Kundian Hydel Power (Private) Limited
A wholly owned subsidiary of Pakistan Atomic Energy Commission Foundation

The Registrar,
National Electric Power Regulatory Authority

Subject: **Application for Grant of Generation License**

I, Tariq Mahmood Qureshi, being the duly authorized representative of Kundian Hydel Power (Private) Limited by virtue of Board Resolution dated 02-03-2022 hereby apply to the National Electric Power Regulatory Authority for grant of generation license to Kundian Hydel Power (Private) Limited pursuant to section (3-1) of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997.

I hereby certify that the documents-in-support attached with this application are prepared and submitted in conformity with the provisions of the National Electric Power Regulatory Authority Licensing (Application, Modification, Extension and Cancellation) Procedure Regulations, 2021, and undertake to abide by the terms and provisions of the above-said Regulations. I further undertake and confirm that the information provided in the attached documents-in-support is true and correct to the best of knowledge and no material omission has been made.

A Bank Draft in the sum of Rupees Three Hundred Twenty Seven Thousand Nine Hundred and Sixty Eight Only, being the license application fee calculated in accordance with Schedule-II to the National Electric Power Regulatory Authority Licensing (Application, Modification, Extension and Cancellation) Procedure Regulations, 2021, is also attached herewith.

Date_____

Tariq Mahmood Qureshi
Director

KUNDIAN HYDEL POWER (PRIVATE) LIMITED

Adjacent to NORI Hospital, Hanna Road, G-8/3, Islamabad. Phone: 051-9263295-97 Fax-051-2709970

KHPPL.1-1/2020-Fin

Islamabad, the 2nd March, 2022

MINITUES OF BOARD OF DIRECTORS

The meeting of the Board of Directors of M/s Kundian Hydel Power (Private) Limited was held on Wednesday, March 2, 2022 at 1000hrs at PAEC Foundation (H.O), Hanna Road, G-8/3 Islamabad, which was attended by the following directors:

PRESENT

- Mr. Munir Ahmed
- Mr. Sohail Ishaq
- Mr. Tariq Mahmood Qureshi

Quorum being present proceedings of the meeting was commenced on the instructions of the Chairman. The directors passed the following resolutions unanimously:

Resolution No. 1: Resolved that the Company be and is hereby authorized to apply for the Power Generation License to National Electric Power Regulatory Authority (NEPRA) in respect of the 5 MW Hydro power Plants and sign, execute all required documents and in relation thereto, make all filings, pay all applicable fees of any nature whatsoever.

Resolution No. 2: Further resolved that Mr. Tariq Mahmood Qureshi (Director) be and hereby authorized and empowered to sign, execute and deal with the National Electric Power Regulatory Authority (NEPRA) regarding the generation license, and other related approvals and represent and sign all the related documents in respect of the same on behalf of the Company.

There being no other business, the meeting ended with a vote of thanks to the Chair.

Munir Ahmed
CEO/Director

Sohail Ishaq
Director

Tariq Mahmood Qureshi
Director

Date: March 02, 2022
Islamabad

Munir Ahmed
Chairman

PROSPECTUS
KUNDIAN HYDEL POWER PLANT **5 MW**
KUNDIAN HYDEL POWER (PRIVATE) LIMITED

PROSPECTUS

PROJECT: KUNDIAN HYDEL POWER PLANT CHASHMA MIANWALI (5MW)

Table of Contents

PROSPECTUS

PROJECT: KUNDIAN HYDEL POWER PLANT CHASHMA MIANWALI (5MW)

1. INTRODUCTION OF THE APPLICANT

Kundian Hydel Power (Private) Limited is project specific firms solely registered under the Companies Act 2017 for the development of 5 MW Hydropower Project. The company is solely owned by:

- Pakistan Atomic Energy Commission Foundation (PAECF)

The Foundation is involved in the business of sublet of agricultural land, sale of agricultural produce, provision of travel agency services, sale of petroleum products and medicine etc. through various projects for the welfare of serving and retired employees of the Pakistan Atomic Energy Commission. The Office of the Foundation is situated at Hanna Road, Sector G-8, Islamabad.

