GOVERNMENT OF THE PUNJAB
ENERGY DEPARTMENT

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TARIFF PETITION FOR 2.82 MW PAKPATTAN HYDROPOWER PROJECT DISTRICT PAKPATTAN, PUNJAB

RENEWABLE ENERGY DEVELOPMENT SECTOR INVESTMENT PROGRAMME (ADB LOAN # 2286)

March 17, 2014

PUNJAB POWER DEVELOPMENT COMPANY LIMITED
77-SHAHJAMAL COLONY, LAHORE-PUNJAB, PAKISTAN

Government of the Punjab
Energy Department
Punjab Power Management Unit
77 Shah Jamal Colony, Lahore

Tel: (042)37578145
Fax :(042) 37584018

March 17, 2014

The Registrar
National Electric Power Regulatory Authority
NEPRA Tower, Ata-Turk Avenue,
Sector G-5/1,
Islamabad.

Sub: **PETITION FOR DETERMINATION OF EPC TARIFF FOR PAKPATTAN HYDROPOWER PROJECT OF 2.82 (GROSS) MW CAPACITY AT PAKPATTAN CANAL, DISTRICT PAKPATTAN IN PROVINCE OF THE PUNJAB**

Dear Sir,

I, Liaqat Ali, Project Director (PD) of Punjab Power Management Unit (the "PPMU"), duly authorized representative of Punjab Power Development Company Limited (the "PPDCL"), having its registered office at 77 Shah Jamal Colony, Lahore , by virtue of the letter of Authorization /Company Resolution dated 31.01.2014 (attached thereto for reference), hereby submit to the National Electric Power Regulatory Authority (NEPRA) a petition for determination of EPC Tariff, adjustment / indexation provisions and other terms and conditions for supply of electric power services from 2.82 MW Hydropower Project at Pakpattan Canal to Multan Electric Power Company (the "MEPCO").

Attached is a Cheque No. 158688 dated March 11, 2014 drawn on National Bank of Pakistan Main Branch Lahore in the sum of Rs.262, 432/= (Pak Rupees two hundred sixty two thousand four hundred thirty two only) being the Tariff Petition Fee calculated in accordance with NEPRA (Tariff Standards & Procedure) Rules, 1998 and the Schedule to NEPRA (Fee Pertaining to Tariff Standards & Procedure) Regulations, 2002 as amended.

Simultaneously, we are also applying separately for the grant of Generation License to the Authority for the same generating facility. We request that both of these applications may kindly be processed simultaneously to meet up the timeline.

It is also added that the said petition has been vetted by the professionals of WPPO (WAPDA) for the authenticity of the format, parameters & tariff structure mentioned in the petition being submitted to NEPRA for determination.

However, in case any further clarification or information is required by the Authority to process the subject application for determination of EPC Tariff, may kindly be intimated promptly.

Yours Sincerely,

For PPDCL

Encl: One original and two copies of Tariff Petition

Certified Copy

BOOK Nº 01587

CHEQUE Nº 158688

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Payee's A/c only

GOVERNMENT OF THE PUNJAB

OFFICE OF THE
Project Director
Punjab Power Management Unit
Government of the Punjab

ASSIGNMENT ACCOUNT CHEQUE

Assg. A/c No: 73

DATED 11-03-2014

To the STATE BANK OF PAKISTAN / NATIONAL BANK OF PAKISTAN TREASURY OR SUB-TREASURY OFFICER Main Branch, Lahore

Pay to National Electric Power Regulatory Authority (NEPRA) or order

Rupees Two Hundred Sixty Two Thousand Four Hundred Thirty Two only

and charge the same against the account of Tariff Petition Fee for PHP

Rs= 262432/=

Project Director
Punjab Power Management Unit
Government of the Punjab

Assistant Director
Punjab Power Management Unit
Energy Department
Government of the Punjab

N.B. THIS CHEQUE IS CURRENT FOR THREE MONTHS ONLY AFTER THE MONTH OF ISSUE.

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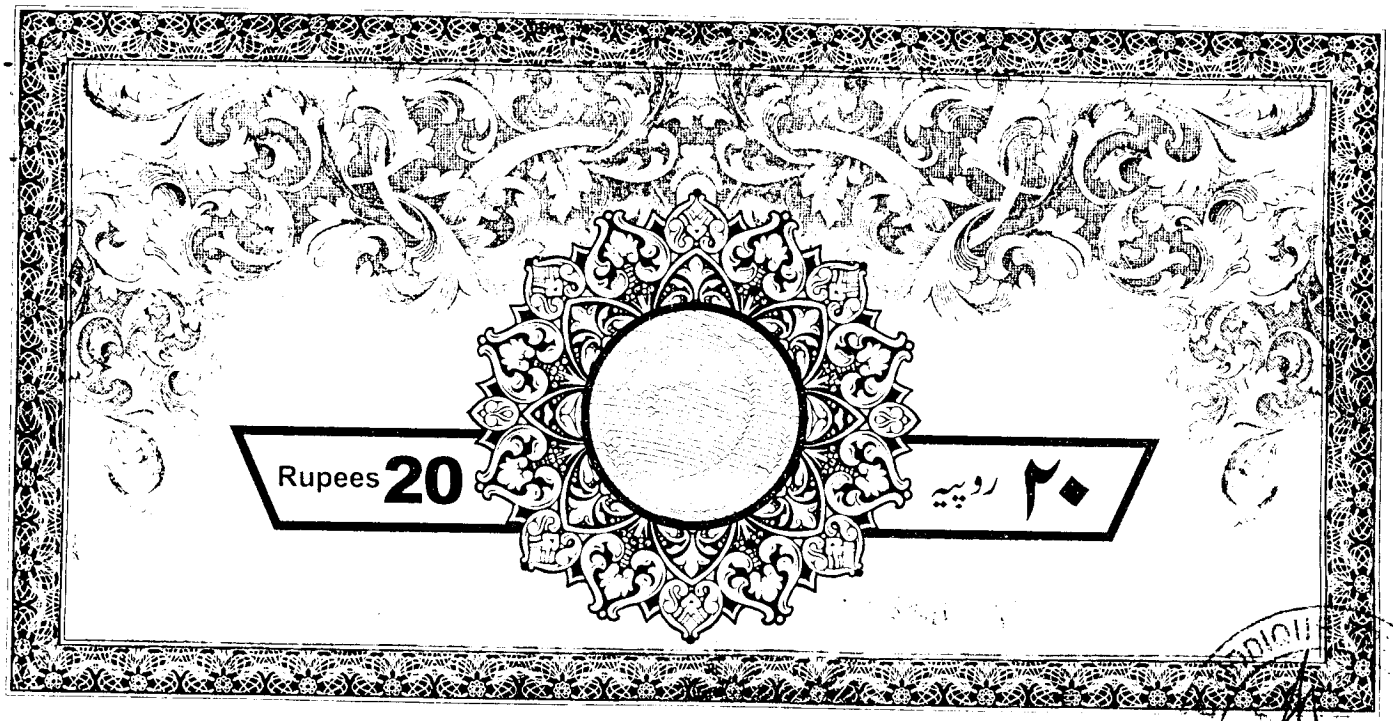

BEFORE THE NATIONAL ELECTRIC POWER REGULATORY AUTHORITY (NEPRA), ISLAMABAD

AFFIDAVIT

Tariff Petition for Determination of EPC Stage Tariff for 2.82 MW Hydropower Project at Pakpattan

1. I, Liaqat Iqbal s/o Mian Ali Muhammad, Project Director, Punjab Power Management Unit, Energy Department, Government of the Punjab, 77 Shah Jamal Colony, Lahore, Deponent, do hereby solemnly affirm and declare that :-

a) I am the Project Director, Punjab Power Management Unit (PPMU), the authorized representative of the Company "Punjab Power Development Company Limited" (PPDCL) designated by Board of Directors of PPDCL in its 26th meeting dated January 31,2014.

b) The contents of the accompanying Petition dated March 17, 2014 for Determination of EPC Stage Tariff for 2.82 MW Pakpattan Hydropower Project (PHP) by NEPRA including all documents-in-support are true and correct to the best of my knowledge and belief , and that nothing material or relevant thereto has been concealed or withheld therefrom;

c) I also affirm that all further documentation and information to be provided by me in connection with the aforesaid Petition shall be true and correct to the best of my knowledge and belief.

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RESOLUTION COPY

Flag A-1

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No. PPDCL/ 1845 /2014

PUNJAB POWER DEVELOPMENT COMPANY LTD
Energy Department, Government of the Punjab
77- Shah Jamal Colony, Lahore 042-99239871

Dated 04 / 03 /2014

To

The Registrar,
National Electric Power Regulatory Authority (NEPRA)
Islamabad

Sub: **RESOLUTION OF BOD**

The Punjab Power Development Company Limited (PPDCL) has been established under the aegis of Government of the Punjab, Energy Department, in pursuance of Section-32 of the Companies Ordinance-1984. The Board of Directors of PPDCL during its 26th Meeting held on 31st January, 2014 has resolved as under:

"Resolved to authorize the Project Director, Punjab Power Management Unit of Renewable Energy Development Sector Investment Programme (REDSIP)of Asian Development Bank to file applications for Generation License and Tariff Petitions with NEPRA on behalf of PPDCL"

Certified Copy

(Ikram Naveed)
Company Secretary

C.C

1. P.S to Additional Chief Secretary (Energy), Govt. of the Punjab, Lahore
2. Chief Executive Officer, PPDCL
3. Project Director , PPMU
4. Master File

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04/03/2014

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BEFORE

THE NATIONAL ELECTRIC POWER REGULATORY AUTHORITY (NEPRA)

TARIFF PETITION

ON BEHALF OF

PUNJAB POWER DEVELOPMENT COMPANY LTD

ENERGY DEPARTMENT, GOVERNMENT OF THE PUNJAB

FOR

DETERMINATION OF EPC (ENGINEERING, PROCUREMENT, CONSTRUCTION) STAGE TARIFF FOR SUPPLY OF ELECTRIC POWER FROM 2.82 (GROSS) MW PAKPATTAN HYROPOWER PROJECT

AT

PAKPATTAN CANAL, PAKPATTAN, PUNJAB

Certified Copy

March 17, 2014

PUNJAB POWER DEVELOPMENT COMPANY LIMITED
77 SHAH JAMAL COLONY, LAHORE
TEL: (042)337578142
FAX: (042)37584018

Compliance with NEPRA (Tariff Standards & Procedure) Rules 1998		
S.No	**NEPRA Rule**	**Description**
1.	Rule 3(1)	Tariff Petition Fee of Rs.262,432/= (covering CPI indexation attached)
2.	Rule 3(2)(a)	Name of Petitioner Mr. Liaqat Ali Project Director Punjab Power Management Unit 77 Shah Jamal Colony , Lahore
3.	Rule 3(2)(b)	Grounds and Facts Provided in detail in this Tariff Petition
4.	Rule 3(2)(c)	**RELIEF SOUGHT:-** The petitioner requests the National Electric Power Regulatory Authority (NEPRA) to kindly approve / determine the followings:- **a.** EPC stage Tariff for Pakpattan Hydropower Project, 2.82 MW (Gross) for a period of 30 Agreement Years from the Commercial Operation Date (COD); **b.** Provisions for adjustments of Tariff at COD stage and for the Cost Re-openers specific to hydropower projects as per laid down standard mechanism i.e. • Adjustment due to Custom Duties and Interest During Construction • Adjustment in Project Cost due to Variations in US$/Rupee Parity • Adjustment in Return on Equity During Construction on the basis of actual drawdown as well as 30 months prior to date of construction start on the analogy of other IPPs as allowed by Ministry of Water and Power vide its letter NO. 7(32)/92-P-II dated 30th July 2009. • Adjustment in Project Cost due to variation in US$/Yen Parity • Adjustments due to all costs associated to Resettlement • Onetime Adjustment in EPC Cost for Civil Works Cost like variations and Enhanced Security Measures for Contractor (Chinese) • Any other item specific to hydropower projects etc. **c.** Adjustment/indexation of Tariff components over the period of thirty (30) years and approval of other salient terms and conditions of the Power Purchase Agreement. • Variable and Local Fixed Energy Charge to be indexed on Inflation Adjustment Factor for WPI • Foreign Fixed Energy charge to be indexed on Pak Rupee Parity Exchange Rate with US Dollar and US CPI; • Insurance Component will be indexed changes in foreign currency exchange rate. • Reference Foreign Debt Interest using Foreign Loan Interest Adjustment Factor at COD

		d. All eligible pass-through items shall be payable by the Power Purchaser to the Company on the basis of actual costs incurred by the Company or to the extent that the Company is obligated pursuant to the Laws of Pakistan to make payments Pass-through items like withholding tax, Worker's Welfare Funds, Sales Tax, Excise Duty, levy, Charge surcharge, cost to be incurred on protective devices etc.
5.	Rule 3(2)(d)	Not Applicable
6.	Rule 3(2)(e)	Not Applicable
7.	Rule 3(2)(f)	Provided in detail in attachments to Tariff Petition
8.	Rule 3(8)	Affidavit is attached

Glossary

ADB	Asian Development Bank
BOOT	Build, Own, Operate and Transfer
COD	Commercial Operation Date
CP	Capacity Charge
CPPA	Central Power Purchasing Agency of NTDC
CPI	Consumer Price Index
Cusec	Cubic Foot Per Second
DSRA	Debt Services Reserve Account
ECNEC	Executive Committee of National Economic Council
EP	Energy Charge
EPC	Engineering, Procurement and Construction
GOP	Government of Pakistan
GOPb	Government of the Punjab
GST	General Sales Tax
GWh	Giga Watt hours=1000,000 KWh
IA	Implementation Agreement
ICB	International Competitive Bidding
IDC	Interest During Construction
IPP	Independent Power Producer
IRR	Internal Rate of Return
ISO	International Organization for Standardization
Km	Kilometer=1000 meters
KV	Kilovolt=1000 volts
KVA	Kilovolt ampere
KW	Kilowatt=1000 watts
KWh	Kilowatt hours
LARP	Land Acquisition & Resettlement Plan
LIBOR	London Inter-Bank Offered Rate
LOI	Letter of Interest
LOS	Letter of Support
LV	Low Voltage
m3/s or Cumecs	Cubic Meters per second
MAF	Million Acre Feet
MVA	Megavolt Ampere=1000 kva
MW	Mega Watt
MWh	Mega Watt hours=1000 KWh
NEPRA	National Electric Power Regulatory Authority
NPV	Net Present Value
NTDC	National Transmission and Dispatch Company
O & M	Operation & Maintenance

PHP	Pakpattan Hydropower Project
POE	Panel of Expert
PPMU	Punjab Power Management Unit
PPTA	Project Preparation Technical Assistance
PKR or Rs.	Pakistani Rupees
PPA	Power Purchase Agreement
PPDB	Punjab Power Development Board
PPIB	Private Power and Infrastructure Board
REDSIP	Renewable Energy Development Sector Investment Program
ROE	Return on Equity
PPC	Pakpattan Canal
USD or US$	United States Dollar
US C or c	United States Cent
VLH	Very Low Head
WPI	Wholesale Price Index

Table of Contents (Pakpattan HPP)

A. INTRODUCTION

Rule 3 EPC stage Tariff Petition **(the "Tariff Petition")** under Rule 31 of the Regulation of Generation, Transmission and Distribution of Electric Power Act 1997 (XL of 1997) **(the "Act")** read with Rule 3 of the National Electric Power Regulatory Authority (Tariff Standards and Procedure) Rules, 1998 **(the "Tariff Rules")** for determination of generation Tariff.

