxiliary losses		2.00%
Auxiliary load-MW		0.8160
Contract Capacity-KW		39984.00
Auxiliary losses (GWh)		4.10
Net Energy potential (GWh)		200.70
Construction Period (Months)		36
Lead Time before construction start (Years) from feasibility study approval		2

40.80 MW KOTO Hydropower Project

Debt Repayment Schedule

Debt including IDC- US \$ Million	110.286
Repayment Period (years)	10
KIBOR	10.0%
Spread	2.5%
Reference interest rate-KIBOR + 4.5%-P.a	12.50%
Mark Up application	Bi annually
No.of Periods	20
Interest Rate	12.50%
Saleable Energy generation-GWh	180.629

Bi Annual Debt Servicing- USD million

9.8113

Year	Installment	Interest- US \$ Million	Principal Repayment- US \$ Million	Total Payment- US \$ Million	Remaining Principal-US \$ Million	Annual Payment- US \$ Million	Cents/KWh
1	1	6.8929	2.918430	9.8113	107.368	19.623	10.864
	2	6.7105	3.100832	9.8113	104.267		
2	3	6.5167	3.294634	9.8113	100.973	19.623	10.864
	4	6.3108	3.500549	9.8113	97.472		
3	5	6.0920	3.719333	9.8113	93.753	19.623	10.864
	6	5.8595	3.951791	9.8113	89.801		
4	7	5.6126	4.198778	9.8113	85.602	19.623	10.864
	8	5.3501	4.461202	9.8113	81.141		
5	9	5.0713	4.740027	9.8113	76.401	19.623	10.864
	10	4.7751	5.036279	9.8113	71.365		
6	11	4.4603	5.351046	9.8113	66.014	19.623	10.864
	12	4.1258	5.685486	9.8113	60.328		
7	13	3.7705	6.040829	9.8113	54.287	19.623	10.864
	14	3.3930	6.418381	9.8113	47.869		
8	15	2.9918	6.819530	9.8113	41.049	19.623	10.864
	16	2.5656	7.245751	9.8113	33.804		
9	17	2.1127	7.698610	9.8113	26.105	19.623	10.864
	18	1.6316	8.179773	9.8113	17.925		
10	19	1.1203	8.691009	9.8113	9.234	19.623	10.864
	20	0.5771	9.234197	9.8113	0.000		

40.80 MW KOTO Hydropower Project	
Analysis for the Insurance Charges	
Insurance Premium 1.0% of EPC	1.00%
EPC Cost-US\$ Million	123.3
Amount of insurance p.a- US \$	1,232,811.8
Contract Capacity-Kw	39,984.0
insurance-US cents/kWh	0.6825
Insurance -Rs./kWh	1.0579