2. PROJECT BACK GROUND

Kundian Hydel Power (Private) Limited (KHP) is to be built on canal used and pupose built by Chashma Nuclear Power Plant (Chashma NPP) for cooling of nuclear reactor and Chashma Nuclear plant will be the sole buyer of the electric produced by the KHP which will be used by Chashma NPP for its internal operational.

Chashma NPP has allowed to PAECF to built and operate Hydel power plant on cooling water canal, which is already built is a part of Chashma NPP. Environmental impact approval and water usage studies for the canal are part Chashma NPP generation license.

- IEE approved by EPA Punjab for Chashma NPP is same for KHP as it located inside the premises of Chashma NPP. Any further environmental study and approval for KHP is not possible due to security restrictions of Chashma NPP.
- Interconnection study is not required as there is no grid connection by KHP and its sole buyer is Chashma NPP.

3. SPONSOR PROFILE

PAEC Foundation (PAECF) was established in 1994 under Charitable Endowments Act 1890 with approval of the Federal Government and its charter was notified in the Gazette of Pakistan vide SO No. 384(1)/94 dated 12.5.1994. As a self-financing organization the Main function of Foundation is to set up profit-oriented units for generation of income to cater for the welfare measures and benefits of PAC employees in particular and poorest of poor people in the adjoining areas in general. It was initially provided with seed money from GOP /PAEC and started as a small nucleus of welfare for PAEC employees and now its activities have multiplied over the years with continued progression.
Aims & Objectives Of Sponsor:

the site parallel to the River Indus approximately 3.0 km west of the Thal Canal. MM road connects the Chashma site which is approximately 7 km from the site.

B. POWER AND ENERGY

KHPP have 2 Units, details are following.

- GENERATION VOLTAGE: - 11KV (For Each Unit)
- POWER FACTOR: - 0.96 (For Each Unit)
- FREQUENCY: - 50HZ (For Each Unit)
- AUTOMATIC GENERATION CONTROL:-

Governor System (OPD) :- (For Each Unit)

- RAMPING RATE: - Ramping Rate of Hydel Power Plants is quite high (APPROXIMATE: 20 SECONDS) (For Each Unit)
- CONTROL METERING AND INSTRUMENTATION:-

Metering System installed at KHPP measure exported electricity via energy meter, CT,

C. PROJECT LAYOUT

Kundian Hydel Power Project (KHP) is located on canal used and pupose built by Chashma Nuclear Power Plant (Chashma NPP) for cooling of nuclear reactor. The cooling water canal is diverted from CJ Link Canal, North of the plant through the intake tunnel. The tunnel will be L shaped, underground structure, trending in north-south direction, it is set between the Unit 1/2 and Unit 3/4 of Chashma NPP. The outfall for the discharge of cooling water shall be in south-west direction, it shall be an open channel from Plant to the River Indus.

C. OVERALL WELFARE ACTIVITIES (2018-2020)

Description of Activity	Total Program Cost (Rs)	Total Program Beneficiaries
Merit Scholarships	27,600,000	1234
Girls School Karachi	92,550,000	2720
Girls School Chesham	24,070,000	779
Fee Support	23,940,000	2863
Award for Position Holders	300000	11
Hunargahs	61,790,000	700
Day Care Center	1,870,000	
Grant for poor students	13,390,000	2981
Religious Education	14,880,000	422
Medical-Assistance	900000	18
Medical-Dispensary (Rawat)	1,550,000	1533
Falahi Dispensaries	18,750,000	56119
Distribution of Medicines	6,170,000	52436
Marriage Grants-Daughters	137,450,000	2603
Marriage Grants - Self	105,980,000	2284
Widows/Parents	13,350,000	235
CREW	2,710,000	989
Religious Festivity	20,590,000	10298
Chashma Colony Welfare Fund (CNPP)	30,000,000	

Miscellaneous Welfare Expenditure	31,270,000	1215
Daughter Marriage	8,390,000	541
Genuine Needs	43,260,000	
Children Education	5,100,000	

D. EXTRACTS OF AUDITED FINANCIAL STATEMENT FOR PAECF OF 2020-21

	2021 RUPEES	2020 RUPEES
Assets		
Non-current assets	2,028,699,201	1,983,219,140
Current assets	1,637,402,102	1,724,349,126
Total assets	3,666,101,303	3,707,568,267
Funds and liabilities		
Funds	1,352,816,303	1,382,420,905
Non-current liabilities	1,972,426,859	1,942,455,028
Current liabilities	340,858,141	382,692,334
Total funds and liabilities	3,666,101,303	3,707,568,267