Rule 3(2)(a) **Petitioner's Name and Address**

Mr. Liaqat Ali
Project Director
Punjab Power Management Unit
Government of the Punjab
Tele: 92-42-37578145
Fax: 92-42-37584018

Authorized Representatives

1. **Mr. Muhammad Yaqoob**
   General Manager Hydropower
   Punjab Power Management Company Limited

2. **Mr. Ehsan- ul- Majeed Khan**
   General Manager Procurement & Contract
   Punjab Power Management Company Limited

3. **Mr. Ikram Naveed**
   Chief Financial Officer (CFO)
   Punjab Power Management Company Limited

4. **Mr. Waheed Ahmad Bhutta**
   Director / Economist/Tariff Specialist
   Punjab Power Management Unit
   Government of the Punjab

Company Registration No. 0064048

Rule 3(2)(a) **Generation License**

Application for grant of Generation License is being submitted separately for approval.

Rule 3(2)(b) **Grounds**
Grounds forming the basis for the petition are elaborated in this -Petition.

Rule 3(2)(c) **Relief Sought**
Relief sought is mentioned in Para 17 of this Tariff Petition.

Rule 3(2)(f) **Summary of Evidence**
A brief detail of technical and financial data, which forms the basis of Tariff Petition, is given in the subsequent Paras.

B. GROUNDS FOR PETITION

Under the "Regulation of Generation, Transmission and Distribution of Electric Power Act (XL of 1997), hereinafter referred to as the NEPRA Act, National Electric Power Regulatory Authority (NEPRA) is responsible, inter-alia, to determine tariffs, rates and other terms and conditions for the supply of electric power services by the generation, transmission and distribution companies in Pakistan and to recommend to the Federal Government for formal notification. NEPRA is also responsible for determining the process and procedures for reviewing and approving tariffs and tariff adjustments etc. up to end consumers.

Punjab Power Development Company Limited hereinafter referred as **the "Company" or (the "PPDCL")** is a Company fully owned by the Government of the Punjab and registered under the Companies Ordinance 1984. **The Company intends to set-up 2.82 MW (Gross) hydropower project in the Punjab Province for taping the potential of electricity generation in the province and also to act as a catalyst between private sector and the government for the development of energy sector.** The Company will also be responsible for the operation and maintenance of five hydropower projects namely Marala, Chianwali, Deg-Outfall, Pakpattan and Okara HPPs being implemented under a Loan (PK 2286) from Asian Development Bank (ADB). This loan / program is intended to exploit the hydro potential of Renewable Energy resources in the Punjab and the province of Khyber Pakhtoon Khawa. Asian Development Bank conducted the feasibility studies through internally engaged consultants and financed from its own resources. Having found the above-mentioned hydropower project sites feasible for developing hydropower projects, they offered a multi-tranche soft loan to Government of the Pakistan for on-lending to concerned projects and provinces declared viable ones for this purpose.

PPDCL is submitting this petition for determination of EPC Stage Tariff based on technical data and the cost estimates, and other assumptions determined through lowest bid obtained through International Competitive Bidding (ICB) process in accordance with the Procurement Rules and Guidelines of Asian Development Bank under Single stage - two envelopes procedures. Eight No. JVs / companies participated in the ICB process and M/s SINOTEC-SHPE-SKAFS (JV), of China and Pakistan was selected and ***awarded the EPC Contract, which became effective on May 28, 2012. The construction has already been started and it is expected that Project will be commissioned in October 2014.***

C. BRIEF DESCRIPTION

(i) ADB Loan and Punjab Power Management Unit (PPMU)

Asian Development Bank (ADB) offered a multi-tranche loan of US$ 500 Million to the Govt. of Pakistan for development of renewable energy resources under Renewable Energy Development Sector Investment Programme (REDSIP). The first tranche of J¥ 5599 million for Punjab, was negotiated in Oct. 2006, however loan was signed on October 5, 2007. Upon approval of PC-Is by ECNEC. Govt. of Pakistan is the "BORROWER" for on – lending to the Govt. of Punjab (GoPb). The GoPb is responsible to share 20% equity in addition to the ADB Loan. The revised allocation of the ADB Loan No. 2286 (OCR) for construction of projects is J¥ 7882 million based on actual bidding and recently the GoPb has made a written commitment to ADB through Economic Affair Division that, in case of any short fall due to depreciation of J¥, the equity will be increased accordingly to complete the implementation of the projects under the REDSIP.

As an advance action, a Project Management Unit was required to be established by ADB prior to Loan signing, so that projects under REDSIP could be taken-up for implementation. Consequently Punjab Power Management Unit (PPMU) was established in May 2007. The approved setup of PPMU as included in the Project Administration Memorandum (PAM), signed between ADB and Government of Punjab is attached. The PPMU is now implementing the Public Sector Projects under the Loan, in the Punjab.

(ii) **ADB Loan and Punjab Power Development Company Limited (PPDCL)**

In addition to PPMU, a corporate entity under the title of Punjab Power Development Company Limited was also agreed to be established under the ADB Loan conditions. Accordingly PPDCL, fully owned by GoPb, has legally been established since Jan. 16, 2008, as required vide "SCHEDULE" of the Project Agreement, between ADB and Govt. of Punjab for Loan 2286/2287-PAK. PPDCL has to take over the REDSIP projects for commercial operation upon completion of construction. The limitation of signing the PPA, as a condition for disbursement of ADB Loan for Generators & Power Transformers, is also expressed in Para 7(b), Schedule-3, of Loan Agreement (OCR).

The Company has also been assigned the development of coal projects on fast track basis in public sector. The Company is registered with Security Exchange Commission of Pakistan (SECP) under the Companies' Ordinance of 1984 and headed by Chief Executive Officer (CEO). For policy guidelines / directions and over-seeing the Company's performance, Government of the Punjab has constituted a Board of Director for this purpose. It has representation of concerned government departments like Finance & Planning & Development Departments and private sector's eminent professionals. The BOD is equipped with suitable administrative and financial autonomy. The functions assigned to PPDCL are:-

1. To develop power projects in Public-Private Partnership (PPP) mode;
2. To arrange funding through loan negotiations or joint venture;
3. To interact with all stakeholders; WAPDA and Federal Government;
4. To negotiate tariff with NTDC (WAPDA) or other buyers of energy;
5. To attract private sector to form joint venture for development and / or operation & management of power projects.

In order to achieve the targets, Government of the Punjab has provided all inputs to the PPDCL particularly the human inputs at specialist level in all disciplines of energy production and management. This includes the discipline of hydro- thermal etc. under the function enlisted at serial no.5 above, all the sub-projects of hydropower of REDSIP would be handed-over to PPDCL for operation and maintenance.

D. ENERGY DEPARTMENT, GOVERNMENT OF THE PUNJAB

Electricity as a subject has been dealt with by the Power Wing of Irrigation & Power Department, Government of the Punjab. The Power Wing primarily dealt with regulatory aspects of electricity distribution, adjudication of consumers versus supplier disputes and safe by aspects of electrical installations at public and private buildings. The generation side of electricity remained the domain of Pakistan Water and Power Development Authority **(WAPDA)**, a Federal Government owned entity, but licensed by the Provincial Government to distribute electricity in the province in terms of the

provisions of Electricity Act 1910. This arrangement remained effective up to 1997. Thereafter, NEPRA was constituted under National Electric Power Regulatory Act 1997 by the Government of Pakistan and made responsible for regulating electricity business through mechanism of grant of licenses, tariff determination and safeguarding the rights of the consumers.

Government of the Punjab decided to play more pro-active role in energy sector to surmount the challenges of energy deficits and to mitigate its adverse impacts on provincial economy. In order to achieve this target, Power Wing of Irrigation & Power Department was transferred into full-fledged independent administrative department i.e. Energy Department as compatible institutional framework with gigantic task of energy sector development along with attachment of PPDCL, PPMU and Punjab Power Development Board (PPDB) with the newly created Energy Department. Further in line with this policy, the post of Secretary Energy has been up-graded to Additional Chief Secretary Energy. It is hoped this would provide necessary impetus and required administrative ease. The responsibilities assigned to this administrative set-up include:

- Updating of power policy;
- Legislation, policy formulation and sector planning;
- Matters under Article 157, 158 and 161 of the Constitution and policy making for the province in respect thereof;
- Development of power generation by exploiting hydro , thermal and renewable energy resources;
- Conservation of energy , efficiency measures, energy audits policy making thereof;
- Standardization of specifications of electric appliances, machinery and installations;
- Matters related to Punjab Power Development Board and Punjab Power Development Company Limited;
- Off-Grid distributed power generation;
- Administrative control related to work of Electric Inspectors;
- Incorporate option of bulk purchase/sale to NTDC/CPPA/DISCOs;
- Define mechanism for dispersal of power from provincial sponsored projects through the transmission/distribution owned by NTDC/DISCOs;
- Articulate Public Private Partnership (PPP) modality and define equity participation by Government of the Punjab in PPP projects;
- Define terms for access to Government Power Guarantee Fund and Power Sector Development Fund; and
- Define terms for community based power generation plants.

1. HYDRO-BASED POWER GENERATION

Water is the most essential natural resource next to the air, a basic human need and the most important input for all human development activities and obviously is considered very

precious and scarce natural resource. Hydropower is a renewable, non-polluting and environmentally benign source of energy. It is perhaps the oldest renewable energy technique known to mankind for mechanical energy conversion as well as electricity generation. Hydropower represents use of water resources towards pollution free energy due to absence of fossil fuel with mature technology characterized by highest prime moving efficiency and spectacular operational flexibility.

Punjab is pre-dominantly agriculture-oriented province and 70% of its rural population largely depends on agriculture for its livelihood. To irrigate its fertile land, the world's largest contiguous 36,000 km long canal system distributes water through the length and breadth of the province. The irrigation water is delivered to the fields through a network of barrages, main canals, branch canals, distributaries, minors, sub-minors and outlets.

The Punjab Irrigation Department, established in 1864, is operator of this vast system. This system is more than century old and it is difficult to imagine today to develop such a system of high level strength and utility. The system works through gravity flow from north to south and every canal is designed to have falls at regular interval to maintain the velocity of water flows. Naturally, these falls possess the potential for power generation. The government through Energy Department Punjab is making all out efforts to utilize these falls for power generation. It is pertinent to mention here that in Punjab and Sindh, having vast plains, the head / fall of canals and barrages ranges between 0.5 meters to 5 meters as against the high head/fall found in the province of KPK and Azad Kashmir or GB being mountainous areas. It is also important to mention here the low/very low head technology is comparatively very expensive. The low head in the Punjab sometimes necessitates the combination of falls to achieve essential head for utilizing the proven technology. Of course, this makes imperative to undertake additional civil works etc making these projects more expensive.

2. JUSTIFICATION FOR HYDROPOWER PROJECTS

There exists great need for electricity both for economic and social advancement of the country. However, our country is facing a huge electric power crisis now a day. This crisis appears insurmountable in the near or even long-term future, unless proper understanding and correct policy is undertaken on priority basis. The installed capacity of the country as on July 1, 2011 was 23,412 MW whereas the available capacity was 19,669 MW. Out of total installed capacity, 16,070 MW (68.64%) is thermal, 6,555 MW (28.00%) is hydro and 787 MW (3.36%) is nuclear. The electricity generated during financial year 2010-11 was 101,699 MkWh denoting under utilization of available capacity significantly. The main reason for non-utilization of total available capacity was the shortage of gas and problems to finance the purchase of furnace oil because its price is increasing frequently and abnormally. This state of affairs is resulting into long load shedding across the country.

It is important to understand the consequences of the prevailing situation. On December 16, 2013, the price of furnace oil was Rs. 94,712/M.Ton (i.e. Rs.94.712/kg). Tentatively, one kg of furnace oil produces 5.38 units / kWh of electricity. Thus, cost of furnace oil for generating one unit of electricity gone up to Rs. 17.60 during the year. On top of this, fixed & variable cost of a thermal plant worked out to be about Rs.3.50/kWh. Therefore, one unit (kWh) of the electricity produced by all thermal plants using furnace oil is approximately Rs.21.10 / kWh. Conversely, on average a consumer was charged Rs.7.78/kWh during the last financial year.

Based on above analysis even without taking into account for simplicity, transmission and distribution cost (including losses); the differential between consumer end average tariff and the cost of furnace oil based-electricity generation is Rs. 12.82/kWh. This variation results into deficit of approximately Rs.450 billion per year, which resulted into a Circular Debt. Ultimately Federal Government bears this deficit through subsidy at the cost of bills of paid by law-abiding electricity consumers. This deficit is somewhat reduced because of cheap power generation through hydel energy and natural gas, but the deficit cannot change substantially, unless bulk of electricity is produced through hydel energy. Obviously immense deficit cannot be sustained, the government does not have resources to pay such a huge subsidy; it is also not feasible to increase the power tariff very much. Therefore, the power crisis is far greater than what is being perceived. In the absence of extremely heavy subsidy, power utility is delaying payments to IPP (Independent Power Producer) as well as Gas and Fuel supply companies. The result is that IPPs are now producing much less electricity than their available capacity.