40.80 MW KOTO Hydropower Project-Tariff Table

year	Fixed O&M-Rs./kWhr	Return on Equity-Rs./kWh	ROEDC-Rs./kWh	Withholding Tax @ 7.5%	Insurance-Rs./kWh	Debt Servicing-Rs./kWhr	Tariff at 69.06 % Plant Factor (Rs./kWh)	Variable O&M-Rs./kWh	Water Use Charges-Rs./kWh	sum of WUC+VOM
1	1.149	6.489	0.251	0.506	1.058	8.684	18.309	0.172	0.000	0.172
2	1.149	6.489	0.251	0.506	1.058	8.684	18.309	0.172	0.000	0.172
3	1.149	6.489	0.251	0.506	1.058	8.684	18.309	0.172	0.000	0.172
4	1.149	6.489	0.251	0.506	1.058	8.684	18.309	0.172	0.000	0.172
5	1.149	6.489	0.251	0.506	1.058	8.684	18.309	0.172	0.000	0.172
6	1.149	6.489	0.251	0.506	1.058	8.684	18.309	0.172	0.000	0.172
7	1.149	6.489	0.251	0.506	1.058	8.684	18.309	0.172	0.000	0.172
8	1.149	6.489	0.251	0.506	1.058	8.684	18.309	0.172	0.000	0.172
9	1.149	6.489	0.251	0.506	1.058	8.684	18.309	0.172	0.000	0.172
10	1.149	6.489	0.251	0.506	1.058	8.684	18.309	0.172	0.000	0.172
11	1.149	6.489	0.251	0.506	1.058	0.000	9.625	0.172	0.000	0.172
12	1.149	6.489	0.251	0.506	1.058	0.000	9.625	0.172	0.000	0.172
13	1.149	6.489	0.251	0.506	1.058	0.000	9.625	0.172	0.000	0.172
14	1.149	6.489	0.251	0.506	1.058	0.000	9.625	0.172	0.000	0.172
15	1.149	6.489	0.251	0.506	1.058	0.000	9.625	0.172	0.000	0.172
16	1.149	6.489	0.251	0.506	1.058	0.000	9.625	0.172	0.000	0.172
17	1.149	6.489	0.251	0.506	1.058	0.000	9.625	0.172	0.000	0.172
18	1.149	6.489	0.251	0.506	1.058	0.000	9.625	0.172	0.000	0.172
19	1.149	6.489	0.251	0.506	1.058	0.000	9.625	0.172	0.000	0.172
20	1.149	6.489	0.251	0.506	1.058	0.000	9.625	0.172	0.000	0.172
21	1.149	6.489	0.251	0.506	1.058	0.000	9.625	0.172	0.000	0.172
22	1.149	6.489	0.251	0.506	1.058	0.000	9.625	0.172	0.000	0.172
23	1.149	6.489	0.251	0.506	1.058	0.000	9.625	0.172	0.000	0.172
24	1.149	6.489	0.251	0.506	1.058	0.000	9.625	0.172	0.000	0.172
25	1.149	6.489	0.251	0.506	1.058	0.000	9.625	0.172	0.000	0.172
26	1.149	6.489	0.251	0.506	1.058	0.000	9.625	0.172	0.000	0.172
27	1.149	6.489	0.251	0.506	1.058	0.000	9.625	0.172	0.000	0.172
28	1.149	6.489	0.251	0.506	1.058	0.000	9.625	0.172	0.000	0.172
29	1.149	6.489	0.251	0.506	1.058	0.000	9.625	0.172	0.000	0.172
30	1.149	6.489	0.251	0.506	1.058	0.000	9.625	0.172	0.000	0.172
NPV		52.27			8.52	49.06	144.092			1.39
Levelized -Rs/KWh							15.2851			
Levelized -Cents /KWh							9.8614			

Adminsitration Expenses Details					
Sr.No	Item	Monthly amount-Rs.	Yearly Amount -Rs	Amount-USD	Comments
1	Office Rent	250,000	3,000,000	19,355	
2	Office Renovation		1,000,000	6,452	
5	Telephone (landline & Mobile including internet)	100,000	1,200,000	7,742	
6	Electricity & Gas	100,000	1,200,000	7,742	
7	Travel		5,000,000	32,258	Rs.200,000 per month for travel to site and to Isb and abroad
8	Entertainment & Gifts (annual Function included)		2,000,000	12,903	
9	Insurance (office & Equipment including Vehicles)	100,000	1,200,000	7,742	
10	Courier and postage	25,000	300,000	1,935	
11	Health Insurance		1,500,000	9,677	
	Total: Administrative Expenses		16,400,000	105,806	
	Exchange Rate	155			

Details of Operational Expenses

Sr.No.	Item	Amount -Rs	Amount -USD	Comments
1	Lubes & Chemicals	500,000	3,226	
2	Consumables	500,000	3,226	
3	Spares replenishment	500,000	3,226	
4	Annual maintenance Spares	10,000,000	64,516	
5	Contract Labour	5,000,000	32,258	
7	Electricity Imported	4,000,000	25,806	2000 units per day for 30 days of major overhaul period every year @ Rs. 16 per kWh
9	Chemical Laboratory	1,000,000	6,452	
10	E&I Workshop	5,000,000	32,258	
11	Mechanical Workshop	10,000,000	64,516	
13	Contract Experts-maintenance (including travel , boarding & Lodging)	10,000,000	64,516	USD 1,000 per day per person for 32 days plus business class travel plus two nights stay in hotel
14	Major Overhauls (Every six year)	50,000,000	322,581	
15	CAPEX Provision (Generator/Transformer/Any other Upgrade)	60,000,000	387,097	includes provision for cost of major replacement after 30 years, all the E&M replaced or upgraded to use HPP for next 20 years
	Total: Operational Expenses	156,500,000	1,009,677	
	Exchange Rate	155		