Particulars	2021 RUPEES	2020 RUPEES
Income	1,862,583,744	1,840,035,471
Expenditure	1,900,230,409	1,723,483,847
Operating (loss) / profit	(37,646,665)	116,551,623
Financial charges	(591,075)	(404,634)
Other income	9,672,864	34,315,741
(Deficit) / surplus for the year before taxation	(28,564,877)	150,462,730
Retirement benefits	(1,039,724)	17,644,841
Total comprehensive income for the year	(29,604,601)	168,107,571

4. PROPOSED PROJECT INVESTMENT COST AND FINANCING

Total Project Cost

Description	Amount
Plant and Machinery	548,343,697
Office Equipment	2,444,724
Furniture & Fixture	467,532
Vehicle	16,626,145
Staff Homes	15,965,979
Total	583,848,077

The complete Plant design, Procurement and construction including civil works of 5 MW units Kundian Hydel Power Projects project will be financed by the sponsor. Pakistan Atomic Energy Commission Foundation is the only shareholder of company and the whole project will be finance by it resources and no other funds for financing will be involved.

5. PATTERN OF SHAREHOLDING

Issued, subscribed and paid-up capital of KHP are 100,000 ordinary shares @ Rs. 10/- each.

No of Shares	Name of Shareholder
100,000/-	Pakistan Atomic Energy Commission Foundation

6. PROJECT SALIANT FEATURE

A. LOCATION AND ACCESS TO THE PROJECT SITE

The site is located on the northwest side of the Thal Doab and is bordered on three sides by mountain ranges, the Salt Range to the northeast, the Surghar Range to the north, and the Khisor and Marwat Ranges to the west. The area south of these ranges is the Punjab Plain, the physiographic province in which the site is located. The plant site is linked with the other parts of the country by rail and road network. A railway track passes through

7. SOCIAL AND ENVIRONMENTAL IMPACT

KHP seem to be environment friendly. It has no or minimal impact on social and environment. The total layout plan of the project is located with in the boundary premises of Chashma NPP so proposed project layout plan does not involve any relocation and resettlement during the land acquisition.

The investigations at site have shown that in general the realization of the project is possible at the sit from an environmental point of view and no adverse impact on the existing flora and fauna at site is expected. The facility will not emit any solid liquid and gaseous waste during the entire life of the project and thus the power will be generated without polluting the environment of the surrounding.

As the project is located in the security sensitive and population sparse area the potential of social interaction between construction worker and local population is nonexistent therefore the deterioration of community health, safety, due to people interaction and behaviors is not applicable. There will be no spread of communicable diseases.

The contractor shall be required to employ full time qualified safety officer for the construction phase of the project. The contractor shall carry out a risk management and then develop a site and project specific safety management plan aimed at prevention of accident, injuries for both construction and operation.

Environmental management plan (EMP) provided with document which identifies activities and monitoring indicators associated with good institutional health and safety. Installation of the proposed Power Plant would require the project proponent to undertake management of following environmental and social issues during the development, construction and operation phases of the project.

- Change in landscape. Change in landform, topography and geomorphology;
- Impact on geology; Noise; Change in air quality;
- Transportation activities; equipment mobilization, transport and storage of construction material;
- Water consumption and waste water generation;
- Construction waste generation and disposal.
- Emissions from emergency power equipment and heat generation;
- Emissions during transportation;
- Handling and management of waste during operations;
- Documenting and developing occupational accidents. diseases and incidents
- Developing emergency prevention preparedness and response arrangement.