The current energy deficit or high electricity price has severe detrimental effect across the economy. The situation calls for concerted short-term, medium-term and long-term actions to surmount this grave problem. During financial year 2010-11, the share of electricity generation from oil, gas and coal has remained 55.07%, 44.73% and 0.20% respectively. To any planner, it should be obvious that the country cannot afford thermal based electricity generation. Keeping in view, rising prices of oil and non-availability of gas for electricity generation, indigenous resources of power generation like Hydropower will have to be developed immediately on war footing basis. In addition to be cheaper in relative terms, it is also environment friendly and sustainable because of natural resource of the country.

Contrary to hydro potential of around 50,000 MW in the country, the installed hydropower capacity does not exceed 6,555 MW (approximately). The share of existing hydro-based installed capacity to the total installed generation capacity of the country is only 28% as compared to 67% during the year 1985. Most of the installed hydro-based capacity is owned by residual of WAPDA.

Prevalent power crisis is grossly devastating due to very high oil prices, and the country has to prepare itself at least for the next several years to somehow cope with it. Unless dependence of electricity generation on oil is substituted with more economical energy mix through exploitation of indigenous/cheaper resources of energy either through domestic coal, biomass, wind, Solar etc and focusing of full attention on hydro based electricity generation, there does not seem to be any short-term "off-the-shelf" solution of this crisis. This transpires that final solution lies depending on the hydropower renewable energy. Moreover, it may also be understood vividly that given the difficulties of private sector in this arena, it appears plausible solution that public sector should also contribute to overcome power deficits.

Pakistan is blessed with World's highest mountain ranges of Himalya, Karakoram and Hindukush in the Northern Areas of Pakistan (KPK and GB) and Azad Jammu and Kashmir (AJK). These mountain ranges also contain seven largest glaciers of the World. Several rivers have also their origin in these mountain ranges; fully covered with snow throughout the year in some areas. The Indus basin and its five rivers, form the Indus basin valley, which ultimately drain into Arabian Sea at Karachi. The slope of rivers and its tributaries / nullahs in the hilly area is quiet steep and flow is perennial in the large rivers and tributaries due to snowy catchment of highest peaks. Due to the availability of the perennial flows and the river system, there exists World's largest gravity flow Irrigation system in Punjab and Sind. Moonson and seasonal rains also increase and establish the perennial flow pattern in the river system. Due to these facts, there are so many large dams and hydropower sites and even several hydropower projects can be

built without dams; as run - of - river schemes. The firm assessment of hydropower potential, based on the projects identified so far is more than 50,000 MW.

Large Tarbela and Mangla Dams with hydropower plants were constructed upto 1980s and several other large dams and hydropower schemes were also planned but, un-luckily, could not be implemented due to political constraints. Resultantly the country has to depend upon thermal and other imported fuel based solutions which is un-economical and un-reliable. The hydel - thermal energy mix as planned in 1980s as 65:35 % has badly been disturbed and is now a days 28:72 %. Due to this abnormal energy mix of un-affordable solution, the energy prices have been increased beyond limits, and the whole economic and financial scenario of the country and industry has badly been disturbed.

In view of the facts as narrated above, and especially when the cheapest and sustainable renewable, indigenous resources of large dams and run- of- river hydropower schemes are not being implemented as planned; it is a dire need to focus all possible renewable and indigenous resources like hydropower potential on barrages and canal system of Punjab, Sind and KPK, where several waterfalls, though of very low head, exist which can be developed to exploit as cheaper, sustainable renewable and indigenous resource.

Accordingly Govt. of Pakistan and Provinces of KPK and Punjab signed a Loan Agreement with ADB for REDSIP so that the renewable hydropower potential on canal falls could be developed and added to the system to contribute the national efforts for overcoming the energy crisis and to enhance the sustainable renewable, indigenous resources of the country / provinces.

3. HYDROPOWER POTENTIAL IN PUNJAB

According to WAPDA's assessment made in year 2000, there are 317 hydel sites with potential of generating 600 MW in the Punjab. In Punjab and Sind, the hydropower potential exists on canal falls of irrigation system only. Out of 317 sites in Punjab, 48 sites are preferred sites having hydropower potential of 2 MW and more. The falls on canals and barrages of Punjab and Sind, range from 0.5 m to 5 m, most of which cannot be developed as a single fall hydropower project. Therefore combination of falls to avail minimum water head of 2 m and above (preferably 3 m and more) for VLH is essential in most of the cases which involves additional costs as compared to high and medium head in other parts of the country. The flow in the perennial canals is available almost in line with design shares, except one month of December, when flow in Rivers and Dams is negligible. Due to perennial flows, defined shares and authentic data of flow (available for years), the plant factors are better and tariff are competitive with limitation of VLH technology.

The Punjab Province is fuel constrained. It has negligible oil and gas reserves of its own. It does have some coal reserves of medium quality and its production is all manual and cannot support large scale coal projects. Owing to this reason the Punjab Province is working on establishment of imported coal-based thermal projects of various sizes. Biomass –based power project, including agriculture waste and municipal solid waste projects, can be utilized for energy generation and total potential of which can be meaningful. This also includes begasse-based plants and sugar mills, as well as agriculture waste-based power projects. Solar resources are indeed practically unlimited but the cost of solar generation is still high compared to other technologies. Wind resources of the province are also minimal, assessment of which is currently underway. On the other hand there exists vast potential under hydro sub-sector.

Private Sector's Constraints In Energy Sector

Private sector has been facing multifarious problems in practical terms in setting up power generation plants in the country. Among others, a few of these are enlisted in below:-

- Lack of Local Manufacturing Facilities and Capabilities: Currently most of the machinery and equipment required for the power generation is being imported from foreign countries. The local manufacturing capability is very limited.

- Expensive Imported Equipments: Since the power project involves multifarious type of imported heavy equipments and machinery, therefore, the power projects require huge amounts of funds.

- Higher Capital Project Cost: Power projects are normally considered very big projects in terms of quantum of funds and gestation period. A large number of components formulate the total cost of the project. They , inter-alia, cover development cost, cost of land & its development, compensation and resettlement cost, civil work, power house, power channel, plant and equipment , spare parts , soil testing, engineering ,consultancy, erection, supervision, import charges, working capital and financial charges. The challenge for the prospective investor is to arrange funds commensurate with project cost.

- Long Gestation/Implementation Period: Power projects normally take longer time for completion besides being capital-intensive. Due to longer completion period time, cost over-runs are inevitable.

- Difficulty in Associating Foreign Equity and Joint Venture Partner: local private investors desirous to establish power generation projects, face problems finding foreign equity or joint venture partners.

- Arrangements for Finances: Sponsors of private power projects are facing great problems in tapping local and foreign currency loans for their projects. The negotiations with local and foreign loan giving institutions involve much time due to which it becomes difficult to achieve financial close timely. On the other hand many foreign loan giving agencies require various types of 'Guarantees'. It is difficult to obtain Supplier's Credit facilities given the country situation.

- Imported Fuel Based Projects: Over time, there is gradual shift in hydro-thermal mix in favor of thermal in general and oil in particular in the country. Resultantly it causes expensive power generation and leading to higher tariff.

- Procedural Rigidities: Currently there exist a number of lengthy, time & money-consuming complicated procedures due to which private investors are problem-stricken. These include the provision of bank guarantees, finalization of project agreement with multitude of government agencies etc.

4. PROJECT DESCRIPTION

Asian Development Bank (ADB) offered a multi-tranche loan of US$ 500 Million to the Govt. of Pakistan for development of renewable energy resources under Renewable Energy Development Sector Investment Programme (REDSIP). The first tranche of J¥ 5599 million

for Punjab, was negotiated in Oct. 2006, however loan was signed on October 5, 2007, upon approval of PC-Is by ECNEC. Govt. of Pakistan is the "BORROWER" for on – lending to the Govt. of Punjab (GoPb). The GoPb is responsible to share 20% equity in addition to the ADB Loan. The revised allocation of the ADB Loan No. 2286 (OCR) for construction of projects is J¥ 7882 million based on actual bidding.

The Feasibility Reports and the original PC-1s were framed by ADB Consultants under PPTA (Project Preparation Technical Assistance) in 2005-06. Management Consultants for REDSIP Punjab were appointed under ADB Loan conditions in 2009-10 and the Feasibility Studies were reviewed by the Management Consultants under their TORs approved by ADB. During review of the Feasibility Studies, the proposed Layouts and Designs of Civil as well as Electro Mechanical Plants (E&M) were thoroughly examined and limitations of the Irrigation Canal System, over looked in the Feasibility Studies, were also considered. The siltation problem in the canal system and its impact on capacity of the canals, in view of some existing hydropower plants on canals since 1960s was also focused. Accordingly workable "Tender Level Designs" for Layouts and appropriate E&M Plant, suitable to the conditions was made, having basic changes in the Feasibility Designs and Layouts. The Tender Documents, based on the Tender Level Designs were framed, and cleared by ADB. Accordingly, International Competitive Bidding (ICB) for EPC/Turnkey Contracts was made as per ADB's Procurement Rules & Guidelines under single stage - two envelopes procedures. Being first experience of EPC/Turnkey Contracts in Punjab, the Chief Minister constituted a Steering Committee (SC), under the Chair of Chainman P&D Board, Punjab with its TORs, as attached. The major TORs of the SC are monitoring the transparency of bidding process and approval of the lowest bids. All the bids have been approved by SC, after clearance / NOC by ADB. The latest revision of the PC-Is has been approved by ECNEC on Oct. 27, 2013 on the basis of actual approved bids as a result of ICB.

The Pakpattan Hydropower Project the instant Project involves a Very Low Head (VLH) proven technology of Pit type turbines (Kaplan) with horizontal shafts and Gear arrangements to have suitable RPMs for generators. The existing head regulator of Pakpattan canal has a net head / fall of 4.43 m and 5.49 m in Kharief and Rabi season respectively and a flow more than 120.6 cumecs, with designed fluctuation, which has been utilized to design the project at d/s of the head regulator at RD-114+000 as by-pass arrangement (Run Of River). The Pakpattan canal is a perennial main canal of Punjab Irrigation system. The generation from the Pakpattan Hydropower Project of 2.82 MW will be injected to the nearby existing Grid at about fourteen (14) Km.

As defined in ADB Loan Agreement, the mode of implementation of the REDSIP is EPC /Turnkey, which in the terms of ADB is "Procurement of Plant, Design, Supply and Install" on Turnkey basis. In EPC mode, the Contractor takes full responsibility of detailed designs, engineering, procurement and construction / commissioning of Plant and carries the associated risks against the offered bid price in view of time schedule as per requirements of sponsors of the Project.

5. PROJECT LOCATION

The Project shall be built on main Pakpattan Canal, which is located in Pakpattan District of Punjab Province. The project site is located at R.D. 114+634 of Pakpattan Canal about 14 km from Pakpattan City on u/s of the city, the district headquarters. Pakpattan is

located along Kasur – Depalpur - Pakpattan - Sahiwal highway and is also connected with Lahore - Multan Highway at Okara (about 180 km from Lahore) through Depalpur town. The project area is accessible from Karachi Port through a good road network of national highways. The road distance between Pakpattan Town and Karachi is about 1,200 km. The project area is linked with Pakpattan town through a 14 km metalled service road along the left bank of Pakpattan canal. Another local road links the project area at Bunga Hayat on mid way of Depalpur and Pakpattan main road. Lahore Airport is the nearest facility to the project area. International and national flights are scheduled from there.

Telephone and telegraph facilities are available in Pakpattan which is connected with other main towns of the country through the nationwide dialing system. International Direct Dialing (IDD) exists, too. Internet access is available with limited speed through the telephone network. Fast speed connections do exist.

5.1 PAKPATTAN CANAL

The Pakpattan Canal is fed from the Sulimanki Barrage and off- takes from the right side of Barrage. The discharges of Pakpattan Canal are controlled by its head regulator. The designed discharge of Pakpattan Canal at its head is 187 m^3/sec. A number of fall structures exist along the canal where hydropower can be developed. The falls at RD 112+350 and RD 124+950 have been selected for combination to construct Pakpattan hydropower project.

6. ENVIRONMENTAL ASPECTS OF THE PROJECT

This project, because of its relatively small size, less than 50 MW, is classified as a category "B" project, in accordance with ADB Guidelines for Environmental Assessment, 2003. An Initial Environmental Assessment (IEE) has been approved by Environmental Protection Department for the Project. The detail environmental assessment and resettlement including mitigation measures and costs for HPP has been prepared.

The PPMU has prepared Land Acquisition and Resettlement Plan (LARP) for Pakpattan Hydropower Project (PHP), The broad objective of this LARP is to describe involuntary resettlement impacts, mitigation measures and compensation of Affected Households (AHHs) in accordance with the ADB's Policy on Involuntary Resettlement and applicable national laws.

The Pakpattan hydropower project with an estimated plant capacity of 2.82 MW will be constructed as a run of the river hydropower project in the power canal in the bypass arrangement at right side of RD 114+000 of Pakpattan canal. The site is located approximately 14 KM from the district town of Pakpattan in Punjab province.

The PPMU has taken all possible steps to minimize the adverse impacts on the local communities in the design and implementation of PHPP, Accordingly, the following specific actions were applied to avoid and minimize the resettlement impacts of this subproject:

- The power house will be constructed on the diversion channel. In this case some land on right side of Pakpattan canal is required on permanent basis for construction of Powerhouse, Headrace Channel, Tailrace channel, Sub stations, Offices & Residences etc.
- The Government land (Auqaf and I&P) will also be utilized for construction of PHPP

Except for land, the subproject will not cause any impacts on farming enterprises (i.e., poultry farms, fruit orchards etc.). The construction of powerhouse complex is entirely in the open land, including private as well as government land where only the agricultural crops and trees will be

affected.

A total of 52.0125 acres of land belongs to private land owners ,3.31 is of Auqaf land and 3.4 acres are possessed by the Punjab Irrigation Department. The total number of Affected House Holds (AHHs) is twenty nine (29)), One is lease holder of Auqaf land and rest of all are landowners, The total population of 29 AHHs is 141 persons. The subproject will also affect a total of 206 wood trees. No houses or shops and any community structures will be affected.

A resettlement plan investigation was also undertaken. There are no private encroachers and informal occupants. Overall LARP (Land Acquisition & Resettlement Plan) costs amount to Rs. 86.00 millions has been prepared for implementation.

There are no identified impacts affecting either archaeological sites or wildlife. Because of the existing falls in the canal system and because of the annual closure regime of the canal system, there are no significant fisheries and the project will have no impact on fish. The impacts identified in this LARP are mostly due to the construction related activities, some temporary loss of land and trees for which compensation and mitigation measures have been proposed.