Licenses and Permits

Sr. No.	Item	Annual Amount-Rs	Amount-USD
1	Generation License	400,000	2,581
2	Electrical License	500,000	3,226
3	Irrigation permits	1,000,000	6,452
4	Legal Consultancy	3,000,000	19,355
5	Technical Audit and cosnultancy Fee	5,000,000	32,258
	Total : Licenses & Permits	9,900,000	63,871
	Exchange Rate	155	

Details of Repalcement & Upgrades Cost				
Sr.No.	Item	Amount - Rs.	Amount - USD	Comments
1	Vehicles, mobiles and laptops	10,000,000	64,516	
2	DCS and software	50,000,000	322,581	DCS to be upgraded after 10 years Amount is USD 0.625 million every time
	Total : Repalcement & upgrades	60,000,000	387,097	
	Exchange Rate	155		

Details of Training & Corporate Social Responsibility Cost			
Sr.No.	Item	Amount-Rs	Amount USD
1	Training	5,000,000	32,258
2	Social Responsibility	5,000,000	32,258
3	Educational Support	1,000,000	6,452
	Total : Training & CSR	11,000,000	70,968
	Exchange rate	155	

Prospectus-40.8 MW Koto HPP

PAKHTUHWA ENERGY DEVELOPMENT ORGANIZATION (PEDO)

40.80 MW KOTO HPP

PROJECT PROSPECTUS

PEDO
20/2/2020

This document provides a brief on the Executing Agency , the Project and other related information

SALIENT FEATURES OF THE PROJECT

Project	Koto Hydropower Project
Location	Timergara (District Lower Dir) Khyber Pakhtunkhwa, Pakistan
WGS 84 Coordinates	Weir (E 3101099, N 1182723)
River	Panjhora
Type	Run-of-River
Purpose of Project	To add badly needed affordable electricity to the National Grid
Hydrology	
Catchment Area	3,977 Km ²
Full Reservoir Level (FRL)	807 masl
Mean Monthly Flow	38.66 m ³ /s to 180.34 m ³ /s
Design Flow (Q_{30})	126 m ³ /s for power yield
Flood Discharge (Q_{100} Year)	2558 m ³ /s
Flood Discharge (Q_{1000} Year)	4470 m ³ /s
Flood Discharge ($Q_{10,000}$ Year)	6466 m ³ /s
Diversion Dam	
Type	Low height concrete diversion weir Ogee, Overflow weir
Weir Top Elevation	814 masl
Ogee Crest Elevation	807 masl
Total height of weir	12.5 m
Length of overflow section	174.10m
Height of overflow section	5m
Size of Stilling Basin	34 m X 203.10 m
Design flood (Q_{1000} Year)	4470 m ³ /s
Bridge Length	128.46 m
Access Road Length	270 m
GATED SECTION	
No. of Under Sluices	4 Nos.
Size of each Under Sluice	4.5 m X 3 m
No. of piers	5
Intake	
Type	Side intake-Gate controlled
Gate Size	6 m X 2.5 m
Nos, of gates	4
Box Channel	
Conduit Length	2488 m
No. of Conduit	4 Nos.
Conduit size	3.20 m X 3.50 m (Rectangular)

SLOPE	1:500
Sand Trap	
Size of sand trap	202m x 67m
Nos. of chambers	6 Nos.
Particle size to be settled	0.2mm
Pressure Conduit	
Conduit Length	165m
Nos. of Conduit	3 Nos.
Power Tunnel	
Length	1,761m
Type	Horseshoe, Reinforced concrete lined
Diameter (Equivalent)	7m (area=40.24 m ²)
Tunnel slope	1:500
Tunnel invert level	784.58 masl
Adit length	230m
Surge Shaft	
Height	32m
Type	Circular, Reinforced concrete lined
Diameter	28m
Access Road Length	921m
Pressure Shaft	
Type	Steel Lined
Vertical Length	20.70m
Horizontal Length	154.14
Diameter	6m
Thickness	16 to 25mm
Tailrace	
Type	Rectangular concrete channel
Length	48m
Power Facilities	
Powerhouse Type	Surface
Dimensions	68.75m X 31m X 31.2m (L x W x H)
Gross Head	47.73m
Net Head	38.63m
Installed Capacity	40.8 MW
Nos. of Units	3 Nos.
Plant Factor	57.3%
Transmission Facilities	
Transmission Line	132 KV - 9 KM (to 66 KV Temergara grid station)