- The property or income of the Foundation may be applied for all or any of the following purposes
- To defray all proper costs, charges and expenses of or incidental to the administration of the Foundation.
- To extend and improve medical facilities to the beneficiaries and their dependents in addition to the Pakistan Atomic Energy Commission Employees Medical Rules.
- To advance, whether as a loan or stipend, grants to the dependents for the purpose of education in approved Institutions.
- To acquire land for construction of houses of various categories and their sale on terms and conditions to be decided by the Board, to the beneficiaries.
- To provide lump-sum grant, at a rate to be decided by the Board in case of death/disability/natural calamity, to a beneficiary.
- To finance, open, run, lad, promote and establish profit oriented units for generation of income for the Foundation to benefit the beneficiaries and their dependents.
- To establish, maintain and run Schools, Vocational Training Centers, community center, clubs, Hospitals etc.
- To form the basis of efficient welfare organizations for the beneficiaries in the time of peace and war.
- To provide any other facility or help which the Board may decide from time to time for the beneficiaries.

A. REVENUE GENERATION

1. Fallow Land with PAEC Projects for cash crops/vegetables.
2. Foundations Travels, Islamabad
3. Pharmacies
4. Fuel Filling Stations
5. Donations

B. WELFARE PROGRAMMES

1. Education
2. Financial Assistance
3. Health
4. Interest Free Loans

Information Required Under Schedule-II (Regulation 3(4) (a) (A) (c) in Respect of New Generation Facility (Renewables))

i. Interconnection Study:-

KHPP is a Mini Hydroelectric Run of River Scheme, constructed on **Outfall of C3 & C4 Canal**, which comprises:

- Powerhouse equipped with 2 Kaplan Turbine/Generators Sets 2.5MW each. The total installed capacity for the Main Units is 5.0MW and Maximum Head Is 13.5M.
- Spillway Structure with Two (2) Gates.
- 11KV Transmission Line with an approximate length of 8.2KM from S&F Grid to KHPP.

The construction of **KHPP** is done with in one major construction stage i.e all major structures have been erected with in a large single construction pit. After completion of main construction works **KHPP** is connected with S&F grid in accordance with the Tariff and Material Modification made at S&F Grid. **KHPP** is connected with S&F grid in order to be an S&F Grid capacity resource. The generation exported to S&F Grid in such a way that Generation is not bottled from a reliability perspective and that there is sufficient transmission capability from the generation resources **(KHPP)** to deliver energy to the load.

Two Generators having capacity of 2.5MW each installed at **KHPP. KHPP** transmit electricity to S&F Grid while S&F distribute electricity to consumers. S&F grid includes Vacuum Circuit Breakers, Protection Relays and Transformers. Similarly **KHPP** includes Transmission Lines, Protection Relays, Switch Gear Panels, Vacuum Circuit Breakers, Synchronizers, Automatic Voltage Regulators etc for the purpose of interconnecting **KHPP** to S&F Grid (Electrical Delivery Point) while data acquisition is done via PLC (Schneider M340) and monitoring software (MTC5.0).

Metering of Generation is done at **KHPP** while metering of Transmission is done at both **KHPP** and S&F Grid.

ii. System Studies (Load Flow, Short Circuit, Stability etc):-

LOAD FLOW: -

Total Load: - 270 Ampere (135 Ampere for Each Unit)

Note: - For Load Flow Study, KHPP One Line Diagram is attached with this document.

SHORT CIRCUIT/STABILITY: - Protection devices that are used for short circuit. tripping and stability of Plant are following.

- GENERATOR PROTECTIONS:-
  - Generator Differential Protection Device **(DMP320C1.2F)**

- Generator Backup Protection Device **(DMP321C1.2F)**

- **11KV LINE PROTECTIONS:-**
  - Over Current Protection
  - Instantaneous Current Protection
  - Synchronizer

iii. Plant Type (Run of the River, Storage, Weir):-

- Plant Type is **Run of River**.
- Constructed on Run of River Through **C3/C4 Lined Canal**.

iv. Plant Characteristics: Generation Voltage, Power Factor, Frequency, Automatic Generation Control, Ramping Rate, Control Metering and Instrumentation:-

KHPP have 2 Units, details are following.

- **GENERATION VOLTAGE:** - 11KV (For Each Unit)
- **POWER FACTOR:** - 0.96 (For Each Unit)
- **FREQUENCY:** - 50HZ (For Each Unit)
- **AUTOMATIC GENERATION CONTROL:-**

  Governor System (OPD) :- (For Each Unit)
- **RAMPING RATE:** - Ramping Rate of Hydel Power Plants is quite high (APPROXIMATE: 20 SECONDS) (For Each Unit)
- **CONTROL METERING AND INSTRUMENTATION:-**

  Metering System installed at KHPP measure exported electricity via energy meter, CT, PT and data acquisition software (MTC5.0).

v. Head (Maximum, Minimum)

- Head Maximum for Both KHPP Units is **13.5 Meter**
- Head Minimum for Both KHPP Units is **10.5 Meter**

vi. Technology (Francis, Pelton, Etc) Size of The Plant and Number of Units:-

- Turbine Technology: **Kaplan Vertical Fixed Blades**
- No of Blades: **05**
- KHPP No of Units: **02**
- Capacity/Size of Plant: **5.0MW (Each Unit of 2.5MW)**

vii. Tunnel (Length, Diameter) (If Proposed):-

No Tunnel Available.

viii. **Resettlement Issues:-**

No resettlement issues as the Plant has been consulted in **PAEC CHASHMA SITE** premises.

ix. **Necessary Approvals have been sought from the concerned authorities of the Federal Government and Provincial Government:-**

No necessary approvals have been sought from above concerned authorities as the Plant consulted in **PAEC CHASHMA SITE** premises.

x. **Infrastructure Development:-**

Infrastructure development includes Roads, Lined Canal, Spillways, Penstocks, main Plant Building, Tailrace Structure and Office Buildings.

xi. **Project Schedule & Expected Life:-**

Project Schedule:

- Contract Signed: **30-04-2014**
- Grid Connection (Unit#01): **28-10-2016**
- Grid Connection (Unit#02): **30-07-2017**
- Main Contractor: **HABIB CONSTRUCTION SERVICES PVT. LTD.**
- Sub-Contractor: **HNAC, CHINA.**

Project Expected Life:

- According to Project Consultant Plant will serve for a period of **50 YEARS**.

xii. **Peaking/Base Load Operation:-**

Minimum Load: - of electricity demand required over a period of 24 hours for **KHPP** is **90 Ampere** (45 Ampere for Each Unit).

Maximum Load/Peaking Load: - Maximum/Peak Load is the time of high demand. For **KHPP** Peak Load is **270 Ampere** (135 Ampere for Each Unit).

Base Load: - Minimum Level of Electricity demand must require over a period of 24 hours. **KHPP** not deal Base Load.

xiii. **Training & Development:-**

KHPP employee's Trainings & Developmental Programs held in **PAEC CHASCENT TRAINING CENTER, CHASHMA** time to time. Like Maintenance, Industrial Safety, Ageing Management, Quality Control etc.

xiv. **Efficiency Parameters :-**

Plant Efficiency depends upon the following Parameters.

- **TURBINE EFFICIENCY: - 93%** (For Each Unit)
- **GENERATOR EFFICIENCY: - 95%** (For Each Unit)

THE COMPANIES ACT, 2017 (XIX of 2017)

(COMPANY LIMITED BY SHARES)

MEMORANDUM

OF

ASSOCIATION

OF

KUNDIAN HYDEL POWER (PRIVATE) LIMITED

THE COMPANIES ACT, 2017 (XIX of 2017)

(COMPANY LIMITED BY SHARES)

MEMORANDUM OF ASSOCIATION

OF

"KUNDIAN HYDEL POWER (PRIVATE) LIMITED"

1. The name of the company is KUNDIAN HYDEL POWER (PRIVATE) LIMITED.

2. The registered office of the Company will be situated in Islamabad Capital Territory.

3. (i) The principal line of business of the company shall be to carry on all or any of the businesses of generating, purchasing, importing, transforming, converting, distributing, supplying, exporting and dealing in electricity and all other forms of energy and products or services associated therewith and of promoting the conservation and efficient use of electricity and to perform all other acts which are necessary or incidental to the business of electricity generation, transmission, distribution and supply, subject to permission of concerned authorities; and to locate, establish, construct, equip, operate, use, manage and maintain thermal power plants, coal fired power plants, hydal power plants, wind mills, solar power plants/panels, solar heating system, power grid station, grid stations, cables, overhead lines, sub-stations, switching stations, tunnels, cable bridges, link boxes, heat pumps, plant and equipment for combined heat and power schemes, offices, computer centres, shops and necessary devices, showrooms, depots, factories, workshops, plants and to provide transforming, switching, conversion and transmission facilities, subject to permission of relevant authorities.