6.1 Social Benefits:

The project will save substantial amount of precious foreign exchange annually that would otherwise be required for import of oil needed for an equivalent thermal plant. The revenues of the government would increase due to direct and indirect taxation, duties and levies on the production of goods and services that will result from the power generation benefits within the project area as well as from the electricity duty collected by the Federal Government, Government of Punjab or any other agency. Sale of electricity is the direct revenue which will be collected by Energy Department, Punjab.

Indirect or the secondary benefits would include creation of employment opportunities and improved standard of living of the people of the area and vicinity. There will be multiple effects on socio-economic development of the region as well. Communication, infrastructures, livestock, forestry, cottage industry, livestock development and other opportunities would open up with construction of the proposed project. Most of the indirect benefits are difficult to quantify in monetary terms but should not be ignored while making the decision for the implementation of the Project.

7. SCOPE OF PROJECT

7.1 Technical Parameters

Following are technical parameters of the project:-

- **Capacity** **2.82 MW**
- **Auxiliary Consumption** **1%**
- **Net Capacity** **2.79 M**
- **Net Annual generation** **21.67 GWh**
- **Number of Units** **2**
- **Design Head** **4.20 meter**
- **Unit discharge** **40.0 Cumecs**

As the "Contract Format" is "EPC/T", therefore, the final design will be the responsibility of the Contractor. The Civil Works for the hydropower project shall be designed, procured, constructed, tested and commissioned in accordance with these requirements. The Contractor shall be responsible for all aspects of design and construction of the civil works in accordance with the design criteria and specifications and in accordance with additional, and supplementary design criteria and specifications prepared by the Contractor and accepted by the Employer.

The scope of Pakpattan Hydropower Project consists of following main components:

7.2 Major Civil Works

The Scope of Civil works activities start from the fall structure at RD 112+350 to the fall at RD 124+950 of the Pakpattan Canal system. The hydropower project mainly consists of combination of two falls to utilize the head for energy output. A power canal (in a bypass arrangement) situated at right side of Pakpattan Canal shall be constructed between the two fall structures and the power house will be constructed approximately midway (opposite Rd 114+000 of Pakpattan Canal) in the power canal. It includes intake section, gated spillway, power house and tail race section etc. The bed level and the embankment of the power canal upstream of power house shall be constructed to the existing level upstream of the fall structure at RD 112+350. The power canal downstream of the power house shall be designed and constructed to the bed level downstream of the fall structure at RD 124+950.

- Construction of power canal works in by-pass arrangement between R.D 112+350 to RD 114+634 on right side of Pakpattan Canal.
- Construction of tail race canal works in by-pass arrangement between R.D 114+634 to 116+302 on right side of Pakpattan Canal.
- Raising of existing Pakpattan Canal embankments from Upstream of Powerhouse Location up to R.D 112+350 according to remodeled cross sections.
- Excavation of Pakpattan Canal from downstream of Powerhouse to R.D 124+950 according to remodeled cross sections.
- Construction of new District Road Bridges adjacent to the existing Fall structures and Village Road Bridges at R.D 112+350 and R.D 124+950 of Pakpattan Canal and dismantling the existing Fall cum Bridge at the same R.Ds'
- Gated Spillway structure with Service Bridge.
- Construction of protection works for sub Project area including sub-station etc.
- Powerhouse buildings and ancillary structures including Machine Hall, Control Building, Intake and outlet bays with cut-offs, and retaining walls etc.
- Paving of 4.5m wide access road with double surface treatment.

- Office and Residences for the Employer and Contractor's temporary Colony and infrastructure.
- Supply of vehicles for the Employer and Management Consultants
- Ancillary and environmental works necessary for the proper operation of the Project.

7.3 Major Electrical and Mechanical Equipment

- Two (2) sets of double regulated horizontal shaft Kaplan turbines, each 1.48 MW, with a rated head of 4.2 m, rated flow of 40 m^3/s complete with all auxiliary equipment including regulating gear, turbine casing, guide vanes, thrust and guide bearings, etc
- Two (2) sets of digital electro hydraulic governors with P.I.D. control complete with all accessories including governor oil pumps, pressure tanks and air compressors
- Two (2) sets of draft tubes with 2 hydraulically operated roller gates
- Two (2) sets of power intake trash racks and stop logs
- Power plant mechanical auxiliaries including, station drainage system, turbine dewatering system, station water services, compressed air services, station HVAC system, oil handling facilities, fire fighting protection and detection system. These should also include miscellaneous mechanical auxiliary equipment such as mobile air compressors, oil filters and submersible pumps for emergency duties
- One 15 ton powerhouse overhead bridge crane
- Two (2) trash rack cleaning machine, capacity: 0.5 ton and 2 m3 volume each
- One 15 ton mobile crane and one 10 ton truck trailer
- Hydraulically operated spillway gates and two (2) sets of stop logs for spillway
- Two (2) sets of flow measuring equipment for turbines
- One (1) set of headrace and tailrace water level measuring equipment
- Two (2) sets of synchronous generators each rated at mcr of 1.76 MVA, 6.3 kV, 0.8 p.f. and 750 rpm complete with excitation transformer, static excitation and AVR equipment current transformers, potential transformers, lightning arrestors and all standard auxiliary equipment and accessories
- Two (2) sets of generator neutral earthling enclosures including neutral earthling transformers, current transformers, and accessories.
- Two (2) sets of generator transformer main connections / XLPE cables with complete termination kits and accessories
- Two (2) numbers each 1.76 MVA, 6.3 kV/11 kV, ONAN cooled, step-up generator transformers fitted with all standard auxiliaries, CTS, PTS, lightning arrestors etc
- Two (2) sets of protection relays and equipment along with all auxiliary equipment, mounting racks and cabinets for complete protection of generators and generator transformers, and connected equipment
- Two (2) sets of metering equipment complete with mounting racks and cabinets
- One (1) set of metal clad 11 kV switchboard comprising withdrawable circuit breakers, load break fused switches, fuses, CTs, PTs, protection and metering equipment, synchronizing equipment, complete in every respect for all incoming and outgoing feeders.
- A complete set of auxiliary power supply system comprising 300 kVA, 11/0.4 kV station and auxiliary transformers, air circuit breakers, 400V auxiliary boards and one (1) standby diesel generator all with complete protection and metering

- Lightning arrestors and potential transformers for 11 kV outgoing lines to WAPDA grid station
- Sets of 110 V main station batteries with chargers complete with fuses, MCCBs and mcbs, bus bars with protective and alarm system
- 11 kV, 400 V/230 V AC power and 110V DC cables, multi core protection, control and communication cables for the power plant
- Power plant lighting and small power system with normal and essential lighting and emergency lighting
- Complete earthling system network comprising earthing meshes, earthing rods, interconnecting earthling conductor and cables and all fittings, clamps and appurtenances for connecting with the draft tubes, power intake and spillway structures, transformer bays, switchgear including all risers and equipment earthing
- All equipment including conductors, spikes and ancillaries for all the project installations and buildings for lightning protection
- Computerized control and monitoring for the project
- Telecom system including internal intercom facilities within the project, PABX with 3 trunk lines for public network connection and 30 extensions and pilot cable between the power plant and the WAPDA grid station for speech and inter tripping / alarms, all complete with telephone sets, modems, intercommunication equipment and DC uninterruptible power supplies
- Mimic diagrams in the central control room depicting electrical quantities, flows, levels measurements, spillway gate positions and auxiliary power supply system etc
- Sequential events and data recording systems
- All interfacing equipment and materials which are necessary for smooth and proper working of the plant whether specifically mentioned in the tender documents or not, but which are essential for the well coordinated working of the power plant
- Station potable water, sanitary and sewerage system
- Workshop with all necessary machine tools and equipment for the maintenance of the power plant
- 400/230 V overhead distribution line between powerhouse and colony
- Spare parts storage facilities
- Spare parts, erection and testing equipment

7.4 INTERCONNECTION WITH NATIONAL GRID

Design and construction of Transmission Line (TL) according to WAPDA specifications and the connectivity of the power generating facility at Pakpattan to the nearest Grid, is the exclusive responsibility of the Contractor under the provisions of the EPC / Turnkey Contract. Conducting the load flow, short circuiting and dynamic stability studies for the smooth connectivity of power house with the MEPCO's Grid at Pakpattan through 11KV transmission line of about 14 Km is also the scope of work of the EPC/Turnkey Contractor including survey of the project area and erection / construction of TL. In addition to TL and interconnection, the contractor will also make assessment and provide additional machinery & equipment required for proper inter-facing at Grid.

7.6 SALIENT FEATURES OF THE PROJECT

The salient features of the Project are summarized as below in tabulated form:-

Sr. No.	Features	Details / Description	
1.	Location	District Pakpattan, Punjab	
2.	River System	Pakpattan Canal System Near fall structure at RD 112+350	
3.	Discharge	Mean Monthly: Total Annual Average:	65.6 m^3/s 2,069 10^6 m^3/y
4.	Main Structures	Design Discharge: Maximum Discharge:	80 m^3/s 112.6 m^3/s
5.	Spillway	Design Discharge: No. of Bays: Type: Sill Level: Design Pressure at Sill: Height: Width:	112.6 m^3/s 4 Nos. Broad crested with radial gates 166.074 masl 1.856 m 1.856 m 8.10 m
6.	Trash Racks	Width: Height: Inclination: Bar Distance:	7.00 m 9.164 m 80° 70 mm
7.	Stop Logs	*Intake* Width: Height: *Spillway* Width: Height:	 7.80 m 6.10 m 8.70 m 2.456 m
8.	Draft Tube	Units: Type: Head on Sill: Height: Width:	2 Roller Gates 6.747 m 4.555 m 6.902 m
9.	Headrace Channel	Water Level at Entrance: Canal Width: Flow Depth: Bed Slope:	167.930 masl 53.95 m 2.59 m 0.000125
10.	Power House	Powerhouse Level: Machine Hall Length: Machine Hall Width: Machine Hall Height:	165.273 masl 36.55 m 16.55 m 12.5 m
11.	Tailrace Channel	Bed Level: Canal Width: Flow Depth: Bed Slope:	161.483 masl 45.72 m 2.59 m 0.000125

Sr. No.	Features	Details / Description
12.	Nominal Head at Maximum Power Output	Headrace Water Level: 167.930 masl Max. Tailrace Water Level: 164.073 masl Min. Tailrace Water Level: 162.136 masl Maximum Gross Head: 5.49 m Minimum Gross Head: 4.43 m Head Loss: 0.06 to 0.19 m
13.	Hydro-mechanical Equipment	Type of Turbine: Hor. Shaft Kaplan Units: 2 Rated Flow for each Unit: 39.76 m^3/s Capacity: 1.505 MW Rotational Speed: 173.6 rpm Rated Head: 4.20 m
14.	Electrical Equipment	*Generator* Unit: 2 Speed: 750 rpm Capacity: 1.7625 MVA *Transformer:* *6.3/11 kV* *Switchgear:* *11 kV*
15.	Power and Energy	Power: 2 x 1.505 MW Mean Annual Energy 20.86 GWh

7.7 Plant Details other Details

1. General Information

- Name of Applicant ..... Punjab Power Development Company Limited (PPDCL)
- Address of the registered office..... 77-Shah Jamal Colony, Lahore
- Plant Location..... District Pakpattan
- Type of Facility ..... VeryLow head Hydropower Project

2. Plant Configuration

- Low Head Hydropower turbines
- Capacity of the Power Plant..... 2.792 MW (Net Power Output)
- Type of Technology..... Low head hydropower generation
- Number of Units / Capacity..... 02
- Power Plant Make and Model..... Low Head Kaplan Pit Type Turbines
- Commissioning Date ..... October 2014

3. Fuel Details

- Type of Fuel..... Hydropower Generation
- Fuel (Imported / Indigenous) ..... Indigenous
- Fuel Supplier..... N.A
- Water Use Agreement ..... With Irrigation Department GoPb

4. Emission values

- SO_x NA
- NO_x NA
- CO NA
- PM10 NA

5. Installed Capacity..... 2.82 MW
6. De-rated Capacity ..... to be provided later
7. Expected Life of the Facility ..... 50 years
8. Operation Record..... New Plant to be commissioned by Oct 2014

9. Plant Characteristics

- Generating Voltage 11 KV
- Frequency 50 Hz
- Power Factor Leading 0.95 and Lagging 0.8
- Automatic Generation Control No
- Ramping Rate to be provided later
- Alternative Fuel No
- Auxiliary Consumption 28 kW
- Time required to Synchronize to be provided later

The Net Capacity of the Licensee's Generation Facility

- Gross Installed Capacity of the Plant (ISO).....2.82 MW

- De-rated Capacity of the Plant.....to be provided later
- Auxiliary Consumption of the Plant .....28 kW
- Net Capacity of the Plant .....2792 kW
- Construction Period .....885 days
- Expected date of Commercial Operation of the Plant — October 30, 2014

The Net Capacity of the Plant available for dispatch to Power Purchaser will be determined through procedures contained in the EPC Agreements or Grid Code.

8. IMPLEMENTATION METHODOLOGY

As defined in ADB Loan Agreement, the mode of implementation of the Project / REDSIP is EPC /Turnkey Basis, which in the terms of ADB is "Procurement of Plant, Design, Supply and Install" on Turnkey basis. In EPC mode, the Contractor takes full responsibility of detailed designs, engineering, procurement and construction / commissioning of plant and carries the associated risks against a fixed price and time span / schedule. The ICB (International Competitive Bidding) on EPC / Turnkey basis on Single–Stage, two Envelopes Bidding Format of Asian Development Bank (ADB) for implementation of Hydropower Projects was the first example in the Punjab.

Accordingly the bidders offered their fixed (lump sum) prices against the specified employer's requirements, on the prescribed Bid Forms. The bidder framed their bid level designs and worked out details and estimates according to its design concepts with its own BOQ (Bill of Quantities) and items rates. A Steering Committee (SC) chaired by the Chairman P&D Board with representation from all concerned departments and eminent specialists from private sector, has been constituted by the Government for the acceptance of the lowest bidder after evaluation of bids by consultants, review by Evaluation Committee and clearance / NOC by ADB. In the instant case in response to international tender notice, 7 bidders submitted their bids and three of them were technically qualified and eligible. Public opening of the financial bids of the qualified bidders was made, evaluated and approved by SC after clearance / NOC by ADB and results were advertised in the Press and placed on ADB and other relevant websites.

Project has been awarded to the successful lowest bidder M/s SINOTEC-SHPE-SKAFS (JV) of China / Pakistan and Contract became effective on May 28, 2012. Being EPC/Turnkey contact, Contractor has completed the Surveys, Geo Technical Investigations, Model Testing for NOC of Irrigation Department and detail designs of civil works as well as E&M Plant. Civil works according to approved performance program are under way, whereas manufacturing, transportation to site and installation of E&M equipment; simultaneous to civil works are also under way in line with planned construction plan. The project is complex in term of construction of civil works, in line with manufacturing, transportation and erection of plant in a sequence and construction of civil, mechanical and electrical works of power plant are linked to each other and have limitations for independent implementation.

9. CONSTRUCTION PERIOD/IMPLEMENTATION SCHEDULE

The original implementation schedule of the Project under ADB was foreseen for duration of 66 months including pre-construction phase for hiring the consultants, preparation of the Tender Design, Bidding Documents, International Competitive Bidding (ICB), evaluation of bids and award of contracts including construction period of 33 months. Due to several reasons, the Project has been delayed for about three years. ADB has already extended the loan close date upto June 2014 and has principally agreed to further extend in view of actual progress at site. Under the agreed time line in the contract,

awarded after clearance of ADB, the project has to be implemented within 885 days till Oct. 28, 2014, however the design flow for full load test will be available in March 2015 due to limitation of flows in the Satluj River / Sulemanki Barrage. The Project may go into commercial operation through single or double units in Feb. 2015. For the purpose of Tariff calculation for this Tariff Petition, the construction period of 30 months, commencing from the effective date of the contract i.e May 28, 2014, has been assumed and Tariff calculations have been prepared accordingly.

10. PROJECT COST DETAILS

The estimates of capital cost of the Marala HPP covers civil works, electrical & mechanical works, and engineering including Transmission Line up to EPC level. It also covers the costs for land & compensation/ resettlement cost, management consultancy, administrative/audit/accounts expenditure and custom duty to be paid on the foreign imported machinery & equipments both for electrical as well as mechanical components and Sind Infra-structure Cess etc. The estimated cost of civil works is based on design presented by EPC contractor and evaluated by the Consultants. The quantities have been taken from the contractor's given layout and drawings of structure.

10.1 Preliminary Works

This component covers the Sponsor's development cost besides i.e. cost of updating the PC-1s, Project Company/Punjab Power Management Unit (PPMU)'s cost & cost of land & compensation/settlement etc.

PAKPATTAN HYDROPOWER PROJECT						
S.No	**Type of Asset**	**Unit**	**Quantity**	**Cost/Unit (Rs)**	**Cost (Million Rs)**	**Remarks**
1	Land	Acre	52.0125(private) + 3.31(Auqaf Land)	1380,000	**71.84**	15 % compulsory land acquisition charges included.
2	Crop Compensation	Acre	55.35	• Fodder = 24000 • cotton+ wheat = 630000 • Vegetables =93000	**3.5**	Wheat in Winter and Rice in Summer. Compensation for 1 year
3	Trees Compensation	No.	206		1.03	
4	Third Party/External Monitoring and Evaluation of Resettlement Plan (LARP)	LS		1,000,000	1.0	

	Sub Total				**77.37**	
5	Special Security Measures				7.73	
	Total				**85.07**	
	Total Rs. (Million)				**Say 86 million**	

The provision given at Serial No. 4 is for third party monitoring & evaluation of LARP (Land Acquisition and Resettlement Plan). Given geo-political scenario of country /area, Government of the Punjab has taken special security measures for the safety of Contractor and their staff/ professionals as per their perception which was originally not contemplated at the time of bidding. This involves the civil works (boundary walls), police details, and installation of electronic security gadgets etc

10.2 Construction Management

Punjab Government has set up an exclusive PPMU (Punjab Power Management Unit) based at Lahore to manage the undertaking & construction during the implementation period. Its expenditure for two & a half years is estimated at Rs. 66.54 Million approximately. It covers salaries & related costs of PPMU besides other expenditures under this head.

S.No	Description/Items	Allocation(Rs. M)
1.	(a) Project Management: Engineering & Supervision	19.19
2.	(b) Consultancy for Pakpattan HPP (Local + Foreign)	17.10
2.	Administration, Audit & Accounts (including Pre-loan signing expenses)	30.25
	Total	**66.54**

10.3 Insurance During Construction/Pre-Cod Insurance Cost

According to Terms of Reference / Aid Memoir with ADB, there will be no separate provision in project cost estimates for **'Insurance during Construction'**. It would be the responsibility of the contractor instead.

10.4 Custom Duties & Taxes

Custom Duties amounting to Rs. 20.33 Million, assumed as 5% of the foreign cost of plant & equipment to be imported for the project, are included in the project cost estimates imported Government of Pakistan's Policy for Power Generation Projects 2002 as amended from time to time. The cost of custom duties and taxes shall be adjusted/updated at COD as per actual cost incurred under this head .Similarly Sind Infra-structure Cess @ 0.68% (Rs.2.76 Million) has been included in the cost estimates of the Project.

10.5 Interest During Construction

Interest During Construction (IDC) has been calculated on the basis of the construction period of 30 months at an interest rate of 1.4% (Six Month LIBOR + 0.6% Premium) for the foreign financing (Debt

from ADB) have been applied. Actual IDC, however, shall be subject to adjust depending on the fluctuations in the interest rate and LIBOR

10.6 Financing Charges

Financing Charges include the costs related to the Debt Financing of the project. Such costs generally include, inter- alia, the lenders up-front fee & commitment; charges related to various letters of credit to be established in favor of different contracting parties etc. As per 'Project Loan Agreement' with Asian Development Bank, a commitment fee @ 0.75% of outstanding amount would be payable. An amount of Rs.31.21 million has been provided in the Project Cost Estimates. Under REDSIP, Commitment Charges would be the primary charge to this head. It will be adjusted as per actual at COD Stage.

10.7 Duties and Taxes

Withholding tax has been treated as a pass through item. Withholding tax has not been included in the cost estimates for PPDCL being a public sector entity. However, this will become a pass through item if PPDCL opts to become a 'listed company'.

11. TOTAL PROJECT COST

S.No	Item	Component Cost (Rs.M)
1.	EPC Cost	1209.82
2.	Base Cost	1367.18
3.	Capital Cost	1390.27
4.	Interest During Construction	16.08
5.	Total Project Cost (Financial)	**1437.56**

12. SUMMARY OF THE PROJECT COST

It may be mentioned here that Planning Commission on the direction of ECNEC (Executive Committee of National Economic Council) dated August 28, 2013 notified that in future the foreign cost of all new or (on-going) revised projects seeking approval of ECNEC, would be worked out on the basis of 'Floating Average Exchange Rate' notified on State Bank of Pakistan's website. Further, in case of Revised Projects *"only the unmet costs and expenditures that likely to be impacted solely by fluctuations in exchange rates"* would be re-estimated for arriving at revised total project's costs. Resultantly the new exchange rate of Rs.102.93/US$ has been used for determining Pakpattan Hydropower Project's second revised total costs approved by ECNCE on October27, 2013. Previously the exchange rate of Rs. 86.1306/US$ was utilized for this purpose at the time of bid evaluation.

SECOND REVISION PAKPATTAN HYDROPOWER PROJECT PUNJAB'S FINAL BREAK-UP OF COST (ECNEC)		
	Overall Project Cost (Rs. Millions)	

S.No	Component	Total Local Cost	Total Eq Foreign Cost	Total Eq Project Cost
1	Civil Works including Employers Facilities	107.29	505.66	612.95
2	Electrical (E) and Mechanical (M) Works including Design Services, Transportation, Testing and Commissioning	24.34	572.54	596.88
3	**Total Bid Price (including Escalation)**	**131.63**	**1,078.19**	**1209.82**
4	C.D.M (Clean Development Mechanism)	4.81	0	4.81
5	Land, Resettlement and Compensation	86.00	0	86.00
6	(a) Project Management-Engineering & Supervision	19.19	0	19.19
7	(b) Consultancy	11.97	5.13	17.10
8	Project Administration , Audit & Account @ 2.5% of EPC Cost	30.25	0	30.25
9	**Base Cost**	**283.85**	**1083.32**	**1367.18**
10	Duties &Taxes (5% of Imported Items only)	20.33	0	**20.33**
11	Sind Infrastructure Cess @ 0.68% of Imported Items	2.76	0	**2.76**
12	**Capital Cost**	**306.95**	**1083.32**	**1390.27**
13	Financing Charges	0	31.21	31.21
14	IDC	0.00	16.08	16.08
15	**Financial Cost (Project Cost)**	**306.95**	**1130.61**	**1437.56**

REFERENCE TARIFF

13. TARIFF CALCULATION ASSUMPTIONS

13.1 Assumption for Calculation of Tariff

The EPC level Reference Tariff has been worked out on the basis of following assumptions:-

S.No	Description	Assumptions
	MAIN ASSUMPTIONS	
1.	Plant Size	2.82 MW (Gross) 2.79 MW Net)
2.	▪ Debt : Equity Ratio ▪ Equity Portion ▪ Equity Funding	▪ **80 : 20** ▪ Rs.287.51 Million ▪ Government of the Punjab through

	▪ Loan Currency	Annual Development Program ▪ Loan Currency is Japanese Yen
3.	Interest Rate	Six Month LIBOR plus Premium of 0.6. Hence (0.8+0.6=1.4%)
4.	Payment Schedule	Six Month Payment inclusive of Principal and interest
5.	Loan Tenure	25 years with 5 year Grace Period. Hence 20 years
6.	Construction Period	30 months
7.	Annual Phasing	10%, 50%, 40%
8.	Reference Exchange Rate	Rs.102.9331 per US$
9.	NPV Discount Rate	10%
10.	Variable O&M Costs	Rs.10.6420 Million. It has been worked out as 25% of 4% of Total Cost net of IDC Rs. 1421.48 Million.
11.	Fixed O&M Costs	Rs.31.9259 Million. It has been worked out as 75% of 4% of Total Project Cost net of IDC Rs.1421.48 Million. It has further been bifurcated into LOCAL Fixed O&M & FOREIGN Fixed O&M in the ratio of 80% & 20% respectively
12.	Insurance	1.35% of EPC Cost i.e. Rs.1209.82 Million
13.	Water Use Charge	Rs. 0.15/kWh as payable to Punjab Government , Irrigation Department.
14.	PPA Term	30 Years
15.	Return on Equity (ROE)	17%
16.	Return on Equity During Construction (ROEDC)	17%
17.	Withholding Tax	Nil as PPDCL is a public entity. It would be charged if PPDCL opts to become 'listed company'
OPERATIONAL ASSUMPTIONS		
18.	Average Annual Net Energy Sale to GEPCO	21.89 GWh
19.	Average Annual Plant Availability Factor	89%
20.	Annual Scheduled Outages	30 Days or 8% of Annual Canal Closure
21.	Annual Forced Outage Allowance	Will be mutually agreed with MEPCO , the Power Purchaser, during PPA Negotiations

13.2 OTHER GENERANAL ASSUMPTIONS

The proposed Tariff is also based on the following general assumptions. Any change in any of these assumptions will necessitate a corresponding adjustment in the Reference Tariff:-

- Capacity Payment is calculated based on the net plant capacity i.e.2.79 MW based on the historical average hydrology.
- The hydrological risk shall be borne by the Power Purchaser.

- The construction period for the purpose of Reference Tariff calculations has been assumed as 30 months from the Signing of the Contract. In case of time over-run, IDC & ROEDC shall be adjusted based on actual time taken for the completion of the project.

- Custom duty @ 5% of foreign imported machinery and equipment has been assumed as per Government of Pakistan's Policy as amended & 0.68 % Sind Infra-structure Cess.

- Power Purchaser shall make payments to PPDCL to cover all the energy delivered to the Grid during the pre-COD period on account of the trial runs and during testing / retesting, commissioning of the plant and during additional Commercial Operations Tests until COD is achieved. Payments will be invoiced to the Power Purchaser as EC component of the Tariff in accordance with the mechanism specified in the PPA. Similarly, the price of energy delivered during post-COD testing shall be paid as per the EC component of the Reference Tariff.

- During construction period, the timing of debt drawdown may vary from that estimated now; the actual 'Interest During Construction' (IDC) will be adjusted/updated at COD and the Tariff Table will be adjusted accordingly.

- Water Use Charge shall be in accordance with the Punjab Power Generation Policy 2006, as amended, and the Water Use Agreement signed between the Company and the Provincial Government & will be indexed on the basis of WPI.

- The Tariff is calculated on the basis of net dependable capacity of the hydel plant;

- No hedging cost has been assumed for exchange rate during construction.

- No provision for working capital has been made on account of any delay in DISCO payments.

- No political risk insurance has been assumed on debt and/or equity.

- Project contingencies, debt service reserves and maintenance reserves are not included in the tariff calculations. If required by the lenders, these will be adjusted accordingly in the Tariff.

- Any tax on any income of the Company including sales proceeds from DISCO, general sales tax and all other corporate taxes will be treated as pass-through items. GST will be claimed along with Energy Charge invoices.

- No withholding tax on supply of plant and equipment. Only 6% tax on local/construction services contract assumed. Withholding tax on dividends is assumed at the rate 7.5% and will be dealt as Pass Through as defined in the PPA.

- No security, trustee fee and/ or agency (local and or foreign agency) fee assumed.

- No taxes or duties (including stamp duties) have been assumed on the execution of the financing documents, loan repayment, interest repayment, agency fee, commitment

fee, upfront fee, advisors' fee or charges, transportation. Such taxes or duties, if any, including on advisors' fee will be treated as pass-through under the PPA.

- No letter of credit and or confirmation charges in relation thereto under the EPC assumed. If applicable, an adjustment will be sought in the Project cost at the time of COD.

- The customs duties, taxes, other duties and cess are estimated numbers. As per NEPRA's previous tariff rulings, adjustment will be allowed in accordance with the actual expenses incurred in this behalf at COD.

- The cost of metering system (except back up meter) and remote terminal unit (RTU) or any other system for transmission of information and signals to National Power Control Centre will be borne by the Power Purchaser. In case the Company is required to meet this cost, it will be treated as pass-through item.

- No royalty or any payment or fees to the relevant port authorities has been assumed.

- All invoicing and payment terms are assumed to be in accordance with the PPA recently signed by NTDC with another hydropower project.

- Any benefit/ concession/incentives given to any other IPP/projects will also be applicable to the Company.

- Any additional costs incurred to cater for any modifications or additions required by the Power Purchaser will form part of the Project cost at the COD.

- No costs associated with the appointment of the "Independent Engineer" under the PPA and/or Hydropower Tariff Mechanism assumed. Any and all costs associated therewith will be sought and allowed as part of the Project Cost at COD.

- The Company remains entitled to all re-openers allowed under Hydropower Tariff Mechanism.

- No provision for the payment of Workers Welfare Fund and Workers Profit Participation has been made in the tariff. In case, the Company has to pay any such fund, that will be treated as pass through item in the Power Purchase Agreement.

- The Project is conceived on the basis of Build Own Operate and Transfer (BOOT) basis. Although, the Sponsor of the Project is Govt of the Punjab, the title of the Project will be transferred to peoples of the Punjab after the redemption of the equity as legal requirement.

13.3 Tariff Structure

The component-wise Tariff for the Project is based on the costs determined through International Competitive Bidding (ICB) as per ADB procedure i.e. Single stage, two envelopes & based

on the lowest bid. The year wise Tariff will be applicable for a period of 30 years commencing from the Commercial Operation Date, is attached herewith for consideration by the Authority (NEPRA) for its determination. The Debt Servicing Schedule is also attached herewith.

The proposed Tariff is a two–part tariff comprising an Energy Charge (EC) payable on the basis of Rs. /kWh for the energy generated and delivered to Power Purchaser and Capacity Charge (CC) payable on the basis of Rs./kW/Month irrespective of energy generation. The Tariff tends to be high during earlier years primarily due to debt-payment period. The Tariff has structured in such a way that it not only recovers the investment on the Project during plant operation period but also ensures return on equity as power policies, which is fair and reasonable. The tariff consists of two parts corresponding to tariff previously approved by NEPRA in line with the 'Federal Policy' and the 'Provincial Policy' as well as the 'Guidelines for Determination of Tariff -2005', which is as below:-

a) Energy Charge in Rs./kWh; and
b) Capacity Charge in Rs./kWh/Month

13.4 Tariff Control Period

Useful / economic life of 30 years has been envisioned for the plant and turbines for tariff calculations. Accordingly the reference tariff is applicable for a period of 30 years commencing from Commercial Operation Date (COD) of the plant.

13.5 Energy Charge

The Energy Charge indicates the price of a unit of electrical energy i.e. kWh. It is payable for the energy generated and delivered to Power Purchaser. It consists of a Variable O&M component and Water Use Charge as explained below:-

13.6 Variable O&M Component

Variable O&M has been calculated based on average annual energy generation of 21.89 GWh worked out from the historical hydrological data of Canal. This component caters for the cost of the services of the O&M operations on a kWh basis for the day to day management of the hydropower plant. In addition, it covers replacement of spare parts on completion of their service life as well as replacement on account of premature failure of the parts. It also includes cost of maintenance of un-foreseen /un-scheduled outages. Consumption of lubricants, chemicals, etc is also included in this component. It has been taken as 25% of 4 % of 'Project's project Cost' net of IDC I.e., Rs.1421.48 Million.

13.7 Water Use Charge

This component represents the Water Use Charge per unit of energy in kWh generated by the plant and delivered to the Power Purchaser by using the water of Upper Chenab Canal. This charge is payable to the Government of the Punjab under the Water Use Agreement to be executed between PPDCL and the Punjab Irrigation Department, Government of the Punjab. It has been taken as Rs. 0.15/kWh as per existing generation policy of the Punjab Government. The water Use Charge will be adjusted against changes in Whole Price Index (WPI) over the term of PPA as agreed with the Power Purchaser.

13.8 Capacity Charge (CC)

The Capacity Charge has been computed on the basis of the plant capacity net of auxiliary consumption and is expressed in Rs. /kWh per month. This tariff component is meant to cater for the fixed costs of the project. It is payable provided the plant is available for dispatch to standards defined in the Power Purchase Agreement (PPA) to be executed between PPDCL and the power purchaser. The Capacity Charge has been further segregated into following components:-

13.9 Fixed Cost (Local & Operation & Maintenance Foreign)

This component represents the fixed costs incidental to plant operation and maintenance. It covers management fee, remuneration to the personnel, rent, utilities, and fee for maintaining consents, environmental monitoring, local taxes and cost of expatriate services to be engaged for O&M of the plant. Here it has been taken as 75% of 4% of 'Project Cost' net of IDC i.e. Rs.1421.48 Million. The fixed O&M has further been bifurcated into "Local fixed O&M Component" and "Foreign fixed O&M Component" in the ratio of 80% and 20% respectively. The Fixed O&M Component will be adjusted against change in Whole Sale Price Index (WPI) while the foreign fixed O&M Component will be adjusted/indexed on the basis of fluctuations in parity exchange rate (Pak Rs./US $) & US CPI (Consumer Price Index) over the term of the PPA as agreed with Power Purchaser.

13.10 Insurance Cost

The insurance component consists of all risk insurance/re-insurance for the project as well as business-interruption insurance which are lender's and PPA's stipulated requirements. Insurance policies are required to be maintained for the plant life specified in the standardized PPA. The risks to be covered through insurance shall include machinery breakdown, natural calamities like earthquake, sabotage and consequential business interruption etc. In this case, it has been calculated @1.35% of EPC cost i.e. Rs.1209.82 Million. The insurance cost will be adjusted against change in US Dollar exchange rates over the term of the PPA as agreed with Power Purchaser.

13.11 Return on Equity & Redemption

The ROE component includes 17% return on the invested equity. Pursuant to GOP's November 2005 Guidelines for Determination of Tariff for IPPs. Equity has been redeemed after retiring of Debt Servicing in first 20 years of tariff control period in this case and thereafter, redemption of invested equity has been worked for the balance 10 years of tariff control period. The Project is conceived on the Built Own Operate and Transfer (BOOT) basis. Although Govt. of the Punjab is the only Sponsor of the Project the title of the Project will be transferred to the Govt. of Punjab / people of the Punjab from PPDCL, as legal requirement, upon the notional payment of Rs. 1 only to meet the legal requirement.

13.12 Debt-Servicing Component

The debt servicing (repayment of principal and interest charges) would be on half-yearly as per loan agreement between Asian Development Bank (ADB) and the Government of Punjab for the first 20 year period after the grace period of five years. There would be no charges under this category for the after 20 years. The debt portion is presently estimated as 80% of total project cost (Rs.1437.56 Million). The rate of interest used, as per loan agreement, is six months LIBOR (0.8) and the premium (0.6) which works out to 1.4%. The interest component of debt service portion will be adjusted against changes in interest (LIBOR) rate. The agreed financing structure is as under:-

S.No	Component	Amount Rs. Million
1.	Total Project Cost	1437.56
2.	Debt 80%	1150.05
3.	Equity 20%	287.51

Pakpattan Hydro Power Project EPC (ECNEC)

Pakpattan Summary of EPC Stage Tariff (ECNEC)			
Description	Tariff		
	Yrs 1-20	Yrs 21-30	Levelized Yrs 1-30
Capacity Purchase Price (CPP)	**Rs.KW/Month**	**Rs.KW/Month**	**Rs.KW/Month**
Fixed O&M (Local + Foreign)	1272.9107	1272.9107	1272.9107
Insurance	487.5178	487.5178	487.5178
Return on Equity	1458.9476	1835.8506	1584.5819
Return on Equity During Construction (ROEDC)	137.4900	137.4900	137.4900
Withholding Tax @ 7.5%	0.0000	0.0000	0.0000
Loan Repayment + Mark up	1973.8669	0.0000	1315.9113
Total	**5330.7330**	**3733.7691**	**4798.4117**
Energy Purchase Price (EPP)			
Variable O&M	0.6559	0.6559	0.6559
Water Use Charges	0.1500	0.1500	0.1500
Total	**0.8059**	**0.8059**	**0.8059**
Total Levelized Tariff (Rs.kwh)			**8.8076**
Total Levelized Tariff (¢.kwh)			**8.5566**

13.3 INDEXATION OF TARIFF COMPONENTS

The above stated Tariff will be indexed against changes in the values as mentioned against each component. The Reference Date for Reference Date CPI and WPI values will be 1st January 2014. The Reference USD rate is Rs. 102.9331 whereas Interest Rates is 0.8% plus 0.6% Margin

Sr. No.	Description	Indexation
1.	Fixed O&M Cost- Local	WPI
2.	Fixed O&M Cost- Foreign	FX Rate & US CPI
3.	Insurance Cost	FX Rate
4.	Return on Equity During Construction and Operation	FX Rate
5.	Interest Rates	Six Months LIBOR Rate
6.	Water Use Charges	WPI
7.	Variable O&M Cost	WPI

13.14 NEPRA Mechanism for Determination of Tariff for Hydropower Projects

13.15 Cost Variation due to Resettlement Costs

In the Project's cost estimates, an amount of Rs. 86.00 million has been provided for environment and ecology costs. However, provisions have been made for compensation of affected buildings and for infra-structure removal / restoration. It includes the cost for maintaining and improving the environmental status of the project area during and after constructing, additional plantation etc. Item-wise details have been given under 'project cost details' above. The compensation costs for trees, buildings, resettlement, etc shall be incurred through provincial administration. Any additional costs shall require proportionate enhancement of Reference Tariff at COD stage. PPDCL will, of course, would provide necessary details and documents-in-support to NEPRA in due course.

It is worth mentioning here that the contractor M/S SINOTEC-SHPE-SKAFS (JV) is of Chinese origin i.e. staff and professionals. In view of current security risks for Chinese workers throughout Pakistan, the Punjab Government has also ordered strict security arrangements for SINOTEC people both at headquarter Lahore and at the project site. At site, certain security measures CCTV cameras, deployment of police and boundary wall around the entire project area. Naturally this would incur the huge amounts of funds. Presently the Punjab government is in process of finalizing it.

13.16 Carbon Credits

Hydropower is a clean form of energy which is environment friendly. Implementation of hydropower projects will reduce CO_2 emissions and would mitigate other pollutants such as $SO_{2,}$ NOX and particulates associated with power generation from fossil fuels. Currently Government of the Punjab is in the process of hiring a consultant who would manage the registration of REDSIP Projects with concerned United Nations agencies like UNFCCC for carbon credits. The total estimated cost of CDM component works out to Rs. 19.254 Millions. This total cost has been proportionately allocated which is 2.26 million for Pakpattan Hydropower Project. The benefits earned during the control period will be shared with the Power Purchaser as per the terms of the PPA & in accordance with Government of Pakistan's Policy of Renewable Energy 2006.

14. VIABILITY OF THE HYDROPOWER PROJECT

Major advantages of hydropower projects are as under:

Hydropower plants are economical on long-term basis. No fossil fuel is required; hence, operation cost is low. These advantages grow with the passage of time due to escalation of fuel cost and degradation of heat rate of thermal plants existing in the system. Tariff of hydropower projects is thus cheaper on long-term basis.

- These can be quickly synchronized and brought on full load within a few minutes;
- These are capable of responding to rapid variations in loads without loss of efficiency;
- The plant and associated civil structures have a long life.
- Maintenance requirements are lesser as compared to thermal and nuclear power plants;
- Hydropower plants are economical than other types in respect of tariff and O&M.
- Un-foreseen outages are less frequent;
- The hydropower plants facilitate thermal the plants to operate in the most economical way;

- Canal Fall/Run-of-River hydropower plants are better suited for base-load duty;
- By taking fluctuations of all kinds, the hydropower plants improve the overall operational stability and reliability of the system;
- They reduce energy-related CO_2 & other gaseous emissions and mitigate climate change/global warming.

However, the project under review, involves exceptionally minor resettlement. The operating capacity of the hydropower plants, on canal falls being dependent on canal supplies, though varies according to available water, but plant factors are better as compared to hydropower plants on natural streams / rivers. The designed shares of the canals are usually available, resulting operation and output of the plant, almost according to the estimate. Nevertheless, the benefits of hydropower projects outweigh their dis-advantages in term of relatively higher cost per MW. In fact, the hydroelectric energy is the most viable mode of renewable energy available for utilization.

The 2.82 MW Pakpattan Hydropower Project (PHP) at Pakpattan (PC) has all the advantages enumerated above. The tariff being sought by PPDCL is much lower than the present tariffs of various other thermal technologies power plants with their emissions adversely impacting the environment adversely. The tariffs of thermal power plants are based on 60% plant capacity utilization factor and in case plant utilization is less than 60%, the actual tariff would be higher. Further, these tariffs would keep on increasing over time due to efficiency degradation and increasing price of the fuels. The proposed levelized Tariff of Rs.8.14/kWh (US Cents 7.91/kWh) for the 2.82 MW project at Pakpattan will become cheaper than those of the thermal power plants with the passage of time as it will not be affected for any increase in the fuel price. This tariff is also competitive to other hydropower projects as compared in the table given below:

Name of Project	Net Capacity (MW)	Levelized Tariff (Cents/kWh)	Remarks
Laraib Energy	84	8.55	Large size, fall of reasonable head, a simple project on escape to river. Adjustment against escalation and TL still to be made.
Pakpattan Hydro Power	2.79	8.56	Small size, VLH, additional Gear system, large machines. Escalation and TL costs already included in the EPC bid till COD.

It is also environment friendly. The project with the proposed reference tariff will provide as IRR-based 17% Return On Equity to Government of Punjab or private investor during the operating period. This is fairly reasonable return when compared to other ventures of similar magnitude and risks available in the market. All the stakeholders including the Power Purchaser, the provincial government and the electricity consumers will indeed be benefitted on completion of the Project. The Project 2.82 MW Pakpattan Hydropower Project at PC is, therefore, viable in economic terms.

The REDSIP hydropower projects on canal falls of Punjab and Sind, have certain limitations, and may not be compared with medium or high head projects in hilly area of the country, due to following reasons:-

1. The Punjab and Sind provinces have vast network of rivers & canals etc. However, compared to KPK & AJK, the head available is extremely low. Very Low Head (VLH) technology in the world is expensive. For similar design discharge, head and size of machines (turbines runners) are inversely related i.e. the more low head, bigger the size of the machines, consequently the higher costs of E&M plants and associated civil works.
2. Due to VLH, the sizes of machines are large whereas RPMs of the machines are very low hence requiring Gears to have minimum RPM for Generators, therefore the VLH necessitates additional costs of E&M and additional width of powerhouse buildings.
3. The proven VLH technology requires preferably a minimum head of three (3) meter. In rare cases it may be 2-3 meters but efficiency and output has to be compromised. Most of the falls on Punjab irrigation system range from 0.5 m to 1.5 m therefore combination of falls is essential to have minimum head of 3 m or to have maximum head for efficient working of the plant. This combination of falls, at a distance of 4 to 10 km apart requires elimination of usually d/s fall with construction of new bridges, head regulators of the off-taking canals from the fall and re-modeling of the large canals of the entire length (4 to 10 km). This fact also increases the cost of the project which commonly is not the case of hydropower projects in hilly area with high head.
4. The cost of detail design and construction / interconnection of Transmission Line (TL) is part of the EPC/Turnkey bid price and is an exclusive responsibility of the Contractor under the provisions of the Contracts of REDSIP Punjab so that generation could be injected immediately to the nearest Grid in the public interest.
5. The EPC/Turnkey bid prices for REDSIP Punjab are fixed lump sum, without any escalation clause in the Contract therefore the bid prices include the minimum 'built-in escalation' in EPC cost till COD, due to competitive process. Other projects do include the escalation clause, hence their cost generally increases immensely at COD stage.
6. Due to very small sizes of the hydropower projects on Irrigation system of Punjab and Sind, the factor for economy of scales is also important.

15. RELIEF SOUGHT:-

The petitioner requests the National Electric Power Regulatory Authority (NEPRA) to kindly approve / determine the followings:-

a. EPC level Tariff for Pakpattan Hydropower Project, 2.82 MW (Gross) for a period of 30 Agreement Years from the Commercial Operation Date;

Pakpattan Hydro Project at Upper Chenab Canal EPC (ECNEC)

EPC Stage Reference Tariff

Years	Energy Purchase Price (Rs/KWh)			Capacity Purchase Price (Rs./KW/Month)										Total Tariff	
	Variable O&M	Water Charges	Total	Fixed O&M Local	Fixed O&M Foregn	Insurance	ROE & Redemption	ROEDC	Withholding Tax @ 7.5%	Loan Repayment	Interest Charges	Total	CPP (Rs/KWh)	(Rs/KWh)	(¢/KWh)
1	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	1498.4989	475.3680	5330.7330	8.2408	9.0468	8.7890
2	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	1519.5513	454.3156	5330.7330	8.2408	9.0468	8.7890
3	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	1540.8995	432.9675	5330.7330	8.2408	9.0468	8.7890
4	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	1562.5476	411.3194	5330.7330	8.2408	9.0468	8.7890
5	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	1584.4998	389.3671	5330.7330	8.2408	9.0468	8.7890
6	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	1606.7604	367.1065	5330.7330	8.2408	9.0468	8.7890
7	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	1629.3338	344.5331	5330.7330	8.2408	9.0468	8.7890
8	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	1652.2243	321.6426	5330.7330	8.2408	9.0468	8.7890
9	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	1675.4364	298.4305	5330.7330	8.2408	9.0468	8.7890
10	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	1698.9746	274.89229	5330.7330	8.2408	9.0468	8.7890
11	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	1722.8435	251.0234	5330.7330	8.2408	9.0468	8.7890
12	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	1747.0478	226.81917	5330.7330	8.2408	9.0468	8.7890
13	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	1771.5920	202.2749	5330.7330	8.2408	9.0468	8.7890
14	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	1796.4811	177.3858	5330.7330	8.2408	9.0468	8.7890
15	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	1821.7199	152.14704	5330.7330	8.2408	9.0468	8.7890
16	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	1847.3132	126.5537	5330.7330	8.2408	9.0468	8.7890
17	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	1873.2661	100.6008	5330.7330	8.2408	9.0468	8.7890
18	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	1899.5837	74.2833	5330.7330	8.2408	9.0468	8.7890
19	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	1926.2709	47.5960	5330.7330	8.2408	9.0468	8.7890
20	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	1953.3331	20.5338	5330.7330	8.2408	9.0468	8.7890
21	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1835.8506	137.4900	0.0000	0.0000	0.0000	3733.7691	5.7721	6.5780	6.3906
22	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1835.8506	137.4900	0.0000	0.0000	0.0000	3733.7691	5.7721	6.5780	6.3906
23	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1835.8506	137.4900	0.0000	0.0000	0.0000	3733.7691	5.7721	6.5780	6.3906
24	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1835.8506	137.4900	0.0000	0.0000	0.0000	3733.7691	5.7721	6.5780	6.3906
25	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1835.8506	137.4900	0.0000	0.0000	0.0000	3733.7691	5.7721	6.5780	6.3906
26	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1835.8506	137.4900	0.0000	0.0000	0.0000	3733.7691	5.7721	6.5780	6.3906
27	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1835.8506	137.4900	0.0000	0.0000	0.0000	3733.7691	5.7721	6.5780	6.3906
28	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1835.8506	137.4900	0.0000	0.0000	0.0000	3733.7691	5.7721	6.5780	6.3906
29	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1835.8506	137.4900	0.0000	0.0000	0.0000	3733.7691	5.7721	6.5780	6.3906
30	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1835.8506	137.4900	0.0000	0.0000	0.0000	3733.7691	5.7721	6.5780	6.3906
Average Tariff															
1-20 Yrs	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	1716.4089	257.4580	5330.7330	8.2408	9.0468	8.7890
21-30 Yrs	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1835.8506	137.4900	0.0000	0	0	3733.7691	5.7721	6.5780	6.3906
1-30 Yrs	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1584.5819	137.4900	0.0000	1144.2726	171.6387	4798.4117	7.4179	8.2239	7.9895
Levelized Tariff															
1-30 Yrs	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1495.4648	137.4900	0.0000	1486.0416	296.5822	5176.0071	8.0016	8.8076	8.5566

b. Provisions for adjustment of Tariff at COD stage and for the Cost Re-openers specific to hydropower projects as per laid down standard mechanism i.e.

- Adjustment due to Custom Duties and Interest During Construction
- Adjustment in Project Cost due to Variations in US$/Rupee Parity
- Adjustment in Return on Equity During Construction on the basis of actual drawdown as well as 30 months prior to date of construction start on the analogy of other IPPs as allowed by Ministry of Water and Power vide its letter NO. 7(32)/92-P-II dated 30th July 2009.
- Adjustment in Project Cost due to variation in US$/Yen Parity
- Adjustments due to all costs associated to Resettlement
- Onetime Adjustment in EPC Cost for Civil Works Cost like variations and Enhanced Security Measures for Contractor
- Any other item specific to hydropower projects etc.

c. Adjustment/indexation of Tariff components over the period of thirty (30) years and approval of other salient terms and conditions of the Power Purchase Agreement.

- Variable and Local Fixed Energy Charge to be indexed on Inflation Adjustment Factor for WPI;
- Foreign Fixed Energy charge to be indexed on Pak Rupee Parity Exchange Rate with US Dollar and US CPI;
- Insurance Component will be indexed changes in foreign currency exchange rate.
- Reference Foreign Debt Interest using Foreign Debt to be indexed using Foreign Loan Interest Adjustment Factor at COD

d. All eligible pass-through items shall be payable by the Power Purchaser to the Company on the basis of actual costs incurred by the Company or to the extent that the Company is obligated pursuant to the Laws of Pakistan to make payments Pass-through items like withholding tax, Worker's Welfare Funds, Sales Tax, Excise Duty, levy, Charge surcharge, cost to be incurred on protective devices etc.

ATTACHMENTS

1. Detailed Design Report
2. Map
3. Estimated Project Cost of Environment Program
4. Loan Agreement with Asian Development Bank
5. EPC Contract with the contractor M/S SINOTEC
6. Overall Tariff Table
7. Debt Servicing Schedule
8. Tariff Summary
9. Commitment letter to EAD from Govt. of Punjab.
10. PAM (Project Administration Memorandum)
11. TORs of Steering Committee

TOR of Steering Committee

i) Monitor the implementation schedules and progress of the Project.

ii) Monitor the transparency of bidding process.

iii) Conclude the limit up to which the tender would be accepted by the department keeping in view the benchmark costs, framed by the Consultants.

iv) Approve the lowest bids, evaluated by "Evaluation Committee".

v) Address the issues relevant to the fast track development of the Projects.

	Overall Project Cost (Rs. Millions)				
S.No.	Component	Total Local Cost	Total Foreign Cost	Total Project Cost	
1	Civil Works including Employers Facilities and Design Services	107.29	505.66	612.95	
2	Electrical (E) and Mechanical (M) Works including Design Services, Transportation, Testing and Commissioning	24.34	572.54	596.88	
3	**Total Bid Price (including Escalation)**	**131.63**	**1,078.19**	**1209.82**	
4	C.D.M (Clean Development Mechanism)	4.81	0	4.81	
5	Land, Resettlement and Compensation	86.00	0	86.00	
6	(a) Project Management-Engineering & Supervision	19.19	0	19.19	
7	(b) Consultancy	11.97	5.13	17.10	
8	Project Administraion , Audit & Account @ 2.5% of EPC Cost	30.25	0	30.25	
9	**Base Cost**	**283.85**	**1083.32**	**1367.18**	1367.18
10	Duties &Taxes on "B" (5% of Imported Items only)	20.33	0	**20.33**	
11	Sind Infrastructure Cess @ 0.68% of Impoted Items	2.76	0	**2.76**	
12	**Capital Cost**	**306.95**	**1083.32**	**1390.27**	1390.27
13	Financing Charges	0	31.21	31.21	1421.48
14	IDC	0.00	16.08	16.08	1437.56
15	**Financial Cost (Project Cost)**	**306.95**	**1130.61**	**1437.56**	

1130.61

Total Project Cost	1,421.48	
IDC	16.08	
Total Project Cost	1,437.56	
Debt	1,150.05	80%
Equity	287.51	20%

Pakpattan Hydro Power Project EPC (ECNEC)

Revised Interest During Construction				
Years	Phasing %	Amount (Rs.M)	Rate (Annual)	IDC
1	10%	112.5206	0.0140	1.5753
2	10%	112.5206	0.0140	1.5973
3	25%	281.3015	0.0140	3.9826
4	25%	281.3015	0.0140	4.0384
5	30%	337.5618	0.0140	4.8826
Total	100%	1125.2061		16.0762
		1125.2061		0.6600

967.856
4.81
66.5401
[illegible]
86
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1,437.56			
2.79			
287.51			
48.88			48,877,078
			4,073,090
1,458.95			2,792
90.7632			
3.07			
	474,5		
	730		

Pakpattan Hydro Power Project EPC (ECNEC)

ROE During Constrution Calculations

	Years	Phasing %	Amount (Rs.M)	Rate (Annual)	ROEDC	Inflated Amount
10%	1	10%	14.3756	0.1700	1.2219	17.5659
50%	2	10%	14.3756	0.1700	1.3258	
40%	3	25%	71.8781	0.1700	6.3262	454.7143
	4	25%	71.8781	0.1700	6.8639	493.3650
	5	40%	115.0049	0.1700	11.1131	
	Total	**100%**	**287.5122**		**26.8510**	**472.2802**
			287.5122		**4.6061**	137.4900

Pakpattan Hydro Project at Upper Chenab Canal EPC (ECNEC)
EPC Stage Reference Tariff

Years	Energy Purchase Price (Rs/KWh)			Capacity Purchase Price (Rs./KW/Month)										Total Tariff	
	Variable O&M	Water Charges	Total	Fixed O&M Local	Fixed O&M Foregn	Insurance	ROE & Redemption	ROEDC	Withholding Tax @ 7.5%	Loan Repayment	Interest Charges	Total	CPP (Rs/KWh)	(Rs/KWh)	(¢/KWh)
1	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	**1498.4989**	**475.3680**	5330.7330	8.2408	9.0468	8.7890
2	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	**1519.5513**	**454.3156**	5330.7330	8.2408	9.0468	8.7890
3	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	**1540.8995**	**432.9675**	5330.7330	8.2408	9.0468	8.7890
4	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	**1562.5476**	**411.3194**	5330.7330	8.2408	9.0468	8.7890
5	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	**1584.4998**	**389.3671**	5330.7330	8.2408	9.0468	8.7890
6	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	**1606.7604**	**367.1065**	5330.7330	8.2408	9.0468	8.7890
7	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	**1629.3338**	**344.5331**	5330.7330	8.2408	9.0468	8.7890
8	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	**1652.2243**	**321.6426**	5330.7330	8.2408	9.0468	8.7890
9	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	**1675.4364**	**298.4305**	5330.7330	8.2408	9.0468	8.7890
10	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	**1698.9746**	**274.89229**	5330.7330	8.2408	9.0468	8.7890
11	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	**1722.8435**	**251.0234**	5330.7330	8.2408	9.0468	8.7890
12	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	**1747.0478**	**226.81917**	5330.7330	8.2408	9.0468	8.7890
13	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	**1771.5920**	**202.2749**	5330.7330	8.2408	9.0468	8.7890
14	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	**1796.4811**	**177.3858**	5330.7330	8.2408	9.0468	8.7890
15	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	**1821.7199**	**152.14704**	5330.7330	8.2408	9.0468	8.7890
16	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	**1847.3132**	**126.5537**	5330.7330	8.2408	9.0468	8.7890
17	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	**1873.2661**	**100.6008**	5330.7330	8.2408	9.0468	8.7890
18	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	**1899.5837**	**74.2833**	5330.7330	8.2408	9.0468	8.7890
19	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	**1926.2709**	**47.5960**	5330.7330	8.2408	9.0468	8.7890
20	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	**1953.3331**	**20.5338**	5330.7330	8.2408	9.0468	8.7890
21	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1835.8506	137.4900	0.0000	0.0000	0.0000	3733.7691	5.7721	6.5780	6.3906
22	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1835.8506	137.4900	0.0000	0.0000	0.0000	3733.7691	5.7721	6.5780	6.3906
23	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1835.8506	137.4900	0.0000	0.0000	0.0000	3733.7691	5.7721	6.5780	6.3906
24	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1835.8506	137.4900	0.0000	0.0000	0.0000	3733.7691	5.7721	6.5780	6.3906
25	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1835.8506	137.4900	0.0000	0.0000	0.0000	3733.7691	5.7721	6.5780	6.3906
26	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1835.8506	137.4900	0.0000	0.0000	0.0000	3733.7691	5.7721	6.5780	6.3906
27	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1835.8506	137.4900	0.0000	0.0000	0.0000	3733.7691	5.7721	6.5780	6.3906
28	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1835.8506	137.4900	0.0000	0.0000	0.0000	3733.7691	5.7721	6.5780	6.3906
29	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1835.8506	137.4900	0.0000	0.0000	0.0000	3733.7691	5.7721	6.5780	6.3906
30	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1835.8506	137.4900	0.0000	0.0000	0.0000	3733.7691	5.7721	6.5780	6.3906
Average Tariff															
1-20 Yrs	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1458.9476	137.4900	0.0000	1716.4089	257.4580	5330.7330	8.2408	9.0468	8.7890
21-30 Yrs	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1835.8506	137.4900	0.0000	0	0	3733.7691	5.7721	6.5780	6.3906
1-30 Yrs	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1584.5819	137.4900	0.0000	1144.2726	171.6387	4798.4117	7.4179	8.2239	7.9895
Levelized Tariff															
1-30 Yrs	0.6559	0.1500	0.8059	1018.3286	254.5821	487.5178	1495.4648	137.4900	0.0000	1486.0416	296.5822	5176.0071	8.0016	8.8076	8.5566