7. CAPITAL COST OF PROJECT												
	Project Components	<p>The Hydropower scheme is divided into the following main groups:</p> <ul style="list-style-type: none">• Preliminary Works• Civil works• Hydro-Mechanical Equipment• Electrical Equipment• Transmission System• Detail Design of Civil and E&M works• Project Administration Cost and PEDO's Overheads• Security Charges										
		<p>vi. Despite proper Geological survey the unforeseeable & unfavorable geological conditions cannot be ignored as has been experienced at almost all locations of the project components such as Powerhouse, Tunnel and Weir sites in Northern areas (DuberKhwar, Khan Khwar&AllaiKhwar Hydropower Project). This aspect has been kept in mind during costing of the project.</p> <p>Vii. The Project area lies in District Lower Dir which has remained extremely sensitive security risks location. The government of Khyber Pakhtunkhwa has recently circulated instruction for making separate provision for security arrangement in all PC-I. The above factors warranted revision.</p>										
8.	Annual Operating and Maintenance Cost After Completion of the project	Annual operation & Maintenance cost has been worked out @ 1 % of the total project costs which comes to Rs. 246 million. This costs also covers the overhauling of the plant after every ten years. The operation budget however required 355 million										
9	Financial Plan and Mode of Financing	<p>The Government of Khyber Pakhtunkhwa will finance the project with following financing parameters;</p> <ul style="list-style-type: none">• 10% through provincial ADP• 90% through Hydel Development Fund/Foreign Investment										
10 PROJECT BENEFITS AND ANALYSIS												
i.	Employment Generation (Direct & Indirect)	<p>The Project is expected to create employment opportunity during construction and operation phase of the project directly as shown under.</p> <p>A. Pre-Construction Phase</p> <table><tr><td>Management</td><td>190 Person Months</td></tr><tr><td>Engineers</td><td>280 Peron Months</td></tr><tr><td>Direct Staff</td><td>800 Person Months</td></tr><tr><td>Indirect Staff</td><td>100 Person Months</td></tr></table> <p>B. Construction Phase</p> <table><tr><td>Management</td><td>700 Person Months</td></tr></table>	Management	190 Person Months	Engineers	280 Peron Months	Direct Staff	800 Person Months	Indirect Staff	100 Person Months	Management	700 Person Months
Management	190 Person Months											
Engineers	280 Peron Months											
Direct Staff	800 Person Months											
Indirect Staff	100 Person Months											
Management	700 Person Months											

		<p>Engineers 1500 Person Months Direct Staff 3500 Person Months Indirect Staff 5000 Person Months</p> <p>C. Post Construction Phase Approximately 20 persons, a schematic management diagram shall be developed.</p>											
ii.	Main Environmental Impacts in pre and post flood conditions	<p>Negative Impacts:</p> <p>The matters of concern are as follows:</p> <ul style="list-style-type: none"> Stability of the slopes and soil erosion during excavation for the structures, particularly the power tunnel, disposal of excavated material and blasting at quarry areas. Surface water quality of the Panjkora River may get contaminated with debris and soil material during excavation, construction of cofferdams, wastewater disposal from the construction camps and from batching plant and machinery washing yard, and spillage of oils and obnoxious chemicals. The construction activities will affect the air quality and cause noise related hazards, which will be of concern, especially at the Power house where some settlements are close to the construction site. Before flood, about 210 trees (140 shade trees and 70 fruit trees) lie in project area and have to be cut. General Flora of the project area includes Drawa, Deodar, Shisham, Poplar, Chir, Draic, Bakain, Apricot, Persimmon, Pear, Peaches and Walnut. After flood, numbers of trees have been reduced from 210 to 82 (56 shade trees and 26 fruit trees) because flood washed away numeral of plantation. At present general flora after flood of the project area include Shisham, Deodar, Drawa, Poplar, Walnut, Peaches and Pear. Detail of affected trees is given below: <table border="1"> <caption>Detail of affected Trees</caption> <thead> <tr> <th rowspan="2">Type of Trees</th><th colspan="2">No. of Trees</th></tr> <tr> <th>Before Flood</th><th>After Flood</th></tr> </thead> <tbody> <tr> <td>Shade Trees</td><td>140</td><td>56</td></tr> <tr> <td>Fruit Trees</td><td>70</td><td>26</td></tr> </tbody> </table> <ul style="list-style-type: none"> Before flood, the project will consume 387 kanals of private land; out of which 40.3% of agricultural 	Type of Trees	No. of Trees		Before Flood	After Flood	Shade Trees	140	56	Fruit Trees	70	26
Type of Trees	No. of Trees												
	Before Flood	After Flood											
Shade Trees	140	56											
Fruit Trees	70	26											