(ii) Except for the businesses mentioned in sub-clause (iii) hereunder, the company may engage in all the lawful businesses and shall be authorized to take all necessary steps and actions in connection therewith and ancillary thereto.

(iii) Notwithstanding anything contained in the foregoing sub-clauses of this clause nothing contained herein shall be construed as empowering the Company to undertake or indulge, directly or indirectly in the business of a Banking Company, Non-banking Finance Company (Mutual Fund, Leasing, Investment Company, Investment Advisor, Real Estate Investment Trust management company, Housing Finance Company, Venture Capital Company, Discounting Services, Microfinance or Microcredit business), Insurance Business, *Modaraba* management company, Stock Brokerage business, forex, real estate business, managing agency, business of providing the services of security guards or any other business restricted under any law for the time being in force or as may be specified by the Commission.

(iv) It is hereby undertaken that the company shall not:

(a) engage in any of the business mentioned in sub-clause (iii) above or any unlawful operation;

(b) launch multi-level marketing (MLM), Pyramid and Ponzi Schemes, or other related activities/businesses or any lottery business;

(c) engage in any of the permissible business unless the requisite approval, permission, consent or licence is obtained from competent authority as may be required under any law for the time being in force.

4. The liability of the members is limited.

5. The authorized capital of the company is Rs. 1,000,000/- (Rupees One Million only) divided into 100,000/- (One Hundred Thousand only) ordinary shares of Rs.10/- (Rupees Ten only) each with powers to the company from time to time to increase and reduce its capital subject to any permission required under the law.

We, the several persons whose names and addresses are subscribed below, are desirous of being formed into a company, in pursuance of this memorandum of association, and we respectively agree to take the number of shares in the capital of the company as set opposite our respective names:

Name and surname (present & former) in full (in Block Letters)	NIC No. (in case of foreigner, Passport No)	Father's/ Husband's Name in full	Nationality (ies) with any former Nationality	Occupation	Usual residential address in full or the registered/principal office address for a subscriber other than natural person	Number of shares taken by each subscriber (in figures and words)	Signatures
Shahid Mehmood (Nominee Through Pakistan Atomic Energy Commission Foundation)	38201-1162263-7	Karamat Ali	Pakistan	Managing Director, PAECF	House No. 182, Officers Colony, Jauharabad, District Khushab.	1 (One Only)	
Tariq Mehmood Qureshi (Nominee Through Pakistan Atomic Energy Commission Foundation)	61101-1985927-3	Muhammad Yaqoob	Pakistan	Secretary, PAECF	House No. 428, Street No. 82, Sector G-11/3, Islamabad.	1 (One Only)	
Sohail Ishaq(Nominee Through Pakistan Atomic Energy Commission Foundation)	61101-5967895-5	Muhammad Ishaq Wayne	Pakistan	Director Projects, PAECF	DHA, Phase-II, House No. 16, Street No. 13, Sector-G, Islamabad.	1 (One Only)	
Pakistan Atomic Energy Commission Foundation Through Shahid Mehmood	165/9/2004 38201-1162263-7	 Karamat Ali	Pakistan Pakistan		Hanna Road, Adjacent NORI Hospital, G-8/3, Islamabad. House No. 182, Officers Colony, Jauharabad, District Khushab.	99,997 (Ninty Nine Thousand Nine Hundred and Ninety Seven Only)	
		Total number of shares taken (in figures and words)				100,000/- (One Hundred Thousand Only)	

Dated the 28th day of August, 2020

THE COMPANIES ACT, 2017 (XIX of 2017)

(PRIVATE COMPANY LIMITED BY SHARES)

ARTICLES OF ASSOCIATION

OF

KUNDIAN HYDEL POWER (PRIVATE) LIMITED

THE COMPANIES ACT, 2017 (XIX of 2017)

(Private Company Limited by Shares)

ARTICLES OF ASSOCIATION

OF

KUNDIAN HYDEL POWER (PRIVATE) LIMITED

1. The Regulations contained in Table 'A' to the First Schedule to the Companies Act, 2017 (the "Act") shall be the regulations of **KUNDIAN HYDEL POWER (PRIVATE) LIMITED** (the "Company") so far as these are applicable to a private company.