Attachment- 6

Pakpattan Hydro Power Project Upper Chenab Canal EPC								
Debt Servicing Schedule								
Loan (Rs. Million)						Tariff Values		
Period	Principal	Repayment	Mark up	Balance	Debt Servicing	Rpmt (Rs/Month)	Interest (Rs/Month)	Debt Service (Rs/Month)
First Half	1150.0489	$25.0135	8.0503	$1,125.0354	$33.0639			
Second Half	$1,125.0354	$25.1886	7.8752	$1,099.8468	$33.0639			
Year 1	**1150.0489**	**$50.2021**	**15.9256**	**$1,099.8468**	**$66.1277**	**1498.4989**	**475.3680**	**1973.8669**
First Half	$1,099.8468	$25.3649	$7.6989	1074.4819	33.0639			
Second Half	1074.481856	$25.5425	$7.5214	1048.9394	33.0639			
Year 2	**$1,099.8468**	**$50.9074**	**$15.2203**	**$1,048.9394**	**$66.1277**	**1519.5513**	**454.3156**	**1973.8669**
First Half	$1,048.9394	25.72127446	7.342576	1023.2181	33.0639			
Second Half	1023.218105	25.90132338	7.162527	997.3168	33.0639			
Year 3	**$1,048.9394**	**51.62259784**	**14.5051**	**997.3168**	**66.1277**	**1540.8995**	**432.9675**	**728.5739**
First Half	997.3167812	26.08263265	6.981217	971.2341	33.0639			
Second Half	971.2341486	26.26521107	6.798639	944.9689	33.0639			
Year 4	**997.3167812**	**52.34784372**	**13.77986**	**944.9689**	**66.1277**	**1562.5476**	**411.3194**	**1973.8669**
First Half	944.9689	26.4491	6.6148	918.5199	33.0639			
Second Half	918.5199	26.6342	6.4296	891.8857	33.0639			
Year 5	**944.9689**	**53.0833**	**13.0444**	**891.8857**	**66.1277**	**1584.4998**	**389.3671**	**1973.8669**
First Half	891.8857	26.8207	6.2432	865.0650	33.0639			
Second Half	865.0650	27.0084	6.0555	838.0566	33.0639			
Year 6	**891.8857**	**53.8290**	**12.2987**	**838.0566**	**66.1277**	**1606.7604**	**367.1065**	**1973.8669**
First Half	838.0566	27.1975	5.8664	810.8592	33.0639			
Second Half	810.8592	27.3878	5.6760	783.4713	33.0639			
Year 7	**838.0566**	**54.5853**	**11.5424**	**783.4713**	**66.1277**	**1629.3338**	**344.5331**	**1973.8669**
First Half	783.4713	27.5796	5.4843	755.8918	33.0639			
Second Half	755.8918	27.7726	5.2912	728.1192	33.0639			
Year 8	**783.4713**	**55.3522**	**10.7755**	**728.1192**	**66.1277**	**1652.2243**	**321.6426**	**1973.8669**
First Half	728.1192	27.9670	5.0968	700.1521	33.0639			
Second Half	700.1521	28.1628	4.9011	671.9894	33.0639			
Year 9	**728.1192**	**56.1298**	**9.9979**	**671.9894**	**66.1277**	**1675.4364**	**298.4305**	**1973.8669**
First Half	671.9894	28.3599	4.7039	643.6294	33.0639			
Second Half	643.6294	28.5584	4.5054	615.0710	33.0639			
Year 10	**671.9894**	**56.9184**	**9.2093**	**615.0710**	**66.1277**	**1698.9746**	**274.89229**	**1973.8669**
First Half	615.0710	28.7584	4.3055	586.3126	33.0639			
Second Half	586.3126	28.9597	4.1042	557.3530	33.0639			
Year 11	**615.0710**	**57.7180**	**8.4097**	**557.3530**	**66.1277**	**1722.8435**	**251.0234**	**1973.8669**
First Half	557.3530	29.1624	3.9015	528.1906	33.0639			
Second Half	528.1906	29.3665	3.6973	498.8241	33.0639			
Year 12	**557.3530**	**58.5289**	**7.5988**	**498.8241**	**66.1277**	**1747.0478**	**226.81917**	**1973.8669**
First Half	498.8241	29.5721	3.4918	469.2520	33.0639			
Second Half	469.2520	29.7791	3.2848	439.4729	33.0639			
Year 13	**498.8241**	**59.3512**	**6.7765**	**439.4729**	**66.1277**	**1771.5920**	**202.2749**	**1973.8669**
First Half	439.4729	29.9875	3.0763	409.4854	33.0639			
Second Half	409.4854	30.1975	2.8664	379.2879	33.0639			
Year 14	**439.4729**	**60.1850**	**5.9427**	**379.2879**	**66.1277**	**1796.4811**	**177.3858**	**1973.8669**
First Half	379.2879	30.4088	2.6550	348.8791	33.0639			
Second Half	348.8791	30.6217	2.4422	318.2574	33.0639			
Year 15	**379.2879**	**61.0305**	**5.0972**	**318.2574**	**66.1277**	**1821.7199**	**152.14704**	**1973.8669**

Attachment 7

First Half	318.2574	30.8360	2.2278	287.4213	33.0639			
Second Half	287.4213	31.0519	2.0119	256.3694	33.0639			
Year 16	**318.2574**	**61.8879**	**4.2398**	**256.3694**	**66.1277**	**1847.3132**	**126.5537**	**1973.8669**
First Half	256.3694	31.2693	1.7946	225.1002	33.0639			
Second Half	225.1002	31.4881	1.5757	193.6120	33.0639			$1,150.0489
Year 17	**256.3694**	**62.7574**	**3.3703**	**193.6120**	**66.1277**	**1873.2661**	**100.6008**	**1973.8669**
First Half	193.6120	31.7086	1.3553	161.9035	33.0639			
Second Half	161.9035	31.9305	1.1333	129.9729	33.0639			
Year 18	**193.6120**	**63.6391**	**2.4886**	**129.9729**	**66.1277**	**1899.5837**	**74.2833**	**728.5739**
First Half	129.9729	32.1540	0.9098	97.8189	33.0639			
Second Half	97.8189	32.3791	0.6847	65.4398	33.0639			
Year 19	**129.9729**	**64.5332**	**1.5945**	**65.4398**	**66.1277**	**1926.2709**	**47.5960**	**728.5739**
First Half	65.4398	32.6058	0.4581	32.8340	33.0639			
Second Half	32.8340	32.8340	0.2298	0.0000	33.0639			
Year 20	**65.4398**	**65.4398**	**0.6879**	**0.0000**	**66.1277**	**1953.3331**	**20.5338**	**728.5739**
		1,150.0489						

Pakpattan Hydro Power Project EPC (ECNEC)

Pakpattan Summary of EPC Stage Reference Tariff (ECNEC)			
Description	Reference Tariff		
	Yrs 1-20	Yrs 21-30	Levelized Yrs 1-30
Capacity Purchase Price (CPP)	**Rs.KW/Month**	**Rs.KW/Month**	**Rs.KW/Month**
Fixed O&M (Local + Foreign)	1272.9107	1272.9107	1272.9107
Insurance	487.5178	487.5178	487.5178
Return on Equity	1458.9476	1835.8506	1584.5819
Return on Equity During Construction (ROEDC)	137.4900	137.4900	137.4900
Withholding Tax @ 7.5%	0.0000	0.0000	0.0000
Loan Repayment + Mark up	1973.8669	0.0000	1315.9113
Total	**5330.7330**	**3733.7691**	**4798.4117**
Energy Purchase Price (EPP)			
Variable O&M	0.6559	0.6559	0.6559
Water Use Charges	0.1500	0.1500	0.1500
Total	**0.8059**	**0.8059**	**0.8059**
Total Levelized Tariff (Rs.kwh)			**8.8076**
Total Levelized Tariff (¢.kwh)			**8.5566**

Attachment

8

14.214849

Pakpattan Hydro Power Project EPC
Working of Variable & Fixed Cost (ECNEC)

1,000.00

Local Variable O&M Cost Calculation		
1. Total Project Cost (net of IDC) (Rs. Million)	1421.4849	
2. 4% of Base Cost (Rs. Million)	56.8594	
3. Variable O&M Cost (25%)(Rs. Million)	14.2148	
4. Gross Annual Generation (GWh)	21.89	
5. Auxiliary Losses (1%)	0.2189	
6. Net Annual Generation	21.6711	
7.Total Installed Capacity (MW)	2.82	
8. Net Capacity	2.7918	
9. Net Installed Capacity (Annual) (MW)	33.5016	
10. Net Installed Capacity (Annual) (KW)	33501.6000	
11. Amount Rs. KW/Month	424.3036	
12. Amount Rs. KW/h	0.6559	0.6559
13. Plant Factor	89%	
14. NPV Discount Rate for Levelized Tariff	10%	

Alternate Method	
1. Variable O&M Cost (25%)(Rs. Million)	14.2148
2. Gross Annual Generation (GWh)	21.89
3. Auxiliary Losses (1%)	0.2189
4. Net Annual Generation	21.6711
5. Plant Factor	89%
6. Amount Rs. KW/h	0.6559

Local Fixed O&M Cost Calculation		
1. Total Project Cost (net of IDC) (Rs. Million)	1421.4849	
2. 4% of Base Cost (Rs. Million)	56.8594	
3. Variable O&M Cost (75%)(Rs. Million)	34.1156	
4. Gross Annual Generation (GWh)	21.89	
5. Auxiliary Losses (1%)	0.2189	
6. Net Annual Generation	21.6711	
7.Total Installed Capacity (MW)	2.82	
8. Net Capacity (Annual)	2.7918	
9. Net Installed Capacity (Annual) (MW)	33.5016	
10. Net Installed Capacity (Annual) (KW)	33501.6000	
11. Amount Rs. KW/Month	1018.3286	
12. Amount Rs. KW/h	1.5742	1.5742
13. Plant Factor	89%	
14. NPV Discount Rate for Levelized Tariff	10%	

Alternate Method	
1. Variable D&M Cost (75%)(Rs. Million)	34.1156
2. Gross Annual Generation (GWh)	21.89
3. Auxiliary Losses (1%)	0.2189
4. Net Annual Generation	21.6711
5. Plant Factor	88.61%
6. Amount Rs. KW/h	1.5742

Foreign Fixed O&M Cost Calculation		
1. Total Project Cost(net of IDC)(Rs. Million)	1421.4849	
2. 4% of Base Cost (Rs. Million)	56.8594	
3. Variable O&M Cost (75%)(Rs. Million)	8.5289	
4. Gross Annual Generation (GWh)	21.89	
5. Auxiliary Losses (1%)	0.2189	
6. Net Annual Generation	21.6711	
7.Total Installed Capacity (MW)	2.82	
8. Net Capacity (Annual)	2.7918	
9. Net Installed Capacity (Annual) (MW)	33.5016	
10. Net Installed Capacity (Annual) (KW)	33501.6000	
11. Amount Rs. KW/Month	254.5821	
12. Amount Rs. KW/h	0.3936	0.3936
13. Plant Factor	89%	
14. NPV Discount Rate for Levelized Tariff	10%	

Alternate Method	
1. Variable O&M Cost (75%)(Rs. Million)	8.5289
2. Gross Annual Generation (GWh)	21.89
3. Auxiliary Losses (1%)	0.2189
4. Net Annual Generation	21.6711
5. Plant Factor	88.61%
6. Amount Rs. KW/h	0.3936

Redemption Calculations	
1.Total Capital Cost (Rs.Million)	1437.5611
2. Equity @20% (Rs.Million)	287.5122
3. IRR (%)	0.17
4.Net Generation (GWh)	21.6711
5.ROE	48.8771
6. Energy (730X0.89)	646.8676

Year	21	22	24	25	26	27	28	29	30
ROE	48.8771	48.8771	48.8771	48.8771	48.8771	48.8771	48.8771	48.8771	48.8771
-287.5122	61.7164	61.7164	61.7164	61.7164	61.7164	61.7164	61.7164	61.7164	61.7164
GWh	2.8479	2.8479	2.8479	2.8479	2.8479	2.8479	2.8479	2.8479	2.8479
GW/Month	1842.1925	1842.1925	1842.1925	1842.1925	1842.1925	1842.1925	1842.1925	1842.1925	1842.1925

Attachment 3

PAKPATTAN HYDROPOWER PROJECT						
S.No	**Type of Asset**	**Unit**	**Quantity**	**Cost/Unit (Rs)**	**Cost (Million Rs)**	**Remarks**
1	Land	Acre	52.0125(private) + 3.31(Auqaf Land)	1380,000	**71.84**	15 % compulsory land acquisition charges included.
2	Crop Compensation	Acre	55.35	• Fodder = 24000 • cotton+ wheat = 630000 • Vegetables =93000	**3.5**	Wheat in Winter and Rice in Summer. Compensation for 1 year
3	Trees Compensation	No.	206		1.03	
4	Third Party/External Monitoring and Evaluation of Resettlement Plan (LARP)	LS		1,000,000	1.0	
	Sub Total				**77.37**	
5	Special Security Measures				7.73	
	Total				**85.07**	
	Total Rs. (Million)				**Say 86 million**	