		<p>land and 59.7% of waste land that is likely to be consumed by the project. By and large this is the proprietary land. The lands in the project areas are mainly proprietary.</p> <ul style="list-style-type: none"> • After Flood, the project will also consume 451 kanals of private land but category of land has been changed. The land which fall in agricultural category before flood now it turns into waste land. Statistic tells that out of 387 kanals 14.2% is agricultural land and 85.8% is waste land which was 40.3% and 59.7% respectively. • Before flood, there was Hydel generator (10 KV)/Water Mill within the vicinity of weir. It would be relocated/compensated because it could be distributed. • After Flood there is no Hydel-generator or water mill which need relocation, because flood clean out the area where it exists. • However, due to relocation of powerhouse and Residential colony the land acquisition requirement has been changed. Now it is assumed that permanent land requirements will be 858 kanals, out of which 256 kanals are agriculture land 602 kanals are waste land & abandoned refugee Camp land. Temporary land required is 26 kanals. <p>Positive Impacts</p> <p>Notwithstanding the negative impacts indicated above the project will be beneficial in many areas, particularly in the following manner:</p> <ul style="list-style-type: none"> • The project will provide desperately needed clean and economic hydro power. • Hydropower is a clean and renewable source of energy and avoids contributions to air pollution loads, which would be involved in case of electricity generation through thermal source. Hence it is environment friendly. Thermal power generation plants are known for large variety of toxic emissions i.e carbon dioxide (SO₂), carbon monoxide (CO) and Oxides of Nitrogen (NO_x) etc. • The project will also provide unskilled jobs during the constructional phase and a limited number of jobs in operational as well. This will be a bonus for the men of the area, many of whom are used to travel down country, for the employment. • The creation of reservoir will open the area for tourism which will again be economically beneficial for the local communities in economic terms.
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		<ul style="list-style-type: none"> • Creation of an impoundment of relatively shallow depth will be helpful for development of fishery. • The reservoir is likely to improve the groundwater conditions.
iii.	Environmental Mitigation	<p>Mitigation Actions</p> <p>As may be seen from the preceding section, the negative impacts from the construction activities are not so critical that they cannot be avoided or at least minimized. What are required in certain cases are good engineering practices. These include:</p> <ul style="list-style-type: none"> • Slope stability and soil erosion preventive measures. • Minimizing contamination of land and water resources from soil, wastewater generated from different activities, oils and chemicals. • Use of vehicles and machinery of good conditions and well-tuned engine that will reduce smoke emissions and noise hazards. • Liberal Water sprinkling at construction sites and haul tracts to abate the generation of fugitive dust. • Use of vehicles and machinery of good conditions and well-tuned engine that will reduce smoke emissions and noise hazards according to permissible limits as fixed by Pak-EPA for noise is 85 dB (A), while the WHO noise guidelines prescribed a limit of 55 dB(A), these limits will be considered in operation phase of the project. • Social disruption of the local communities may be minimized by hiring unskilled workforce from the local communities and by avoiding needless interaction of construction crews with locals. <p>As far as the other negative impacts are concerned, the mitigation will be carried out through compensatory actions. These are as follows:</p> <ul style="list-style-type: none"> • Planting of Robina, Poplar, Apple and Apricot/Walnut is preferred for compensation plantation with the cooptation of forest department. • The propriety land will be compensated for in cash in accordance with the market rates that currently prevailing in the area. The average assumed market rate for agricultural land is Rs. 750,000 per kanal and waste land is Rs. 400,000 per kanal, and Temporary land acquisition rate is Rs. 200,000 per kanal. • The proponent will make arrangement during