PRIVATE COMPANY

2. The Company is a "Private Company" within the meaning of Section 2(1)(49) of the Act and accordingly:

   (1) No invitation shall be made to the public to subscribe for the shares or debentures of the Company.

   (2) The number of the members of the Company (exclusive of persons in the employment of the Company), shall be limited to fifty, provided that for the purpose of this provision, where two or more persons hold one or more shares in the company jointly, they shall be treated as single member; and

   (3) The right to transfer shares of the Company is restricted in the manner and to the extent herein appearing.

TRANSFER OF SHARES

3. A member desirous to transfer any of his shares shall first offer such shares for sale or gift to the existing members and in case of their refusal to accept the offer, such shares may be transferred to any other person, as proposed by the transferor member, with the approval of the Board of Directors.

DIRECTORS

4. The number of directors shall not be less than two or a higher number as fixed under the provisions of the Act. The following persons shall be the first directors of the Company and shall hold the office upto the date of First Annual General Meeting:

   1. Shahid Mehmood
   2. Muhammad Tariq Mehmood Qureshi
   3. Sohail Ishaq

We, the several persons whose names and addresses are subscribed below, are desirous of being formed into a company, in pursuance of this article of association, and we respectively agree to take the number of shares in the capital of the company set opposite our respective names:

Name and surname (present & former) in full (in Block Letters)	NIC No. (in case of foreigner, Passport No)	Father's/ Husband's Name in full	Nationality (ies) with any former Nationality	Occupation	Usual residential address in full or the registered/principal office address for a subscriber other than natural person	Number of shares taken by each subscriber (in figures and words)	Signatures
Shahid Mehmood (Nominee Through Pakistan Atomic Energy Commission Foundation)	38201-1162263-7	Karamat Ali	Pakistan	Managing Director, PAECF	House No. 182, Officers Colony, Jauharabad, District Khushab.	1 (One Only)	
Tariq Mehmood Qureshi (Nominee Through Pakistan Atomic Energy Commission Foundation)	61101-1985927-3	Muhammad Yaqoob	Pakistan	Secretary, PAECF	House No. 428, Street No. 82, Sector G-11/3, Islamabad.	1 (One Only)	
Sohail Ishaq(Nominee Through Pakistan Atomic Energy Commission Foundation)	61101-5967895-5	Muhammad Ishaq Wayne	Pakistan	Director Projects, PAECF	DHA, Phase-II, House No. 16, Street No. 13, Sector-G, Islamabad.	1 (One Only)	
Pakistan Atomic Energy Commission Foundation Through Shahid Mehmood	165/9/2004 38201-1162263-7	Karamat Ali	Pakistan Pakistan		Hanna Road, Adjacent NORI Hospital, G-8/3, Islamabad. House No. 182, Officers Colony, Jauharabad, District Khushab.	99,997 (Ninty Nine Thousand Nine Hundred and Ninety Seven Only)	
		Total number of shares taken (in figures and words)				100,000/- (One Hundred Thousand Only)	

Dated the 28th day of August, 2020

A082561

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

SECP

COMPANY REGISTRATION OFFICE

CERTIFICATE OF INCORPORATION

[Under section 16 of the Companies Act 2017 (XIX of 2017)]

Corporate Universal Identification No. **0156782**

I hereby certify that **KUNDIAN HYDEL POWER (PRIVATE) LIMITED** is this day incorporated under the Companies Act, 2017 (XIX of 2017) and that the company is **limited by shares.**

Given under my hand at **Islamabad** this **Thirty First** day of **August,** Two **Thousand** and **Twenty.**

Incorporation fee Rs. **5500.0/=** only

(Syed Jamal Ahmed Zaidi)
Additional Joint Registrar
Islamabad

No. ADI 41784
Dated 31/8/20

THE COMPANIES ACT, 2017
THE COMPANIES (GENERAL PROVISIONS AND FORMS) REGULATIONS, 2018
[Section 197 and Regulations 4 and 20]
PARTICULARS OF DIRECTORS AND OFFICERS, INCLUDING THE CHIEF EