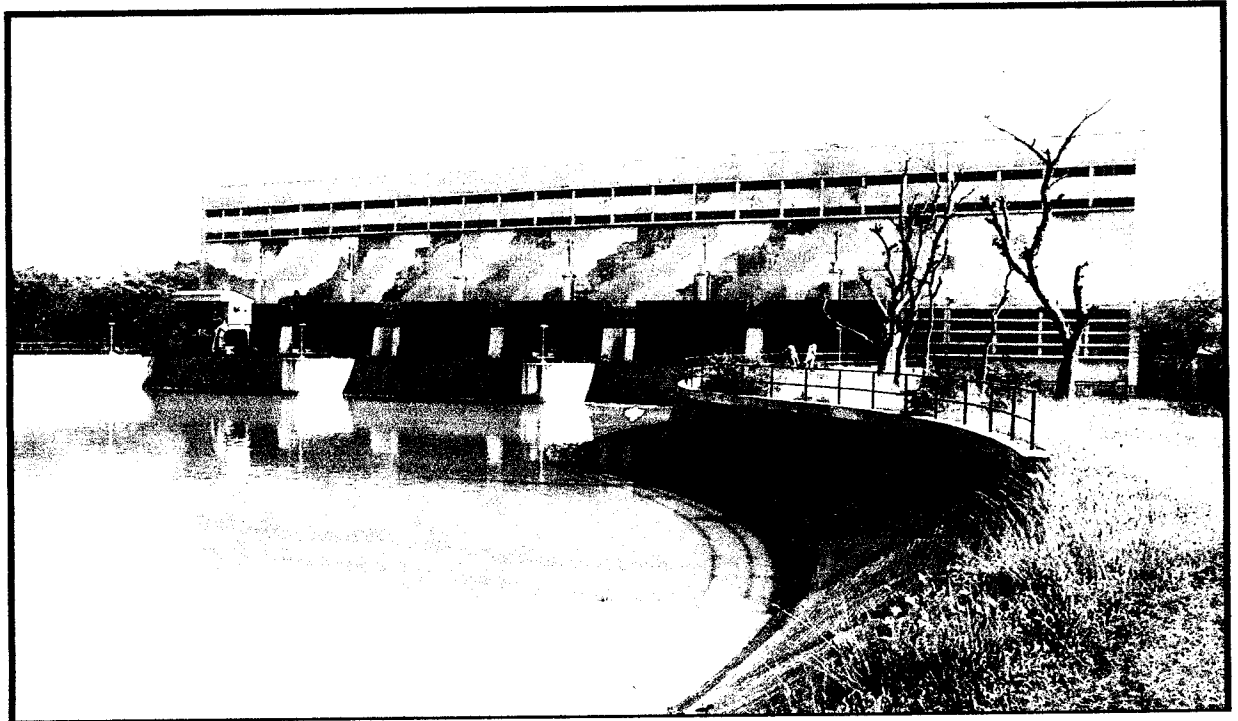


**GOVERNMENT OF THE PUNJAB  
ENERGY DEPARTMENT**

*"Certified Copy"*



**TARIFF PETITION FOR 5.38 MW  
CHIANWALI HYDROPOWER PROJECT  
DISTRICT GUJRANWALA, PUNJAB**



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

**February 16, 2015**

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



Dated February 16, 2015

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

Subject: PETITION FOR DETERMINATION OF EPC STAGE TARIFF FOR CHIANWALI HYDROPOWER PROJECT OF 5.38 (GROSS) MW CAPACITY AT UPPER CHENAB CANAL (UCC), DISTRICT GUJRANWALA IN PROVINCE OF THE PUNJAB

Dear Sir,

I, Moeen-ud-Din Sheikh, 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 (the "NEPRA"/"Authority") a petition for determination of EPC Stage Tariff, adjustment / indexation provisions and other terms and conditions for supply of electric power from 5.38 MW (Gross) Hydropower Project at Upper Chenab Canal (UCC) to Gujranwala Electric Power Company (the "GEPCO").

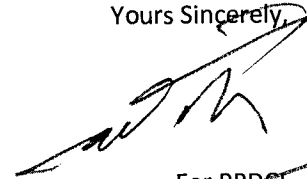
Attached is a Cheque No. 167669 dated January 13, 2015 drawn on National Bank of Pakistan, Main Branch, Lahore in the sum of Rs. 273,248 (Pak Rupees two hundred seventy three thousand, two hundred forty eight) being the Tariff Petition Fee calculated in accordance with NEPRA (Tariff Standards & Procedure) Rules, 1998 and the Schedule to NEPRA (Fee Pertaining to Tariff Standards & Procedure) Regulations, 2002 as amended.

Simultaneously, we are also submitting separately application for grant of Generation License, to the Authority for the instant 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 format, structure, design and parameters of the Petition already stand vetted by the professionals of NTDC / WPPA for their correctness mentioned in the petition being submitted to NEPRA for determination. Moreover, the experience gained during the processing of our earlier two tariff petitions of Marala & Pakpattan Hydropower Projects, has also been utilized in drafting the Petition under consideration.

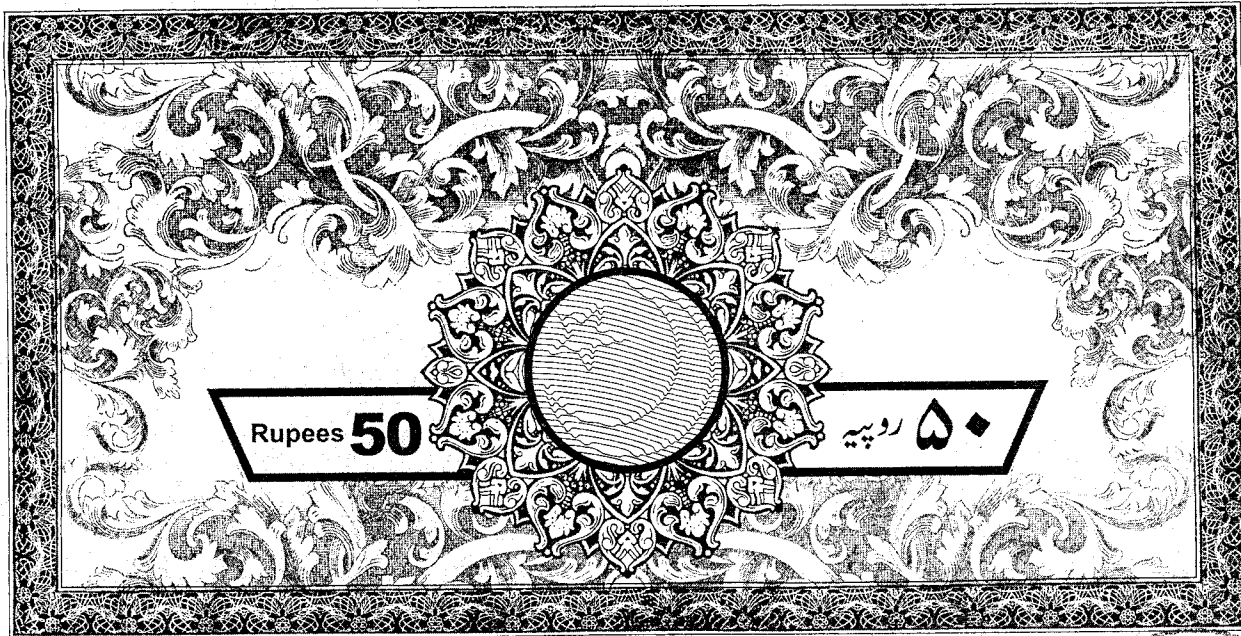
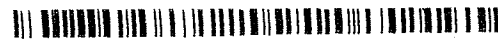
However, in case any further clarification or information is required by the Authority to process the subject application for determination of EPC Tariff, may kindly be intimated promptly.

Yours Sincerely,



For PPDCL  
18.2.2015

Encl: One original and two copies of Tariff Petition



BEFORE

THE NATIONAL ELECTRIC POWER REGULATORY AUTHORITY (NEPRA), ISLAMABAD

AFFIDAVIT

I, Moeen-ud-Din Sheikh s/o SM Salim-ud-Din, Project Director, Punjab Power Management Unit (PPMU), Energy Department, Government of the Punjab, 77 Shah Jamal Colony, Lahore, Deponent, being the authorized representative of PPDCL by virtue of the authority granted by Board of Director of PPDCL through Resolution of 26<sup>th</sup> meeting dated January 31, 2014 hereby solemnly affirm and declare that the contents of the accompanying application for generation license (hydel) dated January 12, 2015 including all documents-in-support relating to Chianwali Hydropower Project (CHPP) of Renewable Energy Development Sector Investment Program (REDSIP) are true and correct to the best of my knowledge and belief and that nothing has been concealed.

I also affirm that all further documentation and information, if any, to be provided by me in connection with the accompanying application for the generation license (electric power hydel) shall be true to the best of my knowledge and belief.

*[Signature]*  
DEPONENT  
25.1.2015



F-2014/A-1

No. PPDCL/ 1845 /2014

**PUNJAB POWER DEVELOPMENT COMPANY LTD**

Energy Department, Government of the Punjab

77- Shah Jahan Colony, Lahore 542-99239871

Dated 04 / 03 /2014

To

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

Sub: **RESOLUTION OF MOD**

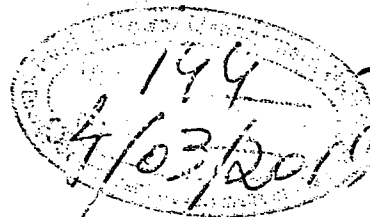
The Punjab Power Development Company Limited (PPDCL) has been established under the aegis of Government of the Punjab, Energy Department, in pursuance of Section-12 of the Companies Ordinance-1984. The Board of Directors of PPDCL during its 26<sup>th</sup> Meeting held on 31<sup>st</sup> January, 2014 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"*

  
(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



**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 5.38 (GROSS) MW  
CHIANWALI HYROPOWER PROJECT**

**AT**

**UPPER CHENAB CANAL, GUJRANWALA, PUNJAB**

**February 16, 2015**

**PUNJAB POWER DEVELOPMENT COMPANY LIMITED  
77 SHAH JAMAL COLONY, LAHORE  
TEL: (042)35403640 + (042)35403641  
FAX: (042)35403642**



Compliance with NEPRA (Tariff Standards & Procedure) Rules 1998		
S.No	NEPRA Rule	Description
1.	Rule 3(1)	Tariff Petition Fee of Rs.273,248=(covering of CPI indexation attached)
2.	Rule 3(2)(a)	<u>Name of Petitioner</u> Mr. Moeen-ud-Din Sheikh Project Director, Punjab Power Management Unit, Government of the Punjab 77 Shah Jamal Colony , Lahore
3.	Rule 3(2)(b)	<u>Grounds and Facts</u> Provided in detail in this Tariff Petition

4.	Rule 3(2)(c)	<p><b><u>RELIEF SOUGHT:-</u></b></p> <p>The Petitioner requests National Electric Power Regulatory Authority (NEPRA) to kindly approve / determine the followings:-</p> <p>a) EPC stage Tariff for Chianwali Hydropower Project, 5.38 MW (Gross) for a period of 30 Agreement Years from the Commercial Operation Date (COD);</p> <p>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.</p> <ul style="list-style-type: none"> <li>• Adjustment due to Custom Duties and Interest During Construction</li> <li>• Adjustment in Project Cost due to Variations in US\$/Rupee Parity</li> <li>• 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 30<sup>th</sup> July 2009.</li> <li>• Adjustment in Project Cost due to variation in US\$/Yen Parity</li> <li>• Adjustments due to all costs associated to Resettlement</li> <li>• Onetime Adjustment in EPC Cost for Civil Works Cost like Variations and Enhanced Security Measures for Contractor (Chinese)</li> <li>• Any other item specific to hydropower projects etc.</li> </ul> <p>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.</p> <ul style="list-style-type: none"> <li>• Variable and Local Fixed Energy Charge to be indexed on Inflation Adjustment Factor for CPI</li> <li>• Foreign Fixed Capacity Charge to be indexed on Pak Rupee Parity Exchange Rate with US Dollar and US CPI;</li> <li>• Insurance Component will be indexed for changes in foreign currency</li> </ul>
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		<p>exchange rate.</p> <ul style="list-style-type: none"> <li>• Reference Foreign Debt Interest using Foreign Loan Interest Adjustment Factor at COD</li> </ul> <p>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.</p>
5.	Rule 3(2)(d)	Not Applicable
6.	Rule 3(2)(e)	Not Applicable
7.	Rule 3(2)(f)	Provided in details 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
CC	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
EC	Energy Charge
EPC	Engineering, Procurement and Construction
GOP	Government of Pakistan
GOPb	Government of the Punjab
GST	General Sales Tax
GWh	Giga Watt hours=1,000,000 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 Hour
LARP	Land Acquisition & Resettlement Plan
LIBOR	London Inter-Bank Offered Rate
LOI	Letter of Interest
LOS	Letter of Support
LV	Low Voltage
m <sup>3</sup> /s or Cumecs	Cubic Meters per second
MAF	Million Acre Feet
MHP	Marala Hydropower Project
MVA	Megavolt Ampere=1000 kVa
MW	Mega Watt
MWh	Mega Watt hour=1000 KWh
NEPRA	National Electric Power Regulatory Authority

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NPV	Net Present Value
NTDC	National Transmission and Dispatch Company Limited
O & M	Operation & Maintenance
POE	Panel of Expert
PPMU	Punjab Power Management Unit
PPTA	Project Preparation Technical Assistance
PKR or Rs.	Pakistan 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
UCC	Upper Chenab Canal
USD or US\$	United States Dollar
US C or c	United States Cent
VLH	Very Low Head
WPI	Wholesale Price Index

2

**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. Moeen-ud-Din Sheikh**  
Project Director  
Punjab Power Management Unit  
Government of the Punjab  
Tele: 92-42-35403840 + 92-42-35403841  
Fax: 92-42-35403842

**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 the Petition.

Rule 3(2) (c) **Relief Sought**

Relief sought is mentioned in Para 20 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. GROUNDINGS 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 5.38 MW (Gross) hydropower project in the Punjab Province for tapping 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 four hydropower projects namely Marala, Chianwali, Deg-Outfall, and Pakpattan 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 provinces of the Punjab and Khyber PakhtoonKhwa. 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 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 procedure. Six Number JVs / companies participated in the ICB process and M/s SINOTEC-SHPE (JV), of China was selected and awarded the EPC Contract, which became effective on February 23, 2013. The construction has already been started and it is expected that Project will be commissioned on February 07, 2016.

## 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. Government of Pakistan is the "BORROWER" for on-lending to the Government of the Punjab (). 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 Affairs Division that, in case of any financial 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 the Punjab is attached. The PPMU is now implementing these 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 Covenants. Accordingly PPDCL, fully owned by GOPb, has legally been established under Company Ordinance 1984 since January 16, 2008, as required vide "SCHEDULE" of the Project Agreement, between ADB and Government of the 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 and 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 in the province 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 safety 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 distribution 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 days. These crisis appear insurmountable in the near or even long-term future, unless proper understanding and appropriate policy is undertaken on war footing basis. The installed capacity of the country during 2014 according to PPIB (Private Power Infrastructure Board Government of Pakistan, was 22,797 MW. Out of total installed capacity, 14,635 MW (64.2%) is thermal (Oil 35.2% & Gas 29%), hydro is 6,611 MW (29%) nuclear is 1,322 MW (5.8%), and others 229 MW. The installed capacity, however, remained underutilized during financial year 2014. 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 massive load shedding across the country.

It is important to understand the consequences of the prevailing situation. On August 1, 2014, the price of furnace oil was Rs. 94,256/M.Ton (i.e. Rs.94.256/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. 17.52 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.21.02 / 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 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. According to NEPRA's State of Industry Report 2013, the share of electricity generation from gas, oil and coal has remained 50%, 31% and 6.62% 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 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 Himalaya, 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 quite 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. Monsoon 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 in 1980s and several other large dams and hydropower schemes were also planned but, unfortunately, could not be implemented so far due to political constraints. Resultantly the country has to depend upon thermal and other imported fuel based solutions which is uneconomical and unreliable. The hydel - thermal energy mix as planned in 1980s as 65:35 % has badly been disturbed and is now a day 28:72 %. Due to this abnormal energy mix of unaffordable 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 the 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.

#### **4. Private Sector's Constraints In Energy Sector**

Private sector has been facing multifarious problems significant 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.
- Depletion of Gas reserves in the country. Difficulty in exploring coal reserves and dependence on imported coal.
- Increasing prices of Diesel and RFO during the last 20 years

In view of above, it is the solution to develop hydel resources of the country wherever these are available.

## 5. PROJECT DESCRIPTION

Asian Development Bank (ADB) offered a multi-tranche loan of US\$ 500 Million to the Government of Pakistan for development of renewable energy resources under Renewable Energy Development Sector Investment Programme (REDSIP). The first tranche of 5599 million Yen (J¥) equivalent US\$ 60 Million for Punjab, was negotiated in Oct. 2006; however loan was signed on October 5, 2007. Upon approval of PC-Is by ECNEC. Government of Pakistan is the "BORROWER" for on-lending to the Government of the 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 namely "Punjab Hydropower Consultants" (PHC) 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 the Punjab, the Chief Minister constituted a Steering Committee (SC), under the Chair of Chairman 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 Chianwali 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 UCC is a perennial main canal of Punjab Irrigation system. The generation from the Chianwali Hydropower Project of 5.38 MW will be injected to the nearby existing Grid.

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.

Overall program has been delayed due to following reasons:-

- The Loan was negotiated in October 2006 but was signed on October 05,2007 with the time lag of exact one year due to delayed approval of PC-1s by ECNEC (Executive Committee of National Economic Council).
- The program remained closed for one year in 2008. Re-establishment of PPMU with the gap of one year caused delay. Positioning of staff afresh proved to be a difficult task. It adversely affected the program tremendously.
- Analysis by Asian Development Bank (ADB) for procurement process of large contract award took a long period of one & a half year (18 months) against stipulated time span of 9 months for International Competitive Bidding (ICB) on EPC / Turn Key basis.
- Similarly procurement of Consultants on QCBS (Quality Cost Based System) took more than 15 months against the planned period of only 6 months.
- Review and unavoidable change in feasibility level design, Model Studies and NOC by Irrigation Department was overlooked by ADB. This caused another delay of 6 months.
- Limited capacity of the Contractor and the Consultants to handle 4 projects simultaneously also caused delays.
- Creation of Energy Department (ED), new functional codes for budget, amendments in rules of business for notifications of ED as Works Department & transfer of funds into Assignment Account of the Project caused delay of 6 months.
- State Bank of Pakistan took considerable time for granting permission for Advance Payment in US\$ as a condition for Effectiveness of the Contracts.