		operation of the project for release of water from the Weir meeting the demand of downstream reach of the river, Proponent will ensure the release of water discharge during constructional and operational phase of the project. Arrangement would be made for release of about $7.9 \text{ m}^3/\text{s}$ of water from the Weir for downstream reach because agricultural practices are dependent on the river water.
iv.	Comparing Alternative Power Sources	<p>Alternative</p> <p>In this context, the following options have been considered.</p> <ul style="list-style-type: none"> • No Action. • Alternative Resources of Power Generation, their exploitation status in the country and Alternative Hydropower Generation resources. • Project Design Alternative. <p>Detail of alternative is given in main IEE report's Chapter No. 5</p>
v.	Economic Analysis	<p>The economic analysis of the project has been carried out on the basis of benefits to the overall economy as a consequence of the least cost optimal development of the hydropower potential in the country. For this purpose, the benefits from the proposed combined cycle gas combustion turbine plant have been evaluated in terms of costs foregone for providing an equivalent generation. Other alternative i.e Simple Open Cycle Gas Turbine and slow/medium speed diesel plant have been omitted in PC-I.</p> <p>Economic Analysis is based on shadow prices and transfer payments and as such interest during construction has been excluded in economic analysis.</p>

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 157,552,095
- 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 1 % of Capital Cost.

- Interest rate 10% (KIBOR)
- Spread over interest 2.5% over KIBOR (as per benchmarks SRO 2018)
- Construction time 48 months
- Levelized tariff Rs. 15.2851 (US cen 9.8614 /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%

Project Capital Cost

The total project cost is given below :

Total Project Cost

Project Budget- KOTO Hydropower Project
Contract Capacity -39984 kW

Description	Budgeted amount-USD
EPC Contract EPC Contract signed on January 19,2015 comprised of foreign portion of USD 62,454,392 and Pak Rs. 6,216,497,256 which is converted to USD 1= Rs. 102.20 ,Exchange rate at the time of signatures (USD 60,826,783.32)	123,281,175.000
Land	3.406.007
Police Security	1.391,313.000
Customs Duties (adjustable as per actual-assumed at 7% of 70% foreign cost)	3,060,265.2080
Withholding Tax on local Services (included in EPC)	
Total Infrastructure Cost	131,138,760.208
Project Management Unit	611,745.929
Management Consultant (including Independent Engineer for 6 month)	1,709,355.000
Insurance during Construction included in EPC	-
Spares (included n EPC)	
Total of Services	

	2,321,100.929
Total CAPEX without IDC	133,459,861.137
Financing Fee (Project financed by PEDO)-	-
Interest during Construction	17,419,241
Contingency-5% of total cost minus IDC	6,672,993
Total Project Cost	157,552,095

PKR/USD = 155

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 10 % , 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

Financial Assumptions for tariff computation

	Value
Plant Price EPC US\$ Million/MW	3.02
Financial Assumptions	
Debt	70%
Equity	30%
Six Month KIBOR	10%
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	0.172
Fixed O & M . Rs/KWh	1.149

Plant Capacity MW (net)	39.9984
Hours Run	24
Days Operated	328.50
Exchange Rates	
Rs/US\$	155

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

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	47.2656
Debt	110.2865
Project Capital Cost	157.5521
Debt Equity Ratio	70:30

CAPEX Disbursement

The CAPEX disbursement is based on the assumption of 48 months COD period. The percentage disbursement of different components of CAPEX will change as per EPCC contracts.

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.

Equity Repayment

Return on equity is computed @ 16% per annum

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	39.9984
Plant Factor	%	57.30
Hours/Day		24
Days		328.50
Net Electrical Output 57.30 % plant factor	GWh	205
Saleable Energy	GWh	180
Water use charges	Rs	0
Variable O&M Cost	Rs/kWh	0.172
Fixed O&M Cost	Rs/kWh	1.149
Operating Insurance %	%	1%
Annual Insurance Cost	\$	1,232,811
	Rs	
	Rs/kWh	1.0579

1. 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

2. Summary of Tariff

	Rs/ Kwh	¢/kWh
Average tariff for 1-10 years	18.3087	11.8120
Average tariff for 11-30 years	9.6251	6.2097
Average tariff for 1-30 years	12.5196	8.0772
Levelized tariff	15.2851	9.8614

Detailed tariff schedule is presented at Annexures