## **6. Project Location**

The Project shall be built on Upper Chenab Canal (UCC), which is located in Gujranwala District of the Punjab Province. The Project site (Latitude 32°39'44" and Longitude 74° 20' 26") is approximately 55 km from Lahore. The Project is a very low head hydropower project to be placed in the permanently constructed diversion channel at right side of Upper Chenab Canal (UCC). Chianwali Hydropower Project on main canal; Upper Chenab Canal (Main Line Lower) is located in Gujranwala District of Punjab Province.

The Chianwali Hydropower Project (CHP) will be constructed UCC at RD 131+250. This proposed run-of-canal hydropower project site is situated between Kamoke and Gujranwala towns, near Chianwali village and the Irrigation Rest House. It is about 55 km from Lahore and 8 km from Gujranwala at UCC RD 131+250 and the project area is running parallel to the Grand Trunk Road at distance of two and a half kilometer. The project area is linked with Gujranwala city by an 8 km service road along the right bank of canal. It is accessible from main road from Lahore-Gujranwala Grand Trunk (G.T) Road at the town of Kamoke by Qila Deedar Singh Road, crossing the D.R Bridge at R.D 139+165 of U.C.C and then along the inspection track of U.C.C up to the Powerhouse location. The project area is accessible from Karachi Port through a good road network of National Highways. The road distance between Lahore and Karachi is about 1,292 km

Upper Chenab Canal (Main Line Lower) is controlled from Bombanwala head regulator. The designed discharge of the head regulator is 315 m<sup>3</sup>/sec. A number of fall structures exist along this canal where hydropower projects can be developed. The falls at RD 164+400 have been selected for hydropower development. Internet access is available with high speed through the telephone network Telephone and telegraph facilities are available in Gujranwala and Chianwali 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 high speed through the telephone network.

Sialkot Airport is the nearest airport. However, Lahore International Airport is also close to the project area.

### **Upper Chenab Canal**

The Upper Chenab Canal (UCC) is fed from the Marala Barrage, leading water from the Chenab River into a number of tributaries of the Punjab irrigation system in Gujranwala, Sheikhpura, Depalpur, Sahiwal and Okara districts of the Punjab Province. The Upper Chenab Canal Main has a design capacity of 477 m<sup>3</sup>/sec. The canal aims primarily as a link canal and to supply water to Upper Chenab Canal Lower, Bambanwala Ravi Badian Depalpur Canal and Nokhar Branch off-taking at its tail RD 133+296. The canal is a perennial link and closed for about one month only every year during December and January for annual maintenance purposes.

## **ENVIRONMENTAL & SOCIAL ASPECTS OF THE PROJECT**

### **Environmental Impacts**

There are no significant Environmental impacts of the project neither on archaeological sites nor on the wildlife or fisheries. Owing to the existing falls in the canals system and annual closure regime, there are no significant fisheries. The impacts identified in the Land Acquisition & Resettlement Plan (LARP) and Environment Management Plan (EMP) is mostly due to construction related activities. The loss of land is restricted to the least possible minimum level, for which compensation and mitigation measures have been proposed. For Environmental Clearance, 'NOC' has been acquired from Environment Protection Authority (EPA).

### Environmental Mitigation

Mitigation measures included in the EMP are as indicated below:

#### **Summary of Mitigation**

Potential Impact	Mitigation
Construction impacts – loss of temporary water quality, loss of trees and access	Implementation through detailed EMP attached to the IEE including provision of stand pipes for drinking water, bridge access across the existing canal.
Permanent loss of small amount of agricultural land and some trees	Compensation package for permanent loss of land & for trees. Implement tree planting program.

### Land Acquisition and Resettlement

This project, because of its relatively small size, less than 50 MW, is classified as a category “B” project, in accordance with Asian Development Bank (ADB) Guidelines for Environmental Assessment, 2003. An Initial Environmental Examination (IEE) has been approved by Environmental Protection Department for the Project. The detail environmental examination and Land Acquisition & Resettlement Plan (LARP) including impacts and mitigation measures for Chianwali HPP has been prepared in accordance with the ADB guidelines.

According to the ADB’s handbook on Involuntary Resettlement, project is categorized “B” based on the following benchmarks:

- Significant impact: if > 200 people are resettled or will lose > 10% or more of their income generating assets are classified as category “A” requiring a full LARP.
- Insignificant Impact: if < 200 people will be resettled or experience a loss of <10% of income generating assets are classified category “B” requiring a short LARP.

A total of 11 households (49 persons) as in June 2010 having ownership of 73.08 Acres (Private & Evacuee Trust Land) are affected by CHPP. None of these Affected Households (AHs) is losing more than 10% of their productive assets. According to Project ADB guidelines on project categorization, the impacts are considered insignificant as less than 200 people are losing their income generating assets. The CHPP is classified as category “B” and a Short LARP for CHPP has been prepared accordingly. The LARP for CHPP has been approved by ADB for its implementation.

The objective of this Short Land Acquisition and Resettlement Plan (SLARP) is to describe the impacts of CHPP, compensation entitlements, and resettlement principles. The Short LARP sets out provisions for compensation of land, structures, crops and trees under the Land Acquisition Act, 1894, and ADB’s policy on involuntary resettlement (1995) and Handbook on Resettlement: A Guide to Good Practices.

None of the AHs resides in the project location therefore; hence no households will be displaced. Most of the AHs also have other sufficient source of incomes for their livelihoods. As the AHs are losing their productive assets, they have been compensated at replacement cost for their losses under ADB guidelines and Land Acquisition Act 1894.

A total of 73.08 Acres (Private & Evacuee Trust Land) has been acquired for the construction of the Power Channel including powerhouse, headrace channel, tailrace channel, sub-station, Offices and O & M staff residencies etc. The total No. of Affected Households (AHs) is 11 which are cultivating the 73.08 Acres (Private & Evacuee Trust Land). The CHPP also affected and 3874 trees of





different species (non-fruit) belonging to Forest Department standing in the Right of Way (ROW) of UCC canal acquired land and replenishment cost has been paid to the Forest Department.

All the households are Muslim and ethnically Punjabi. There is neither tribal nor minority people amongst these AHs. The ADB's Policy on Indigenous People, as specified in the Indigenous Peoples Development Framework (IPDF) prepared for this program is not triggered; therefore neither an Indigenous Peoples Development Plan (IPDP) nor special action is required for CHPP.

The budget for this Short LARP has been calculated using the rates derived through consultation with the APs, Revenue, Agriculture, Building, Irrigation, and Forest Departments and with the local markets at replacement cost. Assessment of compensation rates are in line with ADB's requirement regarding land and other assets to be compensated at replacement costs. The total compensation cost including compulsory acquisition charge @ 15% for the losses of the 11 AHs and external monitoring is estimated at Rs. 107 Million and provided in the Short LARP.

### **Resettlement Budget**

The total compensation cost for resettlement including land acquisition and land based assets that are crops, trees, building infrastructure, Irrigation Facilities, and Monitoring & Evaluation is estimated Rs. 107 Million. The Punjab Power Management Unit (PPMU), Energy Department is responsible for financing to implement this Land Acquisition and Resettlement Plan (LARP) on Chianwali Hydropower Project. The break-up of the resettlement activities and budgeting is as under.

### **Summary of Land Acquisition and Resettlement Cost CHIANWALI HPP**

#### **CHIANWALI HYDROPOWER PROJECT**

S No	Type of Asset	Unit	Quantity	Cost/Unit (Rs)	Cost (Million Rs)	Remarks
1	Land	Acre	73.08	1,200,000	87.696	15 % compulsory land acquisition charges included.
2	Crop Compensation	Acre	73.08	<ul style="list-style-type: none"> <li>Fodder = 2400</li> <li>Rice+ wheat = 63000</li> <li>Vegetables=34000</li> </ul>	4.567	Wheat in Winter and Rice in Summer. Compensation for 1 year.
<b>Affected Buildings/Structures</b>						
	(a) Semi Pacca	Sq.ft	442	600	0.265	
	(b) Tube-well Room	Sq.ft	180	600	0.108	

	(c) Boundary wall	Rft	2506	400	1.002	
<b>Infrastructures</b>						
	(a) Removal of Hand Pumps	No	1	5000	0.005	
	(b) Removal of Tube wells	No	1	120,000	0.120	
<b>Forest Tree Compensation</b>						
5	Trees Re-plantation	Avenue Mile	46.52	59300	2.177	500 trees per avenue mile will be planted
6	Livelihood Allowance for Agri. Workers	No	2	7,000	0.042	Allowance for three months
	Add one severity allowance for households who have lost more than 10% of their productive land	-	-	-	-	-
7	Livelihood Allowance for vulnerable PAP	No	2	10,000	0.020	One time
8	Third Party/ External Monitoring & Evaluation of Resettlement Plan (LARP)	LS		1,000,000	1.0	
	<b>Sub Total</b>				<b>96.885</b>	
9	Special Security Measures	LS			9.70	
	<b>Total</b>				<b>106.702</b>	
	<b>Total Rs. (Million)</b>					<b>Sav 107 million</b>

**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 source of income for Government of the Punjab being the owner of the PPDCL. Water Use Charges will be passed on to the Irrigation Department, Government of the 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**

### **Technical Parameters**

Following are technical parameters of the project:-


<b>Gross Capacity</b>	<b>5.38 MW</b>
<b>Auxiliary Consumption</b>	<b>1%</b>
<b>Net Capacity</b>	<b>5.33MW</b>
<b>Annual generation</b>	<b>28.82 GWH</b>
<b>Number of Units</b>	<b>2 (Horizontal Kaplan Pit Type Turbines)</b>
<b>Design Head</b>	<b>4.20 meters</b>
<b>Unit discharge</b>	<b>75 Cumecs</b>

The powerhouse is located at RD 131+250 approximately 600 m downstream of existing fall structure at RD 128+000 towards the right bank of the canal to make maximum use of the existing road for construction purposes. The powerhouse and spillway are placed adjacently along the same axis. An access road is realigned to pass over the powerhouse draft tube and spillway to connect the existing right bank road.

**The scope of Chianwali Hydropower Project consists of following main components:**

### **CIVIL WORKS**

- Construction of power canal works in by-pass arrangement between R.D 129+256 to R.D 133+035 on right side of U.C.C
- Raising of Existing U.C.C embankments from upstream of Powerhouse Location up to R.D 128+000 according to remodeled cross sections. Similarly excavation of U.C.C bed from downstream of Powerhouse Location up to R.D 164+400 according to remodeled cross sections.
- Construction of new District Road Bridges adjacent to the existing Fall cum Village Road Bridges at R.D 128+000 and R.D 164+400 of UCC and dismantling the existing Fall cum Bridge at the same R.Ds'
- Construct new Bridges adjacent to the existing Bridges with piles foundations at R.D 139+165 and R.D 148+669 of UCC and dismantle the VR Bridges with shallow foundations at same locations
- Construction of protection works for sub Project area including station etc.
- Construction of feeder canal and associated structures to ensure the required discharge for three off taking distributaries downstream of Powerhouse
- Gated Spillway structure with service bridge
- Powerhouse buildings and ancillary structures including Machine Hall, Control Building, Intake and outlet bays with cut-offs, and retaining walls etc.
- Paving of 2.5 Km (approx.) long and 4.5m wide access road with double surface treatment.
- Offices 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

### **ELECTRICAL AND MECHANICAL EQUIPMENT**

Following are the power facilities,

- Two (2) sets of double regulated horizontal shaft Kaplan turbines, each 2.8 MW, with a rated head of 4.2 m, rated flow of 75 m<sup>3</sup>/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 20 ton powerhouse overhead bridge crane
- Two (2) trash rack cleaning machine, capacity: 0.5 ton and 2 m<sup>3</sup> 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
- Nine (9) pumping sets and three (3) standby diesel generating sets at the three pumping stations, complete with all controls and protection system, for the lift Irrigation system downstream of Chianwali power plant
- Two (2) sets of synchronous generators each rated at mcr of 3.37 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 earthing enclosures including neutral earthing 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 3.37 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 and pump house feeder
- 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 earthing system network comprising earthing meshes, earthing rods, interconnecting earthing 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 intertripping / 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 gates 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
- 11 kV overhead distribution line about 10 km long between powerhouse and pumping stations
- 11 kV interconnecting transmission lines between powerhouse and WAPDA grid as specified
- 400 V distribution line for colony as specified
- Spare parts storage facilities
- Spare parts, erection and testing equipment

The implementation time is estimated 1080 days which includes mobilization, detailed design, construction / procurement of plant and equipment, transportation, site installation, testing and commissioning, etc.



## **8. Interconnection Arrangement with National Grid for Power Dispersal of the Plant**

The project is proposed to be connected with the GEPCO's nearest 66 KV Grid Station Chianwali for evacuation of energy generated by the Project. For this purpose the contractor being EPC Contractor has engaged a consultant to conduct Load Flow Study, Short Circuiting Study and Dynamic Stability Study besides studying the route and length of transmission line from the power house to the grid station. The consultant would also study the assessment/requirements of additional equipments needed for proper inter-facing. These studies would be submitted to GEPCO for validation & appraisal as per WAPDA specifications so that the contractor could construct the transmission line as part of EPC contract. --- The Power Policy 2002 allows the Company to construct the Transmission Line from its own sources and include its cost in the Total Cost.

These arrangements have been incorporated in the Project's physical scope to ensure the energy dispersal and inter-connectivity on the immediate basis after the commissioning of the Power House. Traditional arrangements about transmission line are likely to cause delay the energy evacuation /dispersal.

## **9. Salient Features**

### **Background**

Pakistan is facing energy crises since 2003 / last twelve years, which aggravated with the passage of time and now as the gap between demand and effective power supply has widened enough, therefore the country is under huge power outages these days. On the average there is supply demand gap approximately 6,000 MW during the peak hours in Summer. Pakistan does not have enough proven resources of fossil fuels and being a developing country does not have enough resources to import fuels for power generation purposes. The only viable alternative is to depend on less costly and clean hydroelectric potential available along rivers, streams and canals constructed for irrigation.

In Punjab, the hydropower potential exists on canal falls of irrigation system only. Preliminary studies were made by WAPDA, indicating 317 sites with a total potential of more than 600 MW on canal falls and barrages, out of which 48 sites are preferred sites having hydropower potential of 2 MW and more. The falls on canals and barrages range from 0.5 meter to 5 meter, most of which cannot be developed as a single fall hydropower project therefore combination of falls to avail minimum water head of 2 meter and above (preferably 3 meter and more) for VLH is essential in most of the cases which involves additional costs as compared to high and medium head.

### **Salient Features of the Project**

The very Low Head Chianwali Hydropower Project has been designed for a maximum design discharge of 150 cumecs, available in Kharif and will be reduced in Rabi, with a variable head of 3.20 meter to 5.67 meter. The design capacity is 5.38 MW with estimated annual generation of 28.82 GWh having Plant Factor 61%. The technology is 2 units of pit type horizontal Kaplan Turbines with double regulation arrangements. Other details and the salient features are narrated below.

Sr. No.	Features	Details / Description
1.	Location	District Gujranwala, Punjab
2.	River System	Upper Chenab Canal System Near Fall Structure at RD 128+000
3.	Discharge	Mean Monthly: 101.50 m <sup>3</sup> /s Total Annual Average: 3,200 10 <sup>6</sup> m <sup>3</sup> /y
4.	Main Structures	Design Discharge: 150 m <sup>3</sup> /s Maximum Discharge: 271 m <sup>3</sup> /s
5.	Spillway	Units: 7 Type: Radial Gates Sill Level: 221.40 masl Design Pressure at Sill: 2.29 m Height: 2.89 m Width: 7.00 m
6.	Trash Racks	Width: 8.434 m Height: 11.258 m Inclination: 80° Bar Distance: 100 mm
7.	Stop Logs	<i>Intake</i> Width: 8.434 m Height: 8.456 m <i>Spillway</i> Width: 7.00 m Height: 2.70 m
8.	Draft Tube	Units: 2 Type: Roller Gates Head on Sill: 7.50 m Height: 5.67 m Width: 7.20 m
9.	Headrace Channel	Water Level at Entrance: 223.69 masl Canal Width: 75.00 m Flow Depth: 3.20 m Bed Slope: 0.15
10.	Power House	Powerhouse Level: 220.8 masl Machine Hall Length: 29.5 m Machine Hall Width: 20.10 m Machine Hall Height: 13.4 m
11.	Tailrace Channel	Bed Level: 217.31 masl Canal Width: 75.0 m Bed Slope: 0.15
12.	Nominal Head at Maximum Power Output	Headrace Water Level: 223.69 masl Max. Tailrace Water Level: 220.49 masl Min. Tailrace Water Level: 218.02 masl Maximum Gross Head: 5.67 m Minimum Gross Head: 3.20 m



Sr. No.	Features	Details / Description	
		Head Loss:	0.15 m
13.	Hydro-mechanical Equipment	Type of Turbine:	Hor. Shaft Kaplan
		Units:	2
		Rated Flow for each Unit:	75 m <sup>3</sup> /s
		Capacity:	2.837 MW
		Rotational Speed:	120 rpm
		Rated Head:	4.20 m
14.	Electrical Equipment	<i>Generator</i>	
		Unit:	2
		Speed:	600 rpm
		Capacity:	3.3625 MVA
		<i>Transformer:</i>	6.3/11 kV
		<i>Switchgear:</i>	11 kV
15.	Power and Energy	Power:	2 x 2.69 MW
		Mean Annual Energy	28.82 GWh
		[On contract capacity basis (Not Yet Finalized)]	

### Plant Details & Other Details

#### 1. General Information

- Name of Applicant ..... Punjab Power Development Company Limited ( the "PPDCL")- a public limited company owned by the Government of the Punjab
- Address of the registered office ..... 77-Shah Jamal Colony, Lahore
- Plant Location ..... District Gujranwala-Punjab
- Type of Facility ..... Very Low Head Hydropower Project

#### 2. Plant Configuration

- Low Head Hydropower turbines
- Gross Capacity of the Power Plant .... 5.38MW
- Type of Technology ..... Very Low head hydropower generation
- Number of Units / Capacity ..... 02
- Power Plant Make and Model ..... Low Head Kaplan Pit Type Turbines
- Commissioning Date..... February 07, 2016

#### 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<sub>x</sub> ..... NA
  - NO<sub>x</sub> ..... NA
  - CO ..... NA
  - PM10 ..... NA
5. Gross Capacity ..... 5.38 MW
  6. Net Capacity ..... 5.326 MW
  7. Expected Life of the Facility ..... 30 years
  8. Operation Record ..... New Plant to be commissioned by Feb 2016
  9. Plant Factor ..... 61.15%

#### 10. Plant Characteristics

- Generating Voltage ..... 11 KV
- Frequency ..... 50 Hz
- Power Factor ..... Leading 0.95 at Lagging 0.8
- Automatic Generation Control ..... No
- Ramping Rate ..... to be provided later
- Alternative Fuel ..... No
- Auxiliary Consumption ..... 54 kW
- Time required to Synchronize ..... to be provided later

#### Net Capacity of the Licensee's Generation Facility

- Gross Installed Capacity of the Plant (ISO) ..... 5.38 MW
- Auxiliary Consumption of the Plant ..... 54 kW
- Net Capacity of the Plant ..... 5.326 MW
- Construction Period ..... 1080 days
- Expected date of Commercial Operation of the Plant — February 07, 2016

#### 10. 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, 6 bidders, namely CNEEC (China), CWE-TTP JV (China-Pakistan), SINOTEC-SHPE (China), SGEIEDL-ATL JV (China-Pakistan), DESCON – SHZ JV CLIC-HRL Consortium (China-Pakistan), GRC JV (China-Pakistan) & ETIMAAD-ALLONWARD JV (China-Pakistan) submitted their bids and three of them were technically qualified and eligible. Public opening of the financial bids of the qualified bidders was made, and placed on ADB and other relevant websites.

#### **Name of Companies / JVs Participated in International Competitive Bidding**

S.No	Name of Company / JV	Nationality
1	SHUNTAI-JINLUN & AL-FAJAR JV	China & Pakistan
2	CLIC-LAC Consortium	China & Pakistan
3	DESCON-TRIED JV	China & Pakistan
4	CWE-TTP JV	China & Pakistan
5	SINOTEC-SHPE JV	China
6	CNEEC	China & Pakistan

Project has been awarded to the successful lowest bidder M/s SINOTEC-SHPE (JV) of China and Contract became effective on February 23, 2013. Being EPC/Turnkey contract, Contractor has completed the Surveys, Geo Technical Investigations, and 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 underway 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.

## 11. 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 42 months. Due to several reasons, the Project has been delayed for about three years. ADB has already extended the loan close date up to June 2016. Under the agreed time line in the contract, awarded after clearance of ADB, the project has to be implemented within 1080 days up till February 07, 2016; however the design flow for full load test will be available in April / May 2016 due to limitation of flows in the Chenab River and UCC. The Project may go into commercial operation through single or double units in Feb. 2016. For the purpose of Tariff calculation for this Tariff Petition, the construction period of 36 months, commencing from the effective date of the contract i.e. February 23, 2013, has been assumed and Tariff calculations have been prepared accordingly.

## 12. PROJECT COST DETAILS

The estimates of capital cost of the Chianwali 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.

### 12.1 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.

CHIANWALI HYDROPOWER PROJECT						
Sr. No.	Type of Asset	Unit	Quantity	Cost/Unit (Rs)	Cost (Million Rs)	Remarks
1	Land	Acre	73.08	1,200,000	87.696	15 % compulsory land acquisition charges included.
2	Crop Compensation	Acre	73.08	<ul style="list-style-type: none"><li>Fodder = 2400</li><li>Rice+ wheat = 63000</li><li>Vegetables=34000</li></ul>	4.567	Wheat in Winter and Rice in Summer. Compensation for 1 year.

Affected Buildings/Structures						
	(a) Semi Pacca	Sq.ft	442	600	0.265	
	(b) Tube-well Room	Sq.ft	180	600	0.108	
	(c) Boundary wall	R.ft	2506	400	1.002	
Infrastructures						
	(a) Removal of Hand Pumps	No	1	5000	0.005	
	(b) Removal of Tube wells	No	1	120,000	0.120	
Forest Tree Compensation						
5	Trees Re-plantation	Avenue Mile	46.52	59300	2.177	500 trees per avenue mile will be planted
6	Livelihood Allowance for Agri. Workers	No	2	7,000	0.042	Allowance for three months
	Add one severity allowance for households who have lost more than 10% of their productive land	-	-	-	-	-
7	Livelihood Allowance for vulnerable PAP	No	2	10,000	0.020	One time
8	Third Party/ External Monitoring & Evaluation of Resettlement Plan (LARP)	LS		1,000,000	1.0	
	<b>Sub Total</b>				<b>96.885</b>	
9	Special Security Measures	LS			9.70	
	<b>Total</b>				<b>106.702</b>	
	<b>Total Rs. (Million)</b>				<b>Say 107 million</b>	

The provision given at Serial No. 8 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 Contractors 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



## **12.2 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 three years is estimated at Rs. 137.74 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	35.68
2.	(b) Consultancy for Chianwali HPP (Local + Foreign)	39.45
2.	Administration, Audit & Accounts (including Pre-loan signing expenses)	62.61
	<b>Total</b>	<b>137.74</b>

## **12.3 Insurance During Construction/Pre-Cod Insurance Cost**

According to Terms of Reference / Aide Memoire 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. However, insurance will be arranged during operational phase of The Project at the terms & conditions allowed by NEPRA.

## **12.4 Custom Duties & Taxes**

Custom Duties amounting to Rs. 34.13 Million, assumed @ 5% of the foreign cost of plant & equipment to be imported for the project, are included in the project cost estimates as per 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 updated at COD stage as per actual cost incurred under this head. Similarly Sind Infra-structure Cess @ 0.68% (Rs.4.64 Million) has also been included in the cost estimates of the Project.

## **12.5 Interest During Construction**

Interest During Construction (IDC) has been calculated on the basis of the construction period of 36 months and 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 change depending on the fluctuations in the interest rate LIBOR. It will be finally adjusted at COD Stage as per actual in accordance with the Policy and Guidelines of Regulator. This is estimated as 31.93 million at EPC Stage.

## **12.6 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 and 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. 64.61 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 along with other charges like upfront fee and expenses on Letter of Credits.

## 12.7 Duties and Taxes

Withholding tax has been considered as pass through item; therefore, 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'.

## 13. TOTAL PROJECT COST

S.No	Item	Component Cost (Rs.M)
1.	EPC Cost	2504.35
2.	Base Cost	2754.30
3.	Capital Cost	2793.07
4.	Interest During Construction	31.93
5.	<b>Total Project Cost (Financial)</b>	<b>2889.61</b>

## 14. 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' as 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\$ against the previous exchange rate of Rs. 86.1503 / US\$ has been used for determining Deg-Outfall Hydropower Project's second revised total costs, approved by ECNEC on October 27, 2013. Previously the exchange rate of Rs. 86.1503/US\$ was used for this purpose at the time of bid evaluation.

SECOND REVISION CHIANWALI HYDROPOWER PROJECT, PUNJABS-FINAL BREAK UP OF COSTS (ECNEC)				
Overall Project Cost (Rs. Millions)				
S. No	Component	Total Local Cost	Total Eqvi Foreign Cost	Total Equivalent Project Cost
1	Civil Works including Employers Facilities	297.10	1415.41	1712.51
2.	Electrical (E) and Mechanical (M) Works including Design Services, Transportation, Testing and Commissioning	42.14	749.70	791.84
3.	<b>Total Bid Price EPC (including Escalation)</b>	<b>339.24</b>	<b>2165.11</b>	<b>2504.35</b>
4.	C.D.M (Clean Development Mechanism)	5.21	-	5.21
5.	Land, Resettlement and Compensation	107.00	-	107.00

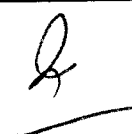
6.	(a)Project Management- Engineering & Supervision	35.68	-	35.68
7.	(b)Consultancy	27.61	11.83	39.45
8.	Project Administration, Audit & Accounts @ 2.5% of EPC cost	62.61	-	62.61
9.	<b>Base Cost</b>	<b>577.35</b>	<b>2,176.94</b>	<b>2,754.30</b>
10.	Duties & Taxes (5% of Imported Items only)	34.13	-	34.13
11.	Sind Infrastructure Cess @ 0.68% of Imported Items	4.64	-	4.64
12.	<b>Capital Cost</b>	<b>616.12</b>	<b>2,176.94</b>	<b>2,793.07</b>
13.	Financing Charges	-	64.61	64.61
14.	IDC	0.00	31.93	31.93
15.	<b>Total Project Cost (Financial)</b>	<b>616.12</b>	<b>2,273.48</b>	<b>2,889.61</b>

## 15. REFERENCE TARIFF

### 15.1 Assumptions for Calculation of Tariff

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

S.No	Description	Assumptions
<b>ASSUMPTIONS</b>		
1.	Plant Size	5.38 MW (Gross) 5.33 MW (Net)
2.	<ul style="list-style-type: none"> <li>▪ Debt : Equity Ratio</li> <li>▪ Equity Portion</li> <li>▪ Equity Funding</li> <li>▪ Loan Currency</li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>80 : 20</b></li> <li>▪ Rs. 577.92 Million</li> <li>▪ Government of the Punjab through ADP (Annual Development Program)</li> <li>▪ Loan Currency is Japanese Yen</li> </ul>
3.	Interest Rate	Six Month LIBOR plus Premium of 0.6. Hence (0.8+0.6=1.4%) per annum
4.	Payment Schedule	Equal Six Month Payment inclusive of Principal and interest
5.	Loan Tenure	25 years with 5 year Grace Period. Hence 20 years
6.	Construction Period	36 months
7.	Annual Phasing	20%, 50%, 30%
8.	Reference Exchange Rate	Rs.102.9331 per US\$



9.	Discount Rate	10%
10.	Variable O&M Costs	Rs. 20.6182 Million. It has been worked out as 25% of 3% (Rs. 82.4727 Million) of Total Base Cost of Rs. 2749.089 Million.
11.	Fixed O&M Costs	Rs.61.8545 Million. It has been worked out as 75% of 3% (Rs. 82.4727 Million) of Total Base Cost of Rs. 2749.089 Million. It has further been bifurcated into LOCAL Fixed O&M & FOREIGN Fixed O&M in the ratio of 80% (Rs.49.4836 Million) & 20% (Rs.12.3709 Million) respectively
12.	Insurance	1.35% of EPC Cost i.e. Rs.2504.3495 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) During Term of Power Purchase Agreement	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 and pass on to Power Purchaser as Pass Through Item'
<b>OPERATIONAL ASSUMPTIONS</b>		
18.	Average Annual Net Energy Sale to GEPCO	28.82 GWh
19.	Average Annual Plant Availability Factor	61.15%
20.	Annual Scheduled Outages	30 Days or 8% of including Annual Canal Closure
21.	Annual Forced Outage Allowance	Will be mutually agreed with GEPCO-the Power Purchaser, during PPA Negotiations
<i>There will be no adjustment, indexation and escalation assumptions as awarded contract is EPC/Turn Key basis and no such clause exists in the contracts of the projects awarded.</i>		

## 15.2 Other General 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. 5.33 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 36 month from the Signing of the Contract. In case of time over-run, IDC & ROEDC shall be adjusted based on actual time taken and drawdown of Equity & Debt 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 & Punjab Power Policy 2006 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 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/ Power Purchaser 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 as per the provisions of GST.
- 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 Government of the Punjab, the title of the Project will be transferred to the Peoples of the Punjab after the redemption of the equity as legal requirement.

## **16. 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, as adjusted from time to time, 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 on Energy Charges (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 per 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 Charges in Rs./kWh; and
- b) Capacity Charges in Rs./kW/Month

### **16.1 Tariff Control Period**

Useful / economic life of 30 years has been envisaged for the plant and turbines for tariff calculations. Accordingly the Tariff is applicable for a period of 30 years commencing from Commercial Operation Date (COD) of the plant. The Tariff will be adjusted against variation of exchange rates, interest rates, WPI and CPI etc pursuant to NEPRA's policies followed in the cases of other IPPs.

### **16.2 Energy Charge**

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

### **16.3 Variable O&M Component**

Variable O&M Component has been calculated based on average annual energy generation of 28.82 GWh worked out from the historical hydrological data of UCC. This component caters for the cost of the services of operation and maintenance on kWh basis for 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 3% of 'Project's Base Cost' i.e. Rs.2749.089 Million. Variable O&M Component will be adjusted against changes in Consumer Price Index (CPI) over the term of the PPA as agreed with Power Purchaser. Variable O&M cost is Rs. 0.7226 / kWh.

#### **16.4 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 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 Consumer Price Index (CPI) over the term of the PPA as agreed with Power Purchaser.

#### **16.5 CAPACITY CHARGE (CC)**

The Capacity Charge has been computed on the basis of the plant Dependable Capacity net of auxiliary consumption and is expressed in Rs. / kW/ Month. This tariff component is meant to cater for the fixed costs (local & foreign), insurance cost, ROE, ROEDC & debt servicing 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 sub-components:-

#### **16.6 Fixed Operation & Maintenance Cost (Local & 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, local taxes and cost of expatriate services to be engaged for O&M of the plant. Here it has been taken as 75% of 3% of 'Project Cost' net of IDC. 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.

#### **16.7 Insurance Cost**

The insurance component consists of all risks of machinery break down, revenue loss, 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 term of the PPA. The risks to be covered through insurance shall include all machinery breakdown, revenue loss, 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. 2504.35 Million. The Insurance Cost will be adjusted against change in US Dollar exchange rates fluctuations over the term of the PPA as agreed with Power Purchaser.

#### **16.8 Return on Equity & Redemption**

The ROE component includes 17% return on the investment 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 and thereafter, redemption of invested equity has been worked out for the balance 10 years of tariff control period in this case. The Project is

conceived on the Built Own Operate and Transfer (BOOT) basis, although Government of the Punjab is the only Sponsor of the Project. The title of the Project will be transferred to the Government of Punjab from PPDCL, as legal requirement, upon the notional payment of Rs. 1 only to meet the legal requirement / people of the Punjab

### 16.9 Debt-Servicing Component

The debt servicing (repayment of principal and interest charges) would be on equal half-yearly as per loan agreement between Asian Development Bank (ADB) and the Government of Punjab for the first 20 years period after the grace period of five years. There would be no charges under this category for the balance 10 years. The debt portion is presently estimated as 80% of total project cost (Rs.2889.61 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 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	2889.61
2.	Debt 80%	2311.69
3.	Equity 20%	577.92

Chianwali Hydro Power Project EPC (ECNEC)			
Chianwali 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 Operation & Maintenance			
Fixed O&M Local	774.2167	774.2167	774.2167
Fixed O&M Foreign	193.5542	193.5542	193.5542
Insurance	528.9687	528.9687	528.9687
Return on Equity	1537.1595	1940.8998	1576.2769
Return on Equity During Construction (ROEDC)	159.1153	159.1153	159.1153
Withholding Tax @ 7.5%	0.0000	0.0000	0.0000
Loan Repayment + Mark up	2079.6828	0.0000	1878.1874
<b>Total</b>	<b>5272.6972</b>	<b>3596.7547</b>	<b>5110.3192</b>
Energy Purchase Price (EPP)			
Variable O&M	0.7226	0.7226	0.7226
Water Use Charges	0.1500	0.1500	0.1500
<b>Total</b>	<b>0.8726</b>	<b>0.8726</b>	<b>0.8726</b>
<b>Total Levelized Tariff (Rs.kwh)</b>			<b>12.3206</b>
<b>Total Levelized Tariff (c.kwh)</b>			<b>11.9695</b>

#### **16.10 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 1<sup>st</sup> January 2014. The Reference USD rate is Rs. 102.9331 whereas Interest Rate is 1.4% = 0.8% plus 0.6% Margin.

Sr. No.	Description	Indexation
1.	Fixed O&M Cost- Local	CPI
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	CPI
7.	Variable O&M Cost	CPI

#### **17. NEPRA Mechanism for Determination of Tariff for Hydropower Projects**

##### **17.1 Cost Variation due to Resettlement Costs**

In the Project's cost estimates, an amount of Rs. 107.00 million has been provided for resettlement, compensation and environment's third party monitoring & evaluation i.e. LARP. However, provisions have been made for compensation of affected buildings and for infra-structure removal / relocation / restoration. It includes the cost for maintaining and improving the environmental status of the project area during and after construction, 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 at that time.

It is worth mentioning here that the contractor M/S SINOTEC-SHPE (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 Chinese 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 would have to be provided. Naturally this would incur the huge amounts of funds. Presently the Punjab government is in process of finalizing it.

#### **18. Carbon Credits**

Hydropower is a clean form of energy which is environment friendly. Implementation of hydropower projects will reduce CO<sub>2</sub> emissions and would mitigate other pollutants such as SO<sub>2</sub>, NO<sub>x</sub> and particulates associated with power generation from fossil fuels. Government of the Punjab has fielded 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 to this Project, which is Rs.5.21 million for Chianwali Hydropower Project. The benefits earned during the control period will be shared with Power Purchaser as per the terms of the PPA and in accordance with Government Policy of Renewable Energy 2006.

#### **19. VIABILITY OF THE CHIANALI 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 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<sub>2</sub> & 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 5.38 MW Chianwali Hydropower Project (CHP) at UCC 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. 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.12.3206/kWh (US Cents 11.9695/kWh) for the 5.38 MW project at Chianwali 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. It is worth mentioning that WUC is indexable against Variations of CPI only and its rate of escalation is far less than the escalation rate of oil and gas. Therefore, hydel project tariff though seems on higher side in initial years but will be more economical in later years.

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 5.38 MW Chianwali Hydropower Project at UCC is, therefore, viable in economic terms.

The REDSIP hydropower projects on canal falls of Punjab and Sind have, however, 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.



**20. RELIEF SOUGHT:-**


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

- a. EPC level Tariff for Chianwali Hydropower Project, 5.38 MW (gross) for a period of 30 Agreement Years from the Commercial Operation Date;

A handwritten signature, possibly 'R', is written above a large checkmark.

Chianwali 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 Forgn	Insurance	ROE & Redemption	ROEDC	Withholding Tax @ 7.5%	Loan Repayment	Interest Charges	Total	CPP (Rs/KWh)	(Rs/KWh)	(¢/KWh)
1	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1578.8311	500.8518	5272.6972	11.8117	12.6844	12.3229
2	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1601.0121	478.6708	5272.6972	11.8117	12.6844	12.3229
3	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1623.5047	456.1782	5272.6972	11.8117	12.6844	12.3229
4	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1646.3133	433.3695	5272.6972	11.8117	12.6844	12.3229
5	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1669.4424	410.2405	5272.6972	11.8117	12.6844	12.3229
6	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1692.8963	386.7865	5272.6972	11.8117	12.6844	12.3229
7	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1716.6798	363.0030	5272.6972	11.8117	12.6844	12.3229
8	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1740.7975	338.88535	5272.6972	11.8117	12.6844	12.3229
9	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1765.2539	314.42889	5272.6972	11.8117	12.6844	12.3229
10	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1790.0540	289.62884	5272.6972	11.8117	12.6844	12.3229
11	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1815.2025	264.48037	5272.6972	11.8117	12.6844	12.3229
12	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1840.7042	238.97859	5272.6972	11.8117	12.6844	12.3229
13	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1866.5643	213.11854	5272.6972	11.8117	12.6844	12.3229
14	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1892.7877	186.89517	5272.6972	11.8117	12.6844	12.3229
15	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1919.3794	160.3034	5272.6972	11.8117	12.6844	12.3229
16	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1946.3448	133.3380	5272.6972	11.8117	12.6844	12.3229
17	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1973.6890	105.9938	5272.6972	11.8117	12.6844	12.3229
18	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	2001.4174	78.2655	5272.6972	11.8117	12.6844	12.3229
19	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	2029.5353	50.1476	5272.6972	11.8117	12.6844	12.3229
20	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	2058.0482	21.6346	5272.6972	11.8117	12.6844	12.3229
21	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1940.9495	159.1153	0.0000	0.0000	0.0000	3596.8044	8.0574	8.9301	8.6756
22	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1940.9495	159.1153	0.0000	0.0000	0.0000	3596.8044	8.0574	8.9301	8.6756
23	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1940.9495	159.1153	0.0000	0.0000	0.0000	3596.8044	8.0574	8.9301	8.6756
24	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1940.9495	159.1153	0.0000	0.0000	0.0000	3596.8044	8.0574	8.9301	8.6756
25	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1940.9495	159.1153	0.0000	0.0000	0.0000	3596.8044	8.0574	8.9301	8.6756
26	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1940.9495	159.1153	0.0000	0.0000	0.0000	3596.8044	8.0574	8.9301	8.6756
27	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1940.9495	159.1153	0.0000	0.0000	0.0000	3596.8044	8.0574	8.9301	8.6756
28	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1940.9495	159.1153	0.0000	0.0000	0.0000	3596.8044	8.0574	8.9301	8.6756
29	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1940.9495	159.1153	0.0000	0.0000	0.0000	3596.8044	8.0574	8.9301	8.6756
30	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1940.9495	159.1153	0.0000	0.0000	0.0000	3596.8044	8.0574	8.9301	8.6756
Average Tariff															
1-20 Yrs	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1808.4229	271.2599	5272.6972	11.8117	12.6844	12.3229
21-30 Yrs	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1940.9495	159.1153	0.0000	0	0	3596.8044	8.0574	8.9301	8.6756
1-30 Yrs	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1671.7561	159.1153	0.0000	1205.6153	180.8400	4714.0663	10.5603	11.4329	11.1072
Levelized Tariff															
1-30 Yrs	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1576.2817	159.1153	0.0000	1565.7059	312.4815	5110.3241	11.4480	12.3206	11.9695


- 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 30<sup>th</sup> 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 CPI
  - Foreign Fixed Capacity 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.



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

## **ATTACHMENTS**

1. Detailed Design Report + Revised Hydrological Data
2. Map
3. Estimated Project Cost of Environment Program
4. Loan Agreement with Asian Development Bank
5. List of Bidders
6. Resettlement Cost
7. EPC Contract with the contractor M/S SINOTEC
8. Overall Tariff Table
9. Debt Servicing Schedule.
10. Tariff Summary
11. Commitment letter to EAD from Govt. of Punjab.
12. PAM (Project Administration Memorandum)
13. TORs of Steering Committee
14. Environmental Approval by Environment Protection Department



**Project Director**  
Punjab Power Management Unit  
Government of the Punjab  
Energy Department



SINOTEC CO., LTD

Attachment #  
1.1.

Our Ref: SINOTEC/CHP/ 67  
Dated: February 13, 2015

The Project Director / Project Manager  
Punjab Power Management Unit (PPMU)  
Energy Department  
Lahore

**SUBJECT: PROCUREMENT OF PLANT, DESIGN, SUPPLY AND INSTALL OF  
CHIANWALI HYDROPOWER PROJECT (CHP) -- ICB-PB-002  
--- Energy Calculations**

References:

- i. Our Letter No. SINOTEC/CHP/125 dated September 13, 2013;
- ii. Director Technical, PPMU Letter No. DT-PPMU/21/2015 dated January 29, 2015;
- iii. Our Letter No. SINOTEC/CHP/46 dated February 03, 2015.

Dear Sir,

In continuation to our letter referred above at serial No. (iii), we want to further explain that following sources of discharges data have been used in our calculations:

- Daily discharges data collected from the gauge registers of the respective Canal Division;
- Daily discharges data given in Feasibility Study of Chianwali HPP.

In our submissions "Detailed Calculation, Design & Drawings (Civil)" vide letter referred above at (i), annual energies were computed from 1980 to 2006 for each year and average annual energy was computed by averaging these annual energies as 24.37 GWh.

It was discussed in depth jointly with PPMU and Consultants and decided that as for other REDSIP projects (MHP, PHP, DHP), energies have been computed using average daily flows so same approach should be adopted for the CHP. In light of the joint decision and fact that most of the flow data of UCC at RD 128+000 is missing, as an alternate approach, average annual energy has been calculated by using average daily flows from 1980 to 2006 as **28.82 GWh** with plant factor of **61%**.

It is requested that energy & plant factor mentioned in our earlier submission should be substituted with the current submission. This is for your information please.

Thanking and assuring you of our best services and cooperation.

Best Regards,

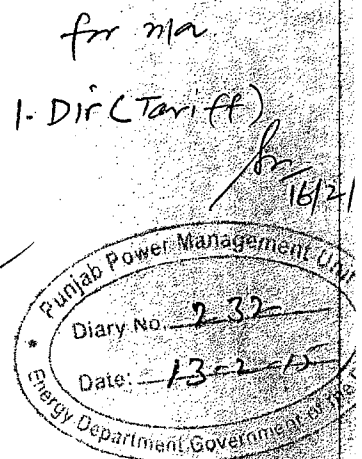
For SINOTEC-SHPE JV

*M. Masih-ud-Din*  
13/15 02/15  
(Mian Muhammad Masih-ud-Din)  
Principal Engineer

*[Signature]*  
Project Director (PPMU)

*[Signature]*  
Dir (T)

*[Signature]*  
13/2/15



C.C. Team Leader, Punjab Hydropower Consultants, 13-L Model Town Extension, Lahore.



# SINOTEC CO., LTD

Our Ref: SINOTEC/CHP/ 46  
Dated: February 03, 2015

The Project Director / Project Manager  
Punjab Power Management Unit (PPMU)  
Energy Department  
Lahore

**SUBJECT: PROCUREMENT OF PLANT, DESIGN, SUPPLY AND INSTALL OF  
CHIANWALI HYDROPOWER PROJECT (CHP) -- ICB-PB-002  
--- Energy Calculations**

Reference: Director Technical, PPMU Letter No. DT-PPMU/21/2015 dated January 29, 2015

Dear Sir,

In apropos to the letter referred above, please find attached the "Annual Energy Calculations" using average daily flows. This is for your information please.

Thanking and assuring you of our best services and cooperation.

Best Regards,

For SINOTEC-SHPE JV

*M. Masih-uddin*  
03/15

(Mian Muhammad Masih-ud-Din)  
Principal Engineer

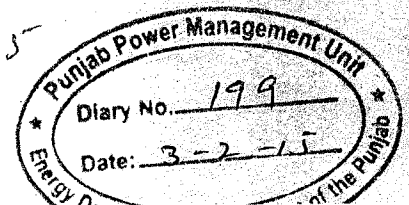
Encl: Annual Energy Output

C.C. Team Leader, Punjab Hydropower Consultants, 13-L Model Town Extension, Lahore.

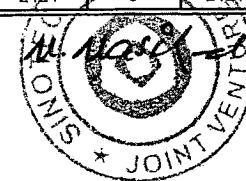
*Dir (Tariff)  
to  
Pr. Spk to Dir (i) and Amman  
in Tariff portion accordingly  
Dir (Tariff) affs per the  
Dir (i) advice for  
consultants  
3/2/2015*

*[Signature]*

*PO/83/15  
6/2/15*

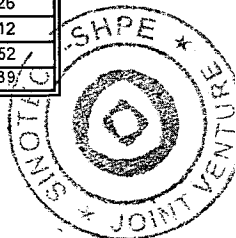


Year	Ave(1980~1981, 1983~1988, 1991~2006)				Annual Energy Output		28.82	GWh								
Date	Days	Inflows	Power Flows	Spills	HWL	TWL	Gross Head	Head Loss	Net Head	Turbine Flows		Power		Total	Energy	
	(1 year)	(m³/s)	(m³/s)	(m³/s)	(masl)	(masl)	(m)	(m)	(m)	Unit-1	Unit-2	Unit-1	Unit-2		(MWh)	
1-Jan	1	9.0	9.0	0.0	223.69	217.59	6.10	0.04	6.05	9.0	0.0	0	0	0	0.000	
2-Jan	2	8.8	8.8	0.0	223.69	217.59	6.10	0.04	6.06	8.8	0.0	0	0	0	0.000	
3-Jan	3	8.8	8.8	0.0	223.69	217.59	6.10	0.04	6.06	8.8	0.0	0	0	0	0.000	
4-Jan	4	9.0	9.0	0.0	223.69	217.60	6.09	0.04	6.05	9.0	0.0	0	0	0	0.000	
5-Jan	5	8.9	8.9	0.0	223.69	217.59	6.10	0.04	6.06	8.9	0.0	0	0	0	0.000	
6-Jan	6	8.9	8.9	0.0	223.69	217.59	6.10	0.04	6.06	8.9	0.0	0	0	0	0.000	
7-Jan	7	8.4	8.4	0.0	223.69	217.57	6.12	0.04	6.08	8.4	0.0	0	0	0	0.000	
8-Jan	8	8.7	8.7	0.0	223.69	217.58	6.11	0.04	6.07	8.7	0.0	0	0	0	0.000	
9-Jan	9	8.8	8.8	0.0	223.69	217.59	6.10	0.04	6.06	8.8	0.0	0	0	0	0.000	
10-Jan	10	8.8	8.8	0.0	223.69	217.59	6.10	0.04	6.06	8.8	0.0	0	0	0	0.000	
11-Jan	11	8.8	8.8	0.0	223.69	217.59	6.10	0.04	6.06	8.8	0.0	0	0	0	0.000	
12-Jan	12	8.9	8.9	0.0	223.69	217.59	6.10	0.04	6.06	8.9	0.0	0	0	0	0.000	
13-Jan	13	8.8	8.8	0.0	223.69	217.59	6.10	0.04	6.06	8.8	0.0	0	0	0	0.000	
14-Jan	14	8.0	8.0	0.0	223.69	217.56	6.13	0.04	6.09	8.0	0.0	0	0	0	0.000	
15-Jan	15	12.7	12.7	0.0	223.69	217.71	5.98	0.06	5.92	12.7	0.0	0	0	0	0.000	
16-Jan	16	12.9	12.9	0.0	223.69	217.72	5.97	0.06	5.92	12.9	0.0	0	0	0	0.000	
17-Jan	17	12.6	12.6	0.0	223.69	217.71	5.98	0.06	5.93	12.6	0.0	0	0	0	0.000	
18-Jan	18	15.3	15.3	0.0	223.69	217.79	5.90	0.07	5.83	15.3	0.0	0	0	0	0.000	
19-Jan	19	19.8	19.8	0.0	223.69	217.93	5.76	0.09	5.67	19.8	0.0	0	0	0	0.000	
20-Jan	20	19.3	19.3	0.0	223.69	217.92	5.77	0.09	5.69	19.3	0.0	0	0	0	0.000	
21-Jan	21	12.4	12.4	0.0	223.69	217.70	5.99	0.06	5.93	12.4	0.0	0	0	0	0.000	
22-Jan	22	13.5	13.5	0.0	223.69	217.74	5.95	0.06	5.89	13.5	0.0	0	0	0	0.000	
23-Jan	23	13.7	13.7	0.0	223.69	217.74	5.95	0.06	5.89	13.7	0.0	0	0	0	0.000	
24-Jan	24	14.9	14.9	0.0	223.69	217.78	5.91	0.07	5.84	14.9	0.0	0	0	0	0.000	
25-Jan	25	16.7	16.7	0.0	223.69	217.84	5.85	0.07	5.78	16.7	0.0	0	0	0	0.000	
26-Jan	26	16.2	16.2	0.0	223.69	217.82	5.87	0.07	5.80	16.2	0.0	0	0	0	0.000	
27-Jan	27	4.3	4.3	0.0	223.69	217.44	6.25	0.02	6.23	4.3	0.0	0	0	0	0.000	
28-Jan	28	4.4	4.4	0.0	223.69	217.45	6.24	0.02	6.22	4.4	0.0	0	0	0	0.000	
29-Jan	29	4.6	4.6	0.0	223.69	217.45	6.24	0.02	6.22	4.6	0.0	0	0	0	0.000	
30-Jan	30	12.2	12.2	0.0	223.69	217.69	6.00	0.05	5.94	12.2	0.0	0	0	0	0.000	
31-Jan	31	12.3	12.3	0.0	223.69	217.70	5.99	0.05	5.94	12.3	0.0	0	0	0	0.000	
1-Feb	32	35.6	35.6	0.0	223.69	218.20	5.49	0.11	5.38	35.6	0.0	1617	0	1617	38.798	
2-Feb	33	36.9	36.9	0.0	223.69	218.22	5.47	0.11	5.36	36.9	0.0	1676	0	1676	40.230	
3-Feb	34	39.2	39.2	0.0	223.69	218.26	5.43	0.11	5.33	39.2	0.0	1787	0	1787	42.879	
4-Feb	35	41.7	41.7	0.0	223.69	218.29	5.40	0.11	5.29	41.7	0.0	1895	0	1895	45.473	
5-Feb	36	44.8	44.8	0.0	223.69	218.33	5.36	0.11	5.24	44.8	0.0	2020	0	2020	48.487	
6-Feb	37	49.1	49.1	0.0	223.69	218.40	5.29	0.12	5.18	49.1	0.0	2192	0	2192	52.600	
7-Feb	38	47.2	47.2	0.0	223.69	218.37	5.32	0.11	5.21	47.2	0.0	2116	0	2116	50.781	
8-Feb	39	46.1	46.1	0.0	223.69	218.35	5.34	0.11	5.22	46.1	0.0	2074	0	2074	49.772	
9-Feb	40	48.8	48.8	0.0	223.69	218.39	5.30	0.12	5.18	48.8	0.0	2181	0	2181	52.337	
10-Feb	41	50.6	50.6	0.0	223.69	218.42	5.27	0.12	5.16	50.6	0.0	2251	0	2251	54.034	
11-Feb	42	41.5	41.5	0.0	223.69	218.29	5.40	0.11	5.29	41.5	0.0	1888	0	1888	45.304	
12-Feb	43	40.7	40.7	0.0	223.69	218.28	5.41	0.11	5.30	40.7	0.0	1854	0	1854	44.484	
13-Feb	44	55.1	55.1	0.0	223.69	218.48	5.21	0.12	5.09	55.1	0.0	2421	0	2421	58.108	



Date	Days	Inflows	Power Flows	Spills	HWL	TWL	Gross Head	Head Loss	Net Head	Turbine Flows		Power			Energy
	(1 year)	(m³/s)	(m³/s)	(m³/s)	(masl)	(masl)	(m)	(m)	(m)	Unit-1	Unit-2	Unit-1	Unit-2	Total	(MWh)
14-Feb	45	54.2	54.2	0.0	223.69	218.47	5.22	0.12	5.11	54.2	0.0	2386	0	2386	57.268
15-Feb	46	56.7	56.7	0.0	223.69	218.50	5.19	0.12	5.07	56.7	0.0	2479	0	2479	59.493
16-Feb	47	58.7	58.7	0.0	223.69	218.53	5.16	0.12	5.04	58.7	0.0	2550	0	2550	61.191
17-Feb	48	66.7	66.7	0.0	223.69	218.64	5.05	0.13	4.92	66.7	0.0	2821	0	2821	67.700
18-Feb	49	68.0	68.0	0.0	223.69	218.66	5.03	0.13	4.90	68.0	0.0	2870	0	2870	68.875
19-Feb	50	68.2	68.2	0.0	223.69	218.66	5.03	0.13	4.90	68.2	0.0	2870	0	2870	68.875
20-Feb	51	66.4	66.4	0.0	223.69	218.64	5.05	0.13	4.93	66.4	0.0	2810	0	2810	67.432
21-Feb	52	66.1	66.1	0.0	223.69	218.63	5.06	0.12	4.93	66.1	0.0	2801	0	2801	67.232
22-Feb	53	72.0	72.0	0.0	223.69	218.72	4.97	0.13	4.84	72.0	0.0	2987	0	2987	71.697
23-Feb	54	67.5	67.5	0.0	223.69	218.65	5.04	0.13	4.91	67.5	0.0	2846	0	2846	68.301
24-Feb	55	89.3	89.3	0.0	223.69	218.90	4.79	0.14	4.65	52.5	36.8	2104	1451	3555	85.318
25-Feb	56	89.8	89.8	0.0	223.69	218.91	4.78	0.14	4.64	52.5	37.3	2102	1470	3572	85.729
26-Feb	57	89.0	89.0	0.0	223.69	218.90	4.79	0.14	4.65	52.5	36.5	2106	1437	3543	85.033
27-Feb	58	72.8	72.8	0.0	223.69	218.73	4.96	0.13	4.83	72.8	0.0	3011	0	3011	72.264
28-Feb	59	68.8	68.8	0.0	223.69	218.67	5.02	0.13	4.89	68.8	0.0	2886	0	2886	69.266
1-Mar	60	93.0	93.0	0.0	223.69	218.94	4.75	0.14	4.61	52.5	40.5	2086	1603	3689	88.539
2-Mar	61	93.4	93.4	0.0	223.69	218.95	4.74	0.14	4.60	52.5	40.9	2085	1617	3702	88.845
3-Mar	62	97.1	97.1	0.0	223.69	218.98	4.71	0.14	4.56	52.5	44.6	2067	1750	3817	91.597
4-Mar	63	84.3	84.3	0.0	223.69	218.85	4.84	0.14	4.70	52.5	31.8	2129	1241	3370	80.883
5-Mar	64	89.0	89.0	0.0	223.69	218.90	4.79	0.14	4.65	52.5	36.5	2106	1438	3544	85.058
6-Mar	65	80.9	80.9	0.0	223.69	218.82	4.87	0.13	4.74	52.5	28.4	2145	1104	3249	77.983
7-Mar	66	79.4	79.4	0.0	223.69	218.80	4.89	0.13	4.75	52.5	26.9	2152	1042	3194	76.661
8-Mar	67	90.9	90.9	0.0	223.69	218.92	4.77	0.14	4.63	52.5	38.4	2096	1519	3616	86.776
9-Mar	68	98.5	98.5	0.0	223.69	219.00	4.69	0.14	4.55	75.0	23.5	2916	857	3773	90.553
10-Mar	69	104.4	104.4	0.0	223.69	219.06	4.63	0.15	4.49	75.0	29.4	2876	1087	3962	95.094
11-Mar	70	99.9	99.9	0.0	223.69	219.01	4.68	0.14	4.53	75.0	24.9	2907	912	3818	91.639
12-Mar	71	95.7	95.7	0.0	223.69	218.97	4.72	0.14	4.58	52.5	43.2	2073	1701	3774	90.583
13-Mar	72	99.5	99.5	0.0	223.69	219.01	4.68	0.14	4.54	75.0	24.5	2910	894	3804	91.296
14-Mar	73	113.1	113.1	0.0	223.69	219.15	4.54	0.15	4.39	75.0	38.1	2816	1425	4242	101.805
15-Mar	74	109.8	109.8	0.0	223.69	219.11	4.58	0.15	4.43	75.0	34.8	2839	1298	4137	99.282
16-Mar	75	113.5	113.5	0.0	223.69	219.15	4.54	0.15	4.39	75.0	38.5	2814	1441	4255	102.117
17-Mar	76	100.7	100.7	0.0	223.69	219.02	4.67	0.14	4.52	75.0	25.7	2901	943	3844	92.261
18-Mar	77	108.3	108.3	0.0	223.69	219.10	4.59	0.15	4.44	75.0	33.3	2849	1237	4086	98.067
19-Mar	78	113.5	113.5	0.0	223.69	219.15	4.54	0.15	4.39	75.0	38.5	2813	1444	4257	102.178
20-Mar	79	113.5	113.5	0.0	223.69	219.15	4.54	0.15	4.39	75.0	38.5	2813	1444	4257	102.178
21-Mar	80	106.5	106.5	0.0	223.69	219.08	4.61	0.15	4.46	75.0	31.5	2861	1168	4030	96.715
22-Mar	81	109.9	109.9	0.0	223.69	219.11	4.58	0.15	4.43	75.0	34.9	2838	1300	4138	99.312
23-Mar	82	109.3	109.3	0.0	223.69	219.11	4.58	0.15	4.43	75.0	34.3	2842	1278	4120	98.879
24-Mar	83	115.4	115.4	0.0	223.69	219.17	4.52	0.15	4.37	75.0	40.4	2800	1517	4317	103.608
25-Mar	84	112.1	112.1	0.0	223.69	219.14	4.55	0.15	4.40	75.0	37.1	2823	1389	4212	101.080
26-Mar	85	112.4	112.4	0.0	223.69	219.14	4.55	0.15	4.40	75.0	37.4	2821	1398	4219	101.265
27-Mar	86	90.0	90.0	0.0	223.69	218.91	4.78	0.14	4.64	52.5	37.5	2101	1481	3581	85.955
28-Mar	87	97.0	97.0	0.0	223.69	218.98	4.71	0.14	4.56	52.5	44.5	2067	1746	3814	91.526
29-Mar	88	89.2	89.2	0.0	223.69	218.90	4.79	0.14	4.65	52.5	36.7	2105	1446	3550	85.212
30-Mar	89	90.7	90.7	0.0	223.69	218.92	4.77	0.14	4.63	52.5	38.2	2098	1509	3606	86.552
31-Mar	90	103.4	103.4	0.0	223.69	219.05	4.64	0.15	4.50	75.0	28.4	2883	1046	3929	94.289

*U. Nasir-uddin*

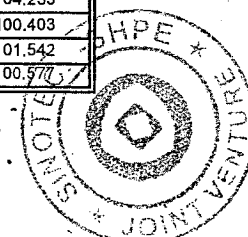




Date	Days	Inflows	Power Flows	Spills	HWL	TWL	Gross Head	Head Loss	Net Head	Turbine Flows		Power			Energy
	(1 year)	(m³/s)	(m³/s)	(m³/s)	(masl)	(masl)	(m)	(m)	(m)	Unit-1	Unit-2	Unit-1	Unit-2	Total	(MWh)
1-Apr	91	97.1	97.1	0.0	223.69	218.98	4.71	0.14	4.56	52.5	44.6	2066	1752	3818	91.638
2-Apr	92	104.8	104.8	0.0	223.69	219.06	4.63	0.15	4.48	75.0	29.8	2873	1101	3974	95.384
3-Apr	93	108.4	108.4	0.0	223.69	219.10	4.59	0.15	4.44	75.0	33.4	2848	1242	4091	98.175
4-Apr	94	107.8	107.8	0.0	223.69	219.09	4.60	0.15	4.45	75.0	32.8	2852	1220	4072	97.727
5-Apr	95	108.7	108.7	0.0	223.69	219.10	4.59	0.15	4.44	75.0	33.7	2846	1255	4101	98.431
6-Apr	96	110.2	110.2	0.0	223.69	219.12	4.57	0.15	4.42	75.0	35.2	2836	1312	4148	99.551
7-Apr	97	109.0	109.0	0.0	223.69	219.10	4.59	0.15	4.44	75.0	34.0	2844	1267	4111	98.655
8-Apr	98	108.1	108.1	0.0	223.69	219.10	4.59	0.15	4.45	75.0	33.1	2851	1230	4081	97.933
9-Apr	99	102.2	102.2	0.0	223.69	219.04	4.65	0.15	4.51	75.0	27.2	2891	999	3890	93.355
10-Apr	100	106.3	106.3	0.0	223.69	219.08	4.61	0.15	4.46	75.0	31.3	2863	1161	4023	96.558
11-Apr	101	99.4	99.4	0.0	223.69	219.01	4.68	0.14	4.54	75.0	24.4	2910	891	3801	91.230
12-Apr	102	100.5	100.5	0.0	223.69	219.02	4.67	0.14	4.53	75.0	25.5	2903	934	3837	92.077
13-Apr	103	106.7	106.7	0.0	223.69	219.08	4.61	0.15	4.46	75.0	31.7	2860	1175	4035	96.844
14-Apr	104	91.8	91.8	0.0	223.69	218.93	4.76	0.14	4.62	52.5	39.3	2092	1557	3649	87.582
15-Apr	105	93.8	93.8	0.0	223.69	218.95	4.74	0.14	4.60	52.5	41.3	2083	1632	3714	89.140
16-Apr	106	98.3	98.3	0.0	223.69	219.00	4.69	0.14	4.55	75.0	23.3	2918	848	3766	90.390
17-Apr	107	108.2	108.2	0.0	223.69	219.10	4.59	0.15	4.44	75.0	33.2	2850	1235	4084	98.025
18-Apr	108	115.9	115.9	0.0	223.69	219.17	4.52	0.15	4.36	75.0	40.9	2797	1534	4331	103.948
19-Apr	109	116.5	116.5	0.0	223.69	219.18	4.51	0.15	4.36	75.0	41.5	2793	1552	4345	104.287
20-Apr	110	115.0	115.0	0.0	223.69	219.17	4.52	0.15	4.37	75.0	40.0	2803	1502	4305	103.329
21-Apr	111	130.0	130.0	0.0	223.69	219.32	4.37	0.16	4.21	75.0	55.0	2700	2000	4700	112.805
22-Apr	112	136.1	136.1	0.0	223.69	219.38	4.31	0.16	4.15	75.0	61.1	2658	2183	4841	116.181
23-Apr	113	122.8	122.8	0.0	223.69	219.24	4.45	0.16	4.29	75.0	47.8	2750	1765	4515	108.349
24-Apr	114	120.2	120.2	0.0	223.69	219.22	4.47	0.16	4.32	75.0	45.2	2767	1679	4446	106.706
25-Apr	115	121.3	121.3	0.0	223.69	219.23	4.46	0.16	4.30	75.0	46.3	2760	1715	4475	107.403
26-Apr	116	124.4	124.4	0.0	223.69	219.26	4.43	0.16	4.27	75.0	49.4	2738	1819	4557	109.376
27-Apr	117	118.1	118.1	0.0	223.69	219.20	4.49	0.15	4.34	75.0	43.1	2782	1607	4389	105.344
28-Apr	118	110.7	110.7	0.0	223.69	219.12	4.57	0.15	4.42	75.0	35.7	2833	1331	4164	99.930
29-Apr	119	122.1	122.1	0.0	223.69	219.24	4.45	0.16	4.30	75.0	47.1	2754	1742	4497	107.918
30-Apr	120	103.8	103.8	0.0	223.69	219.05	4.64	0.15	4.49	75.0	28.8	2880	1061	3941	94.584
1-May	121	112.6	112.6	0.0	223.69	219.14	4.55	0.15	4.40	75.0	37.6	2819	1408	4228	101.467
2-May	122	111.1	111.1	0.0	223.69	219.13	4.56	0.15	4.41	75.0	36.1	2830	1347	4177	100.255
3-May	123	112.0	112.0	0.0	223.69	219.14	4.55	0.15	4.40	75.0	37.0	2824	1384	4208	100.981
4-May	124	114.9	114.9	0.0	223.69	219.16	4.53	0.15	4.37	75.0	39.9	2804	1498	4302	103.241
5-May	125	115.0	115.0	0.0	223.69	219.16	4.53	0.15	4.37	75.0	40.0	2803	1501	4304	103.303
6-May	126	116.2	116.2	0.0	223.69	219.18	4.51	0.15	4.36	75.0	41.2	2795	1543	4338	104.113
7-May	127	110.1	110.1	0.0	223.69	219.12	4.57	0.15	4.42	75.0	35.1	2837	1309	4145	99.490
8-May	128	116.6	116.6	0.0	223.69	219.18	4.51	0.15	4.35	75.0	41.6	2792	1558	4350	104.406
9-May	129	113.5	113.5	0.0	223.69	219.15	4.54	0.15	4.39	75.0	38.5	2813	1444	4257	102.176
10-May	130	106.6	106.6	0.0	223.69	219.08	4.61	0.15	4.46	75.0	31.6	2861	1172	4033	96.785
11-May	131	111.1	111.1	0.0	223.69	219.13	4.56	0.15	4.41	75.0	36.1	2830	1347	4177	100.246
12-May	132	111.4	111.4	0.0	223.69	219.13	4.56	0.15	4.41	75.0	36.4	2828	1360	4188	100.509
13-May	133	116.4	116.4	0.0	223.69	219.18	4.51	0.15	4.36	75.0	41.4	2794	1549	4343	104.233
14-May	134	111.3	111.3	0.0	223.69	219.13	4.56	0.15	4.41	75.0	36.3	2829	1355	4183	100.403
15-May	135	112.7	112.7	0.0	223.69	219.14	4.55	0.15	4.40	75.0	37.7	2819	1412	4231	101.542
16-May	136	111.5	111.5	0.0	223.69	219.13	4.56	0.15	4.41	75.0	36.5	2827	1364	4191	100.577

Energy Computations-3,

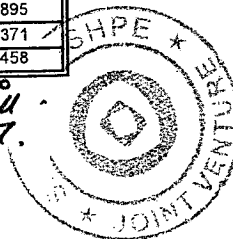
*M. Nasir-uddin*



Date	Days	Inflows	Power Flows	Spills	HWL	TWL	Gross Head	Head Loss	Net Head	Turbine Flows		Power		Energy
	(1 year)	(m³/s)	(m³/s)	(m³/s)	(masl)	(masl)	(m)	(m)	(m)	Unit-1	Unit-2	Unit-1	Unit-2	(MWh)
17-May	137	119.4	119.4	0.0	223.69	219.21	4.48	0.16	4.32	75.0	44.4	2773	1653	4426
18-May	138	128.0	128.0	0.0	223.69	219.30	4.39	0.16	4.23	75.0	53.0	2714	1934	4648
19-May	139	149.7	149.7	0.0	223.69	219.52	4.17	0.17	4.00	75.0	74.7	2565	2556	5121
20-May	140	150.9	150.0	0.9	223.69	219.53	4.16	0.17	3.99	75.0	75.0	2560	2560	5120
21-May	141	153.5	150.0	3.5	223.69	219.55	4.14	0.17	3.97	75.0	75.0	2546	2546	5093
22-May	142	152.3	150.0	2.3	223.69	219.54	4.15	0.17	3.98	75.0	75.0	2553	2553	5105
23-May	143	151.1	150.0	1.1	223.69	219.53	4.16	0.17	3.99	75.0	75.0	2559	2559	5118
24-May	144	149.8	149.8	0.0	223.69	219.52	4.17	0.17	4.00	75.0	74.8	2565	2557	5121
25-May	145	146.0	146.0	0.0	223.69	219.48	4.21	0.17	4.04	75.0	71.0	2590	2459	5049
26-May	146	140.4	140.4	0.0	223.69	219.42	4.27	0.17	4.10	75.0	65.4	2629	2306	4935
27-May	147	123.0	123.0	0.0	223.69	219.25	4.44	0.16	4.29	75.0	48.0	2748	1772	4520
28-May	148	131.2	131.2	0.0	223.69	219.33	4.36	0.16	4.20	75.0	56.2	2692	2037	4729
29-May	149	125.7	125.7	0.0	223.69	219.27	4.42	0.16	4.26	75.0	50.7	2730	1861	4590
30-May	150	125.2	125.2	0.0	223.69	219.27	4.42	0.16	4.26	75.0	50.2	2733	1845	4578
31-May	151	116.3	116.3	0.0	223.69	219.18	4.51	0.15	4.36	75.0	41.3	2794	1546	4341
1-Jun	152	118.5	118.5	0.0	223.69	219.20	4.49	0.15	4.33	75.0	43.5	2779	1620	4400
2-Jun	153	123.3	123.3	0.0	223.69	219.25	4.44	0.16	4.28	75.0	48.3	2746	1781	4527
3-Jun	154	121.7	121.7	0.0	223.69	219.23	4.46	0.16	4.30	75.0	46.7	2757	1727	4485
4-Jun	155	120.0	120.0	0.0	223.69	219.22	4.47	0.16	4.32	75.0	45.0	2769	1671	4440
5-Jun	156	122.4	122.4	0.0	223.69	219.24	4.45	0.16	4.29	75.0	47.4	2753	1751	4503
6-Jun	157	121.7	121.7	0.0	223.69	219.23	4.46	0.16	4.30	75.0	46.7	2757	1729	4486
7-Jun	158	113.7	113.7	0.0	223.69	219.15	4.54	0.15	4.39	75.0	38.7	2812	1451	4263
8-Jun	159	116.5	116.5	0.0	223.69	219.18	4.51	0.15	4.36	75.0	41.5	2793	1552	4345
9-Jun	160	117.4	117.4	0.0	223.69	219.19	4.50	0.15	4.35	75.0	42.4	2787	1583	4370
10-Jun	161	113.8	113.8	0.0	223.69	219.15	4.54	0.15	4.38	75.0	38.8	2811	1455	4267
11-Jun	162	121.5	121.5	0.0	223.69	219.23	4.46	0.16	4.30	75.0	46.5	2758	1723	4481
12-Jun	163	114.2	114.2	0.0	223.69	219.16	4.53	0.15	4.38	75.0	39.2	2808	1471	4280
13-Jun	164	112.6	112.6	0.0	223.69	219.14	4.55	0.15	4.40	75.0	37.6	2820	1406	4226
14-Jun	165	113.2	113.2	0.0	223.69	219.15	4.54	0.15	4.39	75.0	38.2	2816	1429	4245
15-Jun	166	116.2	116.2	0.0	223.69	219.18	4.51	0.15	4.36	75.0	41.2	2795	1542	4337
16-Jun	167	125.1	125.1	0.0	223.69	219.27	4.42	0.16	4.26	75.0	50.1	2734	1841	4575
17-Jun	168	122.0	122.0	0.0	223.69	219.24	4.45	0.16	4.30	75.0	47.0	2755	1740	4495
18-Jun	169	132.8	132.8	0.0	223.69	219.35	4.34	0.16	4.18	75.0	57.8	2681	2083	4764
19-Jun	170	131.8	131.8	0.0	223.69	219.34	4.35	0.16	4.19	75.0	56.8	2688	2053	4741
20-Jun	171	122.2	122.2	0.0	223.69	219.24	4.45	0.16	4.29	75.0	47.2	2753	1747	4500
21-Jun	172	124.6	124.6	0.0	223.69	219.26	4.43	0.16	4.27	75.0	49.6	2737	1825	4562
22-Jun	173	126.0	126.0	0.0	223.69	219.28	4.41	0.16	4.25	75.0	51.0	2727	1872	4599
23-Jun	174	115.5	115.5	0.0	223.69	219.17	4.52	0.15	4.37	75.0	40.5	2799	1521	4320
24-Jun	175	118.3	118.3	0.0	223.69	219.20	4.49	0.15	4.34	75.0	43.3	2780	1615	4395
25-Jun	176	116.0	116.0	0.0	223.69	219.18	4.51	0.15	4.36	75.0	41.0	2796	1536	4332
26-Jun	177	116.3	116.3	0.0	223.69	219.18	4.51	0.15	4.36	75.0	41.3	2794	1547	4341
27-Jun	178	117.1	117.1	0.0	223.69	219.19	4.50	0.15	4.35	75.0	42.1	2789	1573	4362
28-Jun	179	133.9	133.9	0.0	223.69	219.36	4.33	0.16	4.17	75.0	58.9	2673	2117	4790
29-Jun	180	128.5	128.5	0.0	223.69	219.30	4.39	0.16	4.23	75.0	53.5	2710	1952	4662
30-Jun	181	112.5	112.5	0.0	223.69	219.14	4.55	0.15	4.40	75.0	37.5	2820	1404	4224
1-Jul	182	129.4	129.4	0.0	223.69	219.31	4.38	0.16	4.22	75.0	54.4	2704	1982	4686

Energy Computations-1

M. Nasir-uddin



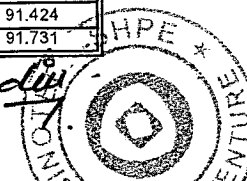
Date	Days (1 year)	Inflows (m³/s)	Power Flows (m³/s)	Spills (m³/s)	HWL (masl)	TWL (masl)	Gross Head (m)	Head Loss (m)	Net Head (m)	Turbine Flows		Power		Energy (MWh)
										Unit-1	Unit-2	Unit-1	Unit-2	
									4.22	75.0	54.3	2705	1979	4683
								0.16	4.18	75.0	58.2	2678	2097	4775
								0.16	4.18	75.0	58.0	2680	2090	4769
2-Jul	183	129.3	129.3	0.0	223.69	219.31	4.38	0.16	4.17	75.0	58.5	2676	2104	4780
3-Jul	184	133.2	133.2	0.0	223.69	219.35	4.34	0.16	4.19	75.0	57.3	2684	2069	4754
4-Jul	185	133.0	133.0	0.0	223.69	219.35	4.34	0.16	4.17	75.0	58.5	2676	2106	4782
5-Jul	186	133.5	133.5	0.0	223.69	219.34	4.35	0.16	4.17	75.0	58.5	2676	2106	4782
6-Jul	187	132.3	132.3	0.0	223.69	219.35	4.34	0.16	4.16	75.0	59.8	2668	2142	4810
7-Jul	188	133.5	133.5	0.0	223.69	219.37	4.32	0.16	4.15	75.0	60.7	2661	2171	4832
8-Jul	189	134.8	134.8	0.0	223.69	219.38	4.31	0.16	4.15	75.0	55.6	2696	2018	4714
9-Jul	190	135.7	135.7	0.0	223.69	219.32	4.37	0.16	4.20	75.0	55.6	2676	2107	4783
10-Jul	191	130.6	130.6	0.0	223.69	219.35	4.34	0.16	4.17	75.0	60.8	2661	2172	4832
11-Jul	192	133.6	133.6	0.0	223.69	219.38	4.31	0.16	4.15	75.0	60.8	2661	2172	4832
12-Jul	193	135.8	135.8	0.0	223.69	219.38	4.31	0.16	4.18	75.0	57.7	2682	2081	4763
13-Jul	194	132.7	132.7	0.0	223.69	219.34	4.35	0.16	4.17	75.0	58.4	2677	2102	4779
14-Jul	195	133.4	133.4	0.0	223.69	219.35	4.34	0.16	4.17	75.0	58.4	2677	2102	4779
15-Jul	196	110.3	110.3	0.0	223.69	219.12	4.57	0.15	4.42	75.0	35.3	2836	1315	4151
16-Jul	197	110.2	110.2	0.0	223.69	219.12	4.57	0.15	4.42	75.0	35.2	2836	1311	4148
17-Jul	198	123.6	123.6	0.0	223.69	219.25	4.44	0.16	4.28	75.0	48.6	2744	1793	4537
18-Jul	199	126.3	126.3	0.0	223.69	219.28	4.41	0.16	4.25	75.0	51.3	2726	1879	4605
19-Jul	200	117.1	117.1	0.0	223.69	219.19	4.50	0.15	4.35	75.0	42.1	2789	1575	4363
20-Jul	201	122.4	122.4	0.0	223.69	219.24	4.45	0.16	4.29	75.0	47.4	2752	1753	4505
21-Jul	202	119.2	119.2	0.0	223.69	219.21	4.48	0.16	4.29	75.0	44.2	2775	1644	4419
22-Jul	203	120.2	120.2	0.0	223.69	219.22	4.47	0.16	4.33	75.0	44.2	2775	1644	4419
23-Jul	204	130.9	130.9	0.0	223.69	219.33	4.36	0.16	4.32	75.0	45.2	2768	1678	4446
24-Jul	205	128.7	128.7	0.0	223.69	219.30	4.39	0.16	4.20	75.0	55.9	2694	2028	4722
25-Jul	206	127.6	127.6	0.0	223.69	219.29	4.40	0.16	4.23	75.0	53.7	2709	1956	4666
26-Jul	207	118.3	118.3	0.0	223.69	219.20	4.49	0.15	4.24	75.0	52.6	2717	1922	4639
27-Jul	208	110.4	110.4	0.0	223.69	219.12	4.57	0.15	4.24	75.0	43.3	2781	1614	4394
28-Jul	209	121.4	121.4	0.0	223.69	219.23	4.46	0.16	4.34	75.0	43.3	2781	1614	4394
29-Jul	210	107.9	107.9	0.0	223.69	219.07	4.60	0.15	4.34	75.0	35.4	2835	1319	4154
30-Jul	211	105.5	105.5	0.0	223.69	219.10	4.59	0.15	4.42	75.0	35.4	2835	1319	4154
31-Jul	212	108.6	108.6	0.0	223.69	219.25	4.44	0.16	4.42	75.0	46.4	2759	1718	4478
1-Aug	213	123.5	123.5	0.0	223.69	219.24	4.45	0.16	4.30	75.0	46.4	2759	1718	4478
2-Aug	214	121.9	121.9	0.0	223.69	219.20	4.49	0.15	4.30	75.0	46.9	2756	1737	4492
3-Aug	215	118.7	118.7	0.0	223.69	219.18	4.51	0.15	4.33	75.0	43.7	2778	1628	4406
4-Aug	216	116.7	116.7	0.0	223.69	219.22	4.47	0.16	4.35	75.0	41.7	2792	1560	4352
5-Aug	217	120.8	120.8	0.0	223.69	219.14	4.55	0.15	4.35	75.0	41.7	2792	1560	4352
6-Aug	218	112.3	112.3	0.0	223.69	219.10	4.59	0.15	4.31	75.0	45.8	2763	1700	4463
7-Aug	219	108.5	108.5	0.0	223.69	219.10	4.59	0.15	4.31	75.0	45.8	2763	1700	4463
8-Aug	220	108.9	108.9	0.0	223.69	219.10	4.59	0.15	4.40	75.0	37.3	2822	1395	4217
9-Aug	221	121.6	121.6	0.0	223.69	219.23	4.46	0.16	4.40	75.0	37.3	2822	1395	4217
10-Aug	222	110.1	110.1	0.0	223.69	219.12	4.57	0.15	4.40	75.0	33.5	2847	1247	4095
11-Aug	223	115.6	115.6	0.0	223.69	219.17	4.52	0.15	4.44	75.0	33.5	2845	1260	4106
12-Aug	224	117.0	117.0	0.0	223.69	219.19	4.50	0.15	4.30	75.0	46.6	2757	1727	4485
13-Aug	225	112.5	112.5	0.0	223.69	219.14	4.55	0.15	4.37	75.0	46.6	2757	1727	4485
14-Aug	226	114.7	114.7	0.0	223.69	219.16	4.53	0.15	4.42	75.0	35.1	2837	1310	4146
15-Aug	227	108.5	108.5	0.0	223.69	219.10	4.59	0.15	4.42	75.0	40.6	2799	1523	4322
16-Aug	228	110.9	110.9	0.0	223.69	219.12	4.57	0.15	4.37	75.0	40.6	2799	1523	4322

Energy Computations-5

M. Nasir-ldin



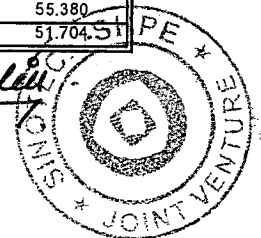
Date	Days	Inflows	Power Flows	Spills	HWL	TWL	Gross Head	Head Loss	Net Head	Turbine Flows		Power		Total	Energy
	(1 year)	(m³/s)	(m³/s)	(m³/s)	(masl)	(masl)	(m)	(m)	(m)	Unit-1	Unit-2	Unit-1	Unit-2		(MVh)
17-Aug	229	109.6	109.6	0.0	223.69	219.11	4.58	0.15	4.43	75.0	34.6	2840	1289	4129	99.095
18-Aug	230	109.9	109.9	0.0	223.69	219.11	4.58	0.15	4.43	75.0	34.9	2838	1301	4139	99.332
19-Aug	231	118.2	118.2	0.0	223.69	219.20	4.49	0.15	4.34	75.0	43.2	2781	1612	4393	105.434
20-Aug	232	110.0	110.0	0.0	223.69	219.11	4.58	0.15	4.43	75.0	35.0	2837	1306	4143	99.428
21-Aug	233	110.3	110.3	0.0	223.69	219.12	4.57	0.15	4.42	75.0	35.3	2835	1317	4152	99.653
22-Aug	234	108.2	108.2	0.0	223.69	219.10	4.59	0.15	4.44	75.0	33.2	2850	1236	4085	98.044
23-Aug	235	101.2	101.2	0.0	223.69	219.03	4.66	0.14	4.52	75.0	26.2	2898	962	3860	92.631
24-Aug	236	102.0	102.0	0.0	223.69	219.03	4.66	0.15	4.51	75.0	27.0	2893	990	3883	93.189
25-Aug	237	110.8	110.8	0.0	223.69	219.12	4.57	0.15	4.42	75.0	35.8	2832	1336	4168	100.028
26-Aug	238	108.4	108.4	0.0	223.69	219.10	4.59	0.15	4.44	75.0	33.4	2848	1243	4091	98.186
27-Aug	239	99.7	99.7	0.0	223.69	219.01	4.68	0.14	4.54	75.0	24.7	2908	903	3811	91.470
28-Aug	240	105.6	105.6	0.0	223.69	219.07	4.62	0.15	4.47	75.0	30.6	2868	1133	4000	96.011
29-Aug	241	102.1	102.1	0.0	223.69	219.03	4.66	0.15	4.51	75.0	27.1	2892	995	3887	93.281
30-Aug	242	96.4	96.4	0.0	223.69	218.98	4.71	0.14	4.57	52.5	43.9	2070	1728	3797	91.136
31-Aug	243	96.6	96.6	0.0	223.69	218.98	4.71	0.14	4.57	52.5	44.1	2069	1732	3801	91.221
1-Sep	244	94.6	94.6	0.0	223.69	218.96	4.73	0.14	4.59	52.5	42.1	2079	1661	3740	89.757
2-Sep	245	100.7	100.7	0.0	223.69	219.02	4.67	0.14	4.52	75.0	25.7	2901	941	3843	92.226
3-Sep	246	89.3	89.3	0.0	223.69	218.91	4.78	0.14	4.65	52.5	36.8	2104	1452	3556	85.353
4-Sep	247	95.9	95.9	0.0	223.69	218.97	4.72	0.14	4.58	52.5	43.4	2072	1709	3781	90.741
5-Sep	248	95.4	95.4	0.0	223.69	218.97	4.72	0.14	4.58	52.5	42.9	2075	1689	3764	90.326
6-Sep	249	97.4	97.4	0.0	223.69	218.99	4.70	0.14	4.56	52.5	44.9	2065	1761	3826	91.830
7-Sep	250	90.2	90.2	0.0	223.69	218.91	4.78	0.14	4.64	52.5	37.7	2100	1490	3590	86.151
8-Sep	251	91.8	91.8	0.0	223.69	218.93	4.76	0.14	4.62	52.5	39.3	2092	1556	3649	87.564
9-Sep	252	91.5	91.5	0.0	223.69	218.93	4.76	0.14	4.62	52.5	39.0	2094	1544	3638	87.308
10-Sep	253	91.9	91.9	0.0	223.69	218.93	4.76	0.14	4.62	52.5	39.4	2092	1559	3651	87.620
11-Sep	254	88.2	88.2	0.0	223.69	218.89	4.80	0.14	4.66	52.5	35.7	2110	1405	3515	84.352
12-Sep	255	84.7	84.7	0.0	223.69	218.86	4.83	0.14	4.70	52.5	32.2	2126	1261	3387	81.295
13-Sep	256	85.0	85.0	0.0	223.69	218.86	4.83	0.14	4.69	52.5	32.5	2125	1271	3396	81.509
14-Sep	257	85.3	85.3	0.0	223.69	218.86	4.83	0.14	4.69	52.5	32.8	2124	1284	3408	81.791
15-Sep	258	85.7	85.7	0.0	223.69	218.86	4.83	0.14	4.69	52.5	33.2	2122	1303	3424	82.183
16-Sep	259	86.4	86.4	0.0	223.69	218.87	4.82	0.14	4.69	52.5	33.9	2119	1328	3447	82.720
17-Sep	260	85.4	85.4	0.0	223.69	218.88	4.81	0.14	4.68	52.5	33.9	2119	1328	3447	82.720
18-Sep	261	93.5	93.5	0.0	223.69	218.87	4.82	0.14	4.68	52.5	33.9	2119	1328	3447	82.720
19-Sep	262	94.3	94.3	0.0	223.69	218.87	4.82	0.14	4.68	52.5	33.9	2119	1328	3447	82.720
20-Sep	263	102.9	102.9	0.0	223.69	218.88	4.81	0.14	4.68	52.5	33.9	2119	1328	3447	82.720
21-Sep	264	96.4	96.4	0.0	223.69	218.87	4.72	0.14	4.60	52.5	41.0	2084	1621	3705	88.927
22-Sep	265	96.0	96.0	0.0	223.69	218.95	4.74	0.14	4.60	52.5	41.8	2080	1652	3732	89.565
23-Sep	266	94.6	94.6	0.0	223.69	218.96	4.73	0.14	4.59	52.5	41.8	2080	1652	3732	89.565
24-Sep	267	89.1	89.1	0.0	223.69	218.96	4.73	0.14	4.59	75.0	27.9	2886	1028	3914	93.944
25-Sep	268	95.2	95.2	0.0	223.69	219.04	4.65	0.15	4.50	52.5	43.9	2070	1726	3796	91.094
26-Sep	269	96.4	96.4	0.0	223.69	218.98	4.71	0.14	4.57	52.5	43.5	2072	1712	3784	90.812
27-Sep	270	103.9	103.9	0.0	223.69	218.97	4.72	0.14	4.58	52.5	43.5	2072	1712	3784	90.812
28-Sep	271	113.3	113.3	0.0	223.69	218.97	4.72	0.14	4.58	52.5	43.5	2072	1712	3784	90.812
29-Sep	272	105.4	105.4	0.0	223.69	218.97	4.72	0.14	4.58	52.5	42.1	2079	1662	3741	89.772
30-Sep	273	96.8	96.8	0.0	223.69	218.96	4.73	0.14	4.59	52.5	42.1	2079	1662	3741	89.772
1-Oct	274	97.2	97.2	0.0	223.69	218.96	4.73	0.14	4.59	52.5	42.1	2079	1662	3741	89.772
										75.0	28.9	2879	1068	3947	94.731
										75.0	38.3	2815	1434	4249	101.978
										75.0	30.4	2869	1127	3995	95.888
										52.5	44.3	2068	1742	3809	91.424
										52.5	44.7	2066	1756	3822	91.731



Date	Days	Inflows	Power Flows	S	HWL	TWL	Gross Head	Head Loss	Net H	Turbine Flows		Power			Energy
	(1 year)	(m³/s)	(m³/s)	(m³/s)	(masl)	(masl)	(m)	(m)	(m)	Unit-1	Unit-2	Unit-1	Unit-2	Total	(MWh)
2-Oct	275	95.4	95.4	0.0	223.69	218.97	4.72	0.14	4.58	52.5	42.9	2075	1690	3765	90.353
3-Oct	276	89.4	89.4	0.0	223.69	218.91	4.78	0.14	4.65	52.5	36.9	2104	1456	3560	85.434
4-Oct	277	89.0	89.0	0.0	223.69	218.90	4.79	0.14	4.65	52.5	36.5	2106	1436	3542	85.017
5-Oct	278	88.3	88.3	0.0	223.69	218.89	4.80	0.14	4.66	52.5	35.8	2109	1409	3519	84.444
6-Oct	279	79.7	79.7	0.0	223.69	218.81	4.88	0.13	4.75	52.5	27.2	2151	1052	3203	76.876
7-Oct	280	78.9	78.9	0.0	223.69	218.80	4.89	0.13	4.76	52.5	26.4	2155	1021	3176	76.216
8-Oct	281	77.6	77.6	0.0	223.69	218.79	4.90	0.13	4.77	52.5	25.1	2161	967	3128	75.066
9-Oct	282	76.4	76.4	0.0	223.69	218.77	4.92	0.13	4.78	52.5	23.9	2167	919	3086	74.068
10-Oct	283	83.4	83.4	0.0	223.69	218.84	4.85	0.13	4.71	52.5	30.9	2133	1205	3338	80.110
F	284	77.5	77.5	0.0	223.69	218.79	4.90	0.13	4.77	52.5	25.0	2161	965	3126	75.033
12-Oct	285	76.7	76.7	0.0	223.69	218.78	4.91	0.13	4.78	52.5	24.2	2165	932	3098	74.343
13-Oct	286	77.1	77.1	0.0	223.69	218.78	4.91	0.13	4.78	52.5	24.6	2164	945	3109	74.618
14-Oct	287	75.5	75.5	0.0	223.69	218.76	4.93	0.13	4.79	52.5	23.0	2171	881	3052	73.254
15-Oct	288	79.8	79.8	0.0	223.69	218.81	4.88	0.13	4.75	52.5	27.3	2151	1056	3207	76.960
16-Oct	289	91.4	91.4	0.0	223.69	218.93	4.76	0.14	4.62	52.5	38.9	2094	1540	3634	87.215
17-Oct	290	81.4	81.4	0.0	223.69	218.82	4.87	0.13	4.73	52.5	28.9	2143	1124	3267	78.397
18-Oct	291	82.3	82.3	0.0	223.69	218.83	4.86	0.13	4.72	52.5	29.8	2138	1161	3299	79.186
19-Oct	292	77.4	77.4	0.0	223.69	218.78	4.91	0.13	4.77	52.5	24.9	2162	961	3123	74.944
20-Oct	293	82.6	82.6	0.0	223.69	218.84	4.85	0.13	4.72	52.5	30.1	2137	1174	3311	79.460
21-Oct	294	87.3	87.3	0.0	223.69	218.88	4.81	0.14	4.67	52.5	34.8	2114	1368	3482	83.563
22-Oct	295	82.4	82.4	0.0	223.69	218.84	4.85	0.13	4.72	52.5	29.9	2138	1166	3304	79.288
23-Oct	296	81.0	81.0	0.0	223.69	218.82	4.87	0.13	4.74	52.5	28.5	2144	1107	3252	78.048
24-Oct	297	79.6	79.6	0.0	223.69	218.81	4.88	0.13	4.75	52.5	27.1	2151	1049	3201	76.817
25-Oct	298	80.7	80.7	0.0	223.69	218.82	4.87	0.13	4.74	52.5	28.2	2146	1094	3240	77.754
26-Oct	299	75.3	75.3	0.0	223.69	218.76	4.93	0.13	4.80	52.5	22.8	2172	873	3045	73.086
27-Oct	300	73.6	73.6	0.0	223.69	218.74	4.95	0.13	4.82	73.6	0.0	3035	0	3035	72.830
28-Oct	301	71.5	71.5	0.0	223.69	218.71	4.98	0.13	4.85	71.5	0.0	2971	0	2971	71.300
29-Oct	302	64.4	64.4	0.0	223.69	218.61	5.08	0.12	4.95	64.4	0.0	2747	0	2747	65.924
30-Oct	303	66.4	66.4	0.0	223.69	218.64	5.05	0.13	4.93	66.4	0.0	2812	0	2812	67.490
31-Oct	304	64.8	64.8	0.0	223.69	218.62	5.07	0.12	4.95	64.8	0.0	2757	0	2757	66.176
1-Nov	305	69.8	69.8	0.0	223.69	218.69	5.00	0.13	4.88	69.8	0.0	2919	0	2919	70.067
2-Nov	306	79.4	79.4	0.0	223.69	218.80	4.89	0.13	4.75	52.5	26.9	2152	1040	3193	76.628
3-Nov	307	68.0	68.0	0.0	223.69	218.66	5.03	0.13	4.90	68.0	0.0	2863	0	2863	68.721
4-Nov	308	68.5	68.5	0.0	223.69	218.67	5.02	0.13	4.90	68.5	0.0	2878	0	2878	69.080
5-Nov	309	58.0	58.0	0.0	223.69	218.52	5.17	0.12	5.05	58.0	0.0	2526	0	2526	60.633
6-Nov	310	62.2	62.2	0.0	223.69	218.58	5.11	0.12	4.99	62.2	0.0	2671	0	2671	64.105
7-Nov	311	66.0	66.0	0.0	223.69	218.63	5.06	0.12	4.93	66.0	0.0	2796	0	2796	67.108
8-Nov	312	64.4	64.4	0.0	223.69	218.61	5.08	0.12	4.96	64.4	0.0	2745	0	2745	65.878
9-Nov	313	66.4	66.4	0.0	223.69	218.64	5.05	0.13	4.93	66.4	0.0	2812	0	2812	67.488
10-Nov	314	67.1	67.1	0.0	223.69	218.65	5.04	0.13	4.92	67.1	0.0	2833	0	2833	67.983
11-Nov	315	58.9	58.9	0.0	223.69	218.53	5.16	0.12	5.04	58.9	0.0	2558	0	2558	61.384
12-Nov	316	65.4	65.4	0.0	223.69	218.62	5.07	0.12	4.94	65.4	0.0	2777	0	2777	66.645
13-Nov	317	60.0	60.0	0.0	223.69	218.55	5.14	0.12	5.02	60.0	0.0	2595	0	2595	62.290
14-Nov	318	52.0	52.0	0.0	223.69	218.44	5.25	0.12	5.14	52.0	0.0	2304	0	2304	55.308
15-Nov	319	52.1	52.1	0.0	223.69	218.44	5.25	0.12	5.14	52.1	0.0	2308	0	2308	55.380
16-Nov	320	48.2	48.2	0.0	223.69	218.38	5.31	0.11	5.19	48.2	0.0	2154	0	2154	51.70451

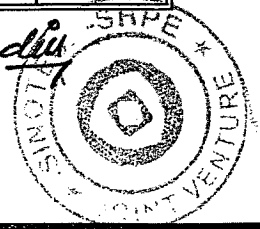
Energy Computations-7

*u. masif d. d. u.*



Date	Days	Inflows	Power Flows	Spills	HWL	TWL	Gross Head	Head Loss	Net Head	Turbine Flows		Power			Energy
	(1 year)	(m³/s)	(m³/s)	(m³/s)	(masl)	(masl)	(m)	(m)	(m)	Unit-1	Unit-2	Unit-1	Unit-2	Total	(MWh)
17-Nov	321	44.9	44.9	0.0	223.69	218.34	5.35	0.11	5.24	44.9	0.0	2026	0	2026	48.629
18-Nov	322	48.7	48.7	0.0	223.69	218.39	5.30	0.11	5.19	48.7	0.0	2175	0	2175	52.204
19-Nov	323	47.2	47.2	0.0	223.69	218.37	5.32	0.11	5.21	47.2	0.0	2118	0	2118	50.823
20-Nov	324	47.5	47.5	0.0	223.69	218.37	5.32	0.11	5.20	47.5	0.0	2128	0	2128	51.083
21-Nov	325	49.7	49.7	0.0	223.69	218.40	5.29	0.12	5.17	49.7	0.0	2213	0	2213	53.123
22-Nov	326	49.8	49.8	0.0	223.69	218.41	5.28	0.12	5.17	49.8	0.0	2220	0	2220	53.286
23-Nov	327	48.6	48.6	0.0	223.69	218.39	5.30	0.11	5.19	48.6	0.0	2174	0	2174	52.166
24-Nov	328	43.8	43.8	0.0	223.69	218.32	5.37	0.11	5.26	43.8	0.0	1981	0	1981	47.535
25-Nov	329	42.0	42.0	0.0	223.69	218.29	5.40	0.11	5.28	42.0	0.0	1907	0	1907	45.763
26-Nov	330	43.7	43.7	0.0	223.69	218.32	5.37	0.11	5.26	43.7	0.0	1978	0	1978	47.465
27-Nov	331	41.9	41.9	0.0	223.69	218.29	5.40	0.11	5.28	41.9	0.0	1905	0	1905	45.731
28-Nov	332	56.0	56.0	0.0	223.69	218.49	5.20	0.12	5.08	56.0	0.0	2456	0	2456	58.940
29-Nov	333	62.1	62.1	0.0	223.69	218.58	5.11	0.12	4.99	62.1	0.0	2669	0	2669	64.054
30-Nov	334	62.6	62.6	0.0	223.69	218.59	5.10	0.12	4.98	62.6	0.0	2685	0	2685	64.429
1-Dec	335	60.5	60.5	0.0	223.69	218.56	5.13	0.12	5.01	60.5	0.0	2611	0	2611	62.669
2-Dec	336	56.6	56.6	0.0	223.69	218.50	5.19	0.12	5.07	56.6	0.0	2476	0	2476	59.433
3-Dec	337	49.3	49.3	0.0	223.69	218.40	5.29	0.12	5.18	49.3	0.0	2201	0	2201	52.820
4-Dec	338	50.3	50.3	0.0	223.69	218.41	5.28	0.12	5.16	50.3	0.0	2239	0	2239	53.731
5-Dec	339	48.7	48.7	0.0	223.69	218.39	5.30	0.11	5.19	48.7	0.0	2177	0	2177	52.245
6-Dec	340	48.2	48.2	0.0	223.69	218.38	5.31	0.11	5.19	48.2	0.0	2156	0	2156	51.754
7-Dec	341	45.0	45.0	0.0	223.69	218.34	5.35	0.11	5.24	45.0	0.0	2030	0	2030	48.726
8-Dec	342	45.2	45.2	0.0	223.69	218.34	5.35	0.11	5.24	45.2	0.0	2037	0	2037	48.892
9-Dec	343	43.5	43.5	0.0	223.69	218.32	5.37	0.11	5.26	43.5	0.0	1969	0	1969	47.265
10-Dec	344	43.9	43.9	0.0	223.69	218.32	5.37	0.11	5.26	43.9	0.0	1983	0	1983	47.595
11-Dec	345	43.5	43.5	0.0	223.69	218.32	5.37	0.11	5.26	43.5	0.0	1971	0	1971	47.292
12-Dec	346	45.1	45.1	0.0	223.69	218.34	5.35	0.11	5.24	45.1	0.0	2033	0	2033	48.797
13-Dec	347	45.8	45.8	0.0	223.69	218.35	5.34	0.11	5.23	45.8	0.0	2061	0	2061	49.466
14-Dec	348	46.0	46.0	0.0	223.69	218.35	5.34	0.11	5.23	46.0	0.0	2067	0	2067	49.609
15-Dec	349	54.4	54.4	0.0	223.69	218.47	5.22	0.12	5.10	54.4	0.0	2397	0	2397	57.526
16-Dec	350	47.3	47.3	0.0	223.69	218.37	5.32	0.11	5.21	47.3	0.0	2122	0	2122	50.940
17-Dec	351	46.5	46.5	0.0	223.69	218.36	5.33	0.11	5.22	46.5	0.0	2091	0	2091	50.175
18-Dec	352	46.8	46.8	0.0	223.69	218.36	5.33	0.11	5.21	46.8	0.0	2102	0	2102	50.445
19-Dec	353	46.0	46.0	0.0	223.69	218.35	5.34	0.11	5.22	46.0	0.0	2071	0	2071	49.698
20-Dec	354	45.9	45.9	0.0	223.69	218.35	5.34	0.11	5.23	45.9	0.0	2064	0	2064	49.539
21-Dec	355	43.9	43.9	0.0	223.69	218.32	5.37	0.11	5.26	43.9	0.0	1984	0	1984	47.620
22-Dec	356	50.8	50.8	0.0	223.69	218.42	5.27	0.12	5.16	50.8	0.0	2257	0	2257	54.174
23-Dec	357	52.7	52.7	0.0	223.69	218.45	5.24	0.12	5.13	52.7	0.0	2329	0	2329	55.897
24-Dec	358	49.9	49.9	0.0	223.69	218.41	5.28	0.12	5.17	49.9	0.0	2221	0	2221	53.302
25-Dec	359	56.6	56.6	0.0	223.69	218.50	5.19	0.12	5.07	56.6	0.0	2477	0	2477	59.439
26-Dec	360	52.9	52.9	0.0	223.69	218.45	5.24	0.12	5.12	52.9	0.0	2338	0	2338	56.110
27-Dec	361	35.7	35.7	0.0	223.69	218.21	5.48	0.11	5.38	35.7	0.0	1622	0	1622	38.929
28-Dec	362	21.2	21.2	0.0	223.69	217.98	5.71	0.09	5.62	21.2	0.0	0	0	0	0.000
29-Dec	363	19.2	19.2	0.0	223.69	217.92	5.77	0.09	5.69	19.2	0.0	0	0	0	0.000
30-Dec	364	9.6	9.6	0.0	223.69	217.61	6.08	0.04	6.04	9.6	0.0	0	0	0	0.000
31-Dec	365	9.7	9.7	0.0	223.69	217.61	6.08	0.04	6.03	9.7	0.0	0	0	0	0.000

Energy Computations-8



## Summary of Land Acquisition and Resettlement Cost CHAINWALI HPP

## CHAINWALI HYDROPOWER PROJECT

S. No	Type of Asset	Unit	Quantity	Cost/Unit (Rs)	Cost (Million Rs)	Remarks
1	Land	Acre	73.08	1,200,000	87.696	15 % compulsory land acquisition charges included.
2	Crop Compensation	Acre	73.08	<ul style="list-style-type: none"> <li>Fodder = 2400</li> <li>Rice+ wheat = 63000</li> <li>Vegetables=34000</li> </ul>	4.567	Wheat in Winter and Rice in Summer. Compensation for 1 year.
<b>Affected Buildings/Structures</b>						
	(a) Semi Pacca	Sq.ft	442	600	0.265	
	(b) Tube-well Room	Sq.ft	180	600	0.108	
	(c) Boundary wall	Rft	2506	400	1.002	
<b>Infrastructures</b>						
	(a) Removal of Hand Pumps	No	1	5000	0.005	
	(b) Removal of Tube wells	No	1	120,000	0.120	
<b>Forest Tree Compensation</b>						
5	Trees Re-plantation	Avenue Mile	46.52	59300	2.177	500 trees per avenue mile will be planted
6	Livelihood Allowance for Agri. Workers	No	2	7,000	0.042	Allowance for three months
	Add one severity allowance for households who have lost more than 10% of their productive land	-	-	-	-	-



# Attachment ⑤ CHP

## Name of Companies / JVs Participated in International Competitive Bidding

S.No	Name of Company / JV	Nationality
1	SHUNTAI-JINLUN & AL-FAJAR JV	China & Pakistan
2	CLIC-LAC Consortium	China & Pakistan
3	DESCON-TRIED JV	China & Pakistan
4	CWE-TTP JV	China & Pakistan
5	SINOTEC-SHPE JV	China
6	CNEEC	China & Pakistan





730
61.15%
102.9331

Chianwali Hydro Project at Upper Chenab Canal EPC (ECNEC)															
EPC Stage Reference Tariff															
Energy Purchase Price (Rs/KWh)			Capacity Purchase Price (Rs./KW/Month)							Total Tariff					
Years	Variable O&M	Water Charges	Total	Fixed O&M Local	Fixed O&M Forgn	Insurance	ROE & Redemption	ROEDC	Withholding Tax @ 7.5%	Loan Repayment	Interest Charges	Total	CPP (Rs/KWh)	(Rs/KWh)	(c/KWh)
1	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1578.8311	500.8518	5272.6972	11.8117	12.6844	12.3229
2	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1601.0121	478.6708	5272.6972	11.8117	12.6844	12.3229
3	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1623.5047	456.1782	5272.6972	11.8117	12.6844	12.3229
4	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1646.3133	433.3695	5272.6972	11.8117	12.6844	12.3229
5	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1669.4424	410.2405	5272.6972	11.8117	12.6844	12.3229
6	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1692.8963	386.7865	5272.6972	11.8117	12.6844	12.3229
7	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1716.6798	363.0030	5272.6972	11.8117	12.6844	12.3229
8	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1740.7975	338.88535	5272.6972	11.8117	12.6844	12.3229
9	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1765.2539	314.42889	5272.6972	11.8117	12.6844	12.3229
10	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1790.0540	289.62884	5272.6972	11.8117	12.6844	12.3229
11	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1815.2025	264.48037	5272.6972	11.8117	12.6844	12.3229
12	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1840.7042	238.97859	5272.6972	11.8117	12.6844	12.3229
13	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1866.5643	213.11854	5272.6972	11.8117	12.6844	12.3229
14	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1892.7877	186.89517	5272.6972	11.8117	12.6844	12.3229
15	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1919.3794	160.3034	5272.6972	11.8117	12.6844	12.3229
16	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1946.3448	133.3380	5272.6972	11.8117	12.6844	12.3229
17	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1973.6890	105.9938	5272.6972	11.8117	12.6844	12.3229
18	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	2001.4174	78.2655	5272.6972	11.8117	12.6844	12.3229
19	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	2029.5353	50.1476	5272.6972	11.8117	12.6844	12.3229
20	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	2058.0482	21.6346	5272.6972	11.8117	12.6844	12.3229
21	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1940.9495	159.1153	0.0000	0.0000	0.0000	3596.8044	8.0574	8.9301	8.6756
22	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1940.9495	159.1153	0.0000	0.0000	0.0000	3596.8044	8.0574	8.9301	8.6756
23	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1940.9495	159.1153	0.0000	0.0000	0.0000	3596.8044	8.0574	8.9301	8.6756
24	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1940.9495	159.1153	0.0000	0.0000	0.0000	3596.8044	8.0574	8.9301	8.6756
25	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1940.9495	159.1153	0.0000	0.0000	0.0000	3596.8044	8.0574	8.9301	8.6756
26	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1940.9495	159.1153	0.0000	0.0000	0.0000	3596.8044	8.0574	8.9301	8.6756
27	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1940.9495	159.1153	0.0000	0.0000	0.0000	3596.8044	8.0574	8.9301	8.6756
28	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1940.9495	159.1153	0.0000	0.0000	0.0000	3596.8044	8.0574	8.9301	8.6756
29	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1940.9495	159.1153	0.0000	0.0000	0.0000	3596.8044	8.0574	8.9301	8.6756
30	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1940.9495	159.1153	0.0000	0.0000	0.0000	3596.8044	8.0574	8.9301	8.6756
Average Tariff															
1-20 Yrs	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1537.1595	159.1153	0.0000	1808.4229	271.2599	5272.6972	11.8117	12.6844	12.3229
21-30 Yrs	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1940.9495	159.1153	0.0000	0	0	3596.8044	8.0574	8.9301	8.6756
1-30 Yrs	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1671.7561	159.1153	0.0000	1205.6153	180.8400	4714.0663	10.5603	11.4329	11.1072
Levelized Tariff															
1-30 Yrs	0.7226	0.1500	0.8726	774.2167	193.5542	528.9687	1576.2817	159.1153	0.0000	1565.7059	312.4815	5110.3241	11.4480	12.3206	11.9695

Overall Project Cost (Rs. Millions)	
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S. No.	Description	Total Local Cost	Total Foreign Cost	Total (Rs. Millions)
1	Civil Works including Employers Facilities and Design Services	297.10	1,415.41	1,712.51
2	Electrical (E) and Mechanical (M) Works including Design Services, Transportation, Testing and Commissioning	42.14	749.70	791.84
3	<b>Total Bid Price (Including Escalation)</b>	<b>339.24</b>	<b>2,165.11</b>	<b>2504.35</b>
4	C.D.M. (Clean Development Mechanism)	5.21	0	5.21
5	Land, Resettlement and Compensation	107.00	0	107.00
6	(a) Project Management-Engineering & Supervision	35.68	0	35.68
7	(b) Consultancy	27.61	11.83	39.45
8	Project Administration, Audit & Account @ 2.5% of EPC Cost	62.61	0	62.61
9	<b>Base Cost</b>	<b>577.35</b>	<b>2176.94</b>	<b>2754.30</b>
10	Duties & Taxes on 'B' (5% of Imported Items only)	34.13	0	34.13
11	Sind Infrastructure Cess @ 0.68% of Imported Items	4.64	0	4.64
12	<b>Capital Cost</b>	<b>616.12</b>	<b>2176.94</b>	<b>2793.07</b>
13	Financing Charges	0	64.61	64.61
14	IDC	0.00	31.93	31.93
15	<b>Financial Cost (Project Cost)</b>	<b>616.12</b>	<b>2273.48</b>	<b>2889.61</b>

Total Project Cost	2,857.68	
IDC	31.93	
Total Project Cost	2,889.61	
Debt	2,311.69	80%
Equity	577.92	20%

2

8.2

DETAILED WORKING OF BID COST (ECNEG)	
A. Revised Total Evaluated Bid (Rs.M)	2504.3495
B. Revised Local Component (Rs.M)	339.2400
C. Revised Foreign Component (Rs.M)	2165.1095
D. Revised % Share of Local Component	13.5460
E. Revised % Share of Foreign Component	86.4540

Detailed Working of New Capital Cost ECNEG	
1. Works Cost excluding Land	2504.3495
Sub-Total	2504.3495
3. Sponsors Expenditure @ 5.5%	137.7392
Sub-Total	2642.089
4. Land Cost & Compensation	107.000
Base Cost Sub-Total	2749.089
5. Custom Duty @ 5%	34.1261
6. Sind Infrastructure Cess @ 0.68%	4.6412
7. Total Custom Duty charged	38.7673
Total Capital Cost	2787.8560

8. Total Foreign Component (\$ M)	21.7100
8a. Total E&M Excls Plant Cost \$ M	7.3200
10. Custom Duty @ 5%	34.1261
11. Plant Factor	61.15%
12. Total Energy (GWh)	28.82
13. Installed Capacity (MW)	105.38
14. Exchange Rate Rs./US\$	107.9331
15. Land Cost	107.000
16. Total Foreign Debt @ 80% CAPEX	2230.2848
17. Total IBC + Commitment Charge	54.5066
18. Total Debt to Be Retired	2284.7914
19. Interest Rate Foreign LIBOR+ 0.6	1.40%
20. Interest Rate Local	12.62%
21. NPV Discount Rate for Levelized Tariff	10%
22. Rate of Return on Equity	17%

Total Foreign E&M	
Already Paid	
Balance (\$M)	
Exchange Rate New	107.93
Equivalent (Rs.M)	6820
Custom Duty @ 5%	34
Sind Infra Cess @ 0.68%	4

1. Installed Capacity (MW)	
2. Total REDSIP Capacity	
3. Total Contract (Rev) (Rs.M)	145
4. Chianwalk Share	3

1. Installed Capacity (MW)	
2. Total REDSIP Capacity	1
3. Total Contract (Rev) (Rs.M)	19
4. Marala Share	

10.30908 41.23633084  
30.92725

*[Handwritten signature]*

Chianwali Hydro Power Project Upper Chenab Canal EPC (ECNEC)								
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	2311.6853	\$50.2790	16.1818	\$2,261.4062	\$66.4608			
Second Half	\$2,261.4062	\$50.6310	15.8298	\$2,210.7752	\$66.4608			
Year 1	2311.6853	\$100.9100	32.0116	\$2,210.7752	\$132.9217	1578.8311	500.8518	2079.6828
First Half	\$2,210.7752	\$50.9854	\$15.4754	2159.7898	66.4608			
Second Half	2159.789828	\$51.3423	\$15.1185	2108.4475	66.4608			
Year 2	\$2,210.7752	\$102.3277	\$30.5940	\$2,108.4475	\$132.9217	1601.0121	478.6708	2079.6828
First Half	\$2,108.4475	51.70170779	14.75913	2056.7458	66.4608			
Second Half	2056.745809	52.06361974	14.39722	2004.6822	66.4608			
Year 3	\$2,108.4475	\$103.7653275	\$29.15635	\$2,004.6822	\$132.9217	1623.5047	456.1782	1464.4887
First Half	2004.682189	52.42806508	14.03278	1952.2541	66.4608			
Second Half	1952.254124	52.79506154	13.66578	1899.4591	66.4608			
Year 4	\$2,004.682189	\$105.2231266	\$27.69855	\$1,899.4591	\$132.9217	1646.3133	433.3695	2079.6828
First Half	1899.4591	53.1646	13.2962	1846.2944	66.4608			
Second Half	1846.2944	53.5368	12.9241	1792.7577	66.4608			
Year 5	\$1,899.4591	\$106.7014	\$26.2203	\$1,792.7577	\$132.9217	1669.4424	410.2405	2079.6828
First Half	1792.7577	53.9115	12.5493	1738.8461	66.4608			
Second Half	1738.8461	54.2889	12.1719	1684.5572	66.4608			
Year 6	\$1,792.7577	\$108.2005	\$24.7212	\$1,684.5572	\$132.9217	1692.8963	386.7865	2079.6828
First Half	1684.5572	54.6689	11.7919	1629.8883	66.4608			
Second Half	1629.8883	55.0516	11.4092	1574.8366	66.4608			
Year 7	\$1,684.5572	\$109.7206	\$23.2011	\$1,574.8366	\$132.9217	1716.6798	363.0030	2079.6828
First Half	1574.8366	55.4370	11.0239	1519.3997	66.4608			
Second Half	1519.3997	55.8250	10.6358	1463.5746	66.4608			
Year 8	\$1,574.8366	\$111.2620	\$21.6597	\$1,463.5746	\$132.9217	1740.7975	338.88535	2079.6828
First Half	1463.5746	56.2158	10.2450	1407.3588	66.4608			
Second Half	1407.3588	56.6093	9.8515	1350.7495	66.4608			
Year 9	\$1,463.5746	\$112.8251	\$20.0965	\$1,350.7495	\$132.9217	1765.2539	314.42889	2079.6828
First Half	1350.7495	57.0056	9.4552	1293.7439	66.4608			
Second Half	1293.7439	57.4046	9.0562	1236.3392	66.4608			
Year 10	\$1,350.7495	\$114.4102	\$18.5115	\$1,236.3392	\$132.9217	1790.0540	289.62884	2079.6828
First Half	1236.3392	57.8065	8.6544	1178.5328	66.4608			
Second Half	1178.5328	58.2111	8.2497	1120.3217	66.4608			
Year 11	\$1,236.3392	\$116.0176	\$16.9041	\$1,120.3217	\$132.9217	1815.2025	264.48037	2079.6828
First Half	1120.3217	58.6186	7.8423	1061.7031	66.4608			
Second Half	1061.7031	59.0289	7.4319	1002.6742	66.4608			
Year 12	\$1,120.3217	\$117.6475	\$15.2742	\$1,002.6742	\$132.9217	1840.7042	238.97859	2079.6828
First Half	1002.6742	59.4421	7.0187	943.2320	66.4608			
Second Half	943.2320	59.8582	6.6026	883.3738	66.4608			
Year 13	\$1,002.6742	\$119.3003	\$13.6213	\$883.3738	\$132.9217	1866.5643	213.11854	2079.6828
First Half	883.3738	60.2772	6.1836	823.0966	66.4608			
Second Half	823.0966	60.6992	5.7617	762.3974	66.4608			
Year 14	\$883.3738	\$120.9764	\$11.9453	\$762.3974	\$132.9217	1892.7877	186.89517	2079.6828
First Half	762.3974	61.1241	5.3368	701.2734	66.4608			
Second Half	701.2734	61.5519	4.9089	639.7214	66.4608			
Year 15	\$762.3974	\$122.6760	\$10.2457	\$639.7214	\$132.9217	1919.3794	160.3034	2079.6828
First Half	639.7214	61.9828	4.4781	577.7387	66.4608			
Second Half	577.7387	62.4167	4.0442	515.3220	66.4608			
Year 16	\$639.7214	\$124.3995	\$8.5222	\$515.3220	\$132.9217	1946.3448	133.3380	2079.6828
First Half	515.3220	62.8536	3.6073	452.4684	66.4608			\$2,311.6853
Second Half	452.4684	63.2936	3.1673	389.1748	66.4608			
Year 17	\$515.3220	\$126.1471	\$6.7745	\$389.1748	\$132.9217	1973.6890	105.9938	2079.6828
First Half	389.1748	63.7366	2.7242	325.4382	66.4608			
Second Half	325.4382	64.1828	2.2781	261.2554	66.4608			
Year 18	\$389.1748	\$127.9194	\$5.0023	\$261.2554	\$132.9217	2001.4174	78.2655	1464.4887
First Half	261.2554	64.6321	1.8288	196.6234	66.4608			
Second Half	196.6234	65.0845	1.3764	131.5389	66.4608			
Year 19	\$261.2554	\$129.7165	\$3.2052	\$131.5389	\$132.9217	2029.5353	50.1476	1464.4887
First Half	131.5389	65.5401	0.9208	65.9988	66.4608			
Second Half	65.9988	65.9988	0.4620	0.0000	66.4608			
Year 20	\$131.5389	\$131.5389	\$1.3828	\$0.0000	\$132.9217	2058.0482	21.6346	1464.4887

b

9.1

Chianwali Summary of EPC Stage Reference Tariff (ECNEC)			
Description	Reference Tariff		
	Yrs 1-20	Yrs 21-30	Levelized Yrs 1-30
	Rs.KW/Month	Rs.KW/Month	Rs.KW/Month
<b>Capacity Purchase Price (CPP)</b>			
Fixed Operation & Maintenance			
Fixed O&M Local	774.2167	774.2167	774.2167
Fixed O&M Foreign	193.5542	193.5542	193.5542
Insurance	528.9687	528.9687	528.9687
Return on Equity	1537.1595	1940.8998	1576.2769
Return on Equity During Construction (ROEDC)	159.1153	159.1153	159.1153
Withholding Tax @ 7.5%	0.0000	0.0000	0.0000
Loan Repayment + Mark up	2079.6828	0.0000	1878.1874
<b>Total</b>	<b>5272.6972</b>	<b>3596.7547</b>	<b>5110.3192</b>
<b>Energy Purchase Price (EPP)</b>			
Variable O&M	0.7226	0.7226	0.7226
Water Use Charges	0.1500	0.1500	0.1500
<b>Total</b>	<b>0.8726</b>	<b>0.8726</b>	<b>0.8726</b>
<b>Total Levelized Tariff (Rs.kwh)</b>			<b>12.3206</b>
<b>Total Levelized Tariff (c.kwh)</b>			<b>11.9695</b>



20.6181654

## Chianwali Hydro Power Project EPC

## Working of Variable &amp; Fixed Cost (ECNEC)

1,000.00

1,000,000.00

Local Variable O&M Cost Calculation		
1. Total Base Cost (Rs. Million)	2749.0887	
2. 3% of Base Cost (Rs. Million)	82.4727	
3. Variable O&M Cost (25%)(Rs. Million)	20.6182	
4. Gross Annual Generation (GWh)	28.82	
5. Auxiliary Losses (1%)	0.2882	
6. Net Annual Generation	28.5318	
7. Total Installed Capacity (MW)	5.38	
8. Net Capacity	5.3262	
9. Net Installed Capacity (Annual) (MW)	63.9144	
10. Net Installed Capacity (Annual) (KW)	63914.4000	
11. Amount Rs. KW/Month	322.5903	
12. Amount Rs. KW/h	0.7227	0.7227
13. Plant Factor	61.15%	
14. NPV Discount Rate for Levelized Tariff	10%	

Alternate Method		
1. Variable O&M Cost (25%)(Rs. Million)	20.6182	
2. Gross Annual Generation (GWh)	28.82	
3. Auxiliary Losses (1%)	0.2882	
4. Net Annual Generation	28.5318	
5. Plant Factor	61.15%	
6. Amount Rs. KW/h	0.7226	

Local Fixed O&M Cost Calculation		
1. Total Base Cost Rs. Million	2749.0887	
2. 3% of Base Cost (Rs. Million)	82.4727	
3. Variable O&M Cost (75%)(80%)(Rs. Million)	49.4836	
4. Gross Annual Generation (GWh)	28.82	
5. Auxiliary Losses (1%)	0.2882	
6. Net Annual Generation	28.5318	
7. Total Installed Capacity (MW)	5.38	
8. Net Capacity (Annual)	5.3262	
9. Net Installed Capacity (Annual) (MW)	63.9144	
10. Net Installed Capacity (Annual) (KW)	63914.4000	
11. Amount Rs. KW/Month	774.2167	
12. Amount Rs. KW/h	1.7344	1.7344
13. Plant Factor	61.15%	
14. NPV Discount Rate for Levelized Tariff	10%	

Alternate Method		
1. Variable O&M Cost (75%)(Rs. Million)	49.4836	
2. Gross Annual Generation (GWh)	28.82	
3. Auxiliary Losses (1%)	0.2882	
4. Net Annual Generation	28.5318	
5. Plant Factor	61.15%	
6. Amount Rs. KW/h	1.7343	

Foreign Fixed O&M Cost Calculation		
1. Total Base Cost Rs. Million	2749.0887	
2. 3% of Base Cost (Rs. Million)	82.4727	
3. Variable O&M Cost (75%)(20%)(Rs. Million)	12.3709	
4. Gross Annual Generation (GWh)	28.82	
5. Auxiliary Losses (1%)	0.2882	
6. Net Annual Generation	28.5318	
7. Total Installed Capacity (MW)	5.38	
8. Net Capacity (Annual)	5.3262	
9. Net Installed Capacity (Annual) (MW)	63.9144	
10. Net Installed Capacity (Annual) (KW)	63914.4000	
11. Amount Rs. KW/Month	193.5542	
12. Amount Rs. KW/h	0.4336	0.4336
13. Plant Factor	61.15%	
14. NPV Discount Rate for Levelized Tariff	10%	

Alternate Method		
1. Variable O&M Cost (75%)(Rs. Million)	12.3709	
2. Gross Annual Generation (GWh)	28.82	
3. Auxiliary Losses (1%)	0.2882	
4. Net Annual Generation	28.5318	
5. Plant Factor	61.15%	
6. Amount Rs. KW/h	0.4336	



## ASSUMPTIONS/CRITICAL (ECONOMY)

1. Total Cost (Capital)(Rs. Million)	2749.0887
2. Exchange Rate (Rs. / \$)=86/1 \$	102.9331
3. Debt Equity Ratio = 80:20	80:20:00
4. Debt Rs.Million	2199.2710
5. Equity Rs. Million	549.8177445
6. Return on Equity (Annual Dividend)(IRR-Based) = 17%	17%
7. Discount Rate for Levelized Tariff = 10%	10%
8. Repayment of Foreign Loan (ADB) (Years) = 20 Years	20 Years
9. Share of foreign loan = 80%	80%
10. Interest Rate on Domestic Loan= 12.62%	12.62%
11. Interest Rate on Foreign loan = 1.40 % (LIBOR 0.8%+ Premium 0.6%)	1.40%
12. Commitment Fee = 0.75% of unutilized amount	0.75%
13. Installed Capacity (Gross) (MW)= 4.04	5.38
14. Gross Mean Annual Generation (GWh)	28.82
15. Auxiliary Losses (1 %) (GWh)	0.2882
16. Net Annual Generation (GWh)	28.5318
17. Water Use Charges (Rs./kwh) =0.15	0.15
18. Variable O&M (25% of overall 3% of Base Cost (Rs.2749.089 M)	20.6182
19. Fixed O&M Local Cost ( 75% of overall 3% of Base Cost (Rs.2749.089 M ) 80%	49.4836
20. Fixed O&M Forgn Cost ( 75% of overall 3% of Base Cost (Rs.2749.089 M ) 20%	12.3709
21. Withholding Tax*	7.50%
21. Insurance Cost @1.35% of total EPC Cost (Rs.2749. Million)	528.9687

\* Withholding tax taken as zero due to PPDCL being a public sector entity. This will be a pass through item in case PPDCL opts to become a listed company.

9.4

Redemption Calculations	
1. Total Capital Cost (Rs. Million)	2889.6066
2. Equity @20% (Rs. Million)	577.9213
3. IRR (%)	0.17
4. Net Generation (GWh)	28.5318
5. ROE	98.2466
6. Energy (730X61.15%)	446.3950
7. Net Energy	5.3262

Year	21	22	23	24	25	26	27	28	29	30
ROE	98.2466	98.2466	98.2466	98.2466	98.2466	98.2466	98.2466	98.2466	98.2466	98.2466
-577.9213	124.0546	124.0546	124.0546	124.0546	124.0546	124.0546	124.0546	124.0546	124.0546	124.0546
Total Redemption	23291.3942	23291.3942	23291.3942	23291.3942	23291.3942	23291.3942	23291.3942	23291.3942	23291.3942	23291.3942
Redemption/Month	1940.9495	1940.9495	1940.9495	1940.9495	1940.9495	1940.9495	1940.9495	1940.9495	1940.9495	1940.9495



9.5

Requirement Equity Calculations			
2,889.61			
15,614.5			
577.92			
98,246.6			98,246,624
			8,187,219
1,537.16			5,326,200
63,914.4			
4,049.4			
	379.6		
	730		

B

q.6

Cash Flow Requirement Equity Budget (Consolidated)		
Equity	577.92	17%
1	57.79	4.912
2	57.79	5.330
3	144.48	13.151
4	144.48	14.269
5	86.69	10.570
6	86.69	11.051
	577.92	59.283
	ROEDC	10.1698
	Rs/kW/Month	159.1153

*B*

### Chianwali Hydro Power Project EPC (ECNEC)

Revised Interest During Construction						
Years	Phasing %	Amount (Rs.M)	Rate (Annual)	IDC	Commitment Charges	Total Fincc. Charges
1	10%	225.3430	0.0140	3.1548	7.6053	10.7601
2	10%	225.3430	0.0140	6.3538	7.6053	13.9591
3	25%	563.3575	0.0140	14.2856	6.3378	20.6233
4	25%	563.3575	0.0140	22.2836	6.3378	28.6214
5	15%	338.0145	0.0140	27.1278	7.1828	34.3106
6	15%	338.0145	0.0140	31.9278	7.1828	39.1106
Total	100%	2253.4298		31.9278	42.2518	74.1796
		2253.4298		1.3107		



## 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.

Attachment (13)



# ENVIRONMENT PROTECTION DEPARTMENT

Government of the Punjab  
National Hockey Stadium, Lahore



NO. DD (EIA)/EPA/F-430(IEE)/2006/Cir/ 330

Dated: 07/05/2011

To

The Chief Engineer (Power),  
Marala Hydro Power Project,  
Irrigation and Power Department,  
First Floor Central Design Building,  
Irrigation Secretariat, Near Old Anarkali,  
Lahore.

Subject: **ENVIRONMENTAL APPROVAL**

Reference: your letter No. PD-PPMU/446/2011 dated 26-03-2011.

1. Description of Project: 5.4 MW Chianwali Hydro Power Project(CHPP).
2. Location of Project: The site is located at RD 130.000 on Upper Chenab Canal (UCC) near Chianwali Bungla, Eiman Abad, and District Gujranwala.
3. After review of Initial Environmental Examination (IEE) Report, SIR by DOE and other relevant record, the Environmental Protection Agency, Punjab accorded approval for construction phase of the above mentioned project at the aforementioned site vide letter No. DD (EIA)/EPA/F-430/2507/2K6/320 dated 30-07-2008.
4. Environment Protection Department, Punjab extends this period under Regulation 16 of IEE/EIA Regulations, 2000 read with Section 12 of Pakistan Environmental Protection Act, 1997 for further three years subject to the following conditions:
  - i. The proponent shall ensure compliance of National Environmental Quality Standards (NEQS).
  - ii. Mitigation Measures suggested in the IEE report and Environmental Management and Monitoring Plan shall be strictly adhered to minimize any negative impacts on soil, ground water, air and biological resources of the project area.
  - iii. Monitoring shall be carried out during the entire period of the project activities. Monitoring reports shall be submitted to EPA, Punjab on monthly basis.
  - iv. Camping sites shall be located at suitable distance from any settlement to avoid disturbance to the local people. Sewerage generated from camping sites shall be treated in septic tanks and soak pits or by other appropriate methods. The septic tanks and soak pits shall be constructed at a suitable distance from any permanent or seasonal water source. Septic tanks and soak pits shall not be located in the areas where high ground water table exists.
  - v. At least 90% unskilled and to the extent possible skilled jobs shall be give to the locals after providing them proper training.
  - vi. Proponent will submit a community development plan for the benefit of communities of the project area to Punjab, EPA within two months of the start of the project construction phase.
  - vii. The proponent shall not discharge treated or untreated wastewater in a surface or sub-surface water body that may be used for drinking purposes.
  - viii. The proponent shall ensure that strict and efficient health and safety measures are in place for protection of workers backed by a comprehensive emergency response system.
  - ix. The proponent shall carry out extensive tree plantation especially of indigenous species in and around the project area i.e. at least 15,000 trees of minimum height 6-7 feet may be planted on available space in consultation with District Forest Officer and District Officer (Environment), Sialkot within six months. The proponent will also make necessary arrangement for the maintenance and protection of these trees.
  - x. The proponent will provide a copy of this letter and Environmental Assessment report to the contractor for his information and compliance.
  - xi. The proponent shall obtain NOCs / clearance of all other concerned departments before

5. The proponent shall be liable for correctness and validity of information supplied to this department by the consultant.

6. The proponent shall be liable for compliance of Sections 13, 14, 17 and 18 of IEE/EIA Regulations, 2000, regarding approval, conformation of compliance, entry, and inspection and monitoring.

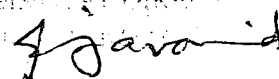
7. This approval is accorded only for the installation /construction phase of the project. The proponent will obtain approval for operation of the above mentioned project in accordance with Section 13(2)(b) and Section 18 of the IEE/EIA Regulations, 2000.

8. Any change in the approved project shall be communicated to EPA, Punjab and shall be commenced after obtaining the approval.

9. This approval does not absolve the proponent of the duty to obtain any other approval or consent that may be required under any law in force. The approval shall be treated as null and void if all or any of the conditions, mentioned above, is / are not complied with and is subjudice to the legal proceedings in any court of competent jurisdiction / legal fora.

10. This approval shall be valid (for commencement of construction) for a period of three years from the date of issue under Section 16 of IEE / EIA Regulations, 2000.

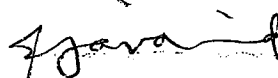
11. This approval can be withdrawn at anytime without any prior notice if deem necessary in public/national interest.

  
ASSISTANT DIRECTOR (EIA)  
for Director General, EPA, Punjab  
Ph: # 042-99232228

NO. & DATE EVEN.

A copy is forwarded for information to:

1. The District Officer (Environment), Gujranwala w.r.t his letter No. 1138/DOE/GRW dated 22-08-2006. He is requested to ensure compliance of the above mentioned conditions / measures under intimation to this office.

  
ASSISTANT DIRECTOR (EIA)  
for Director General, EPA, Punjab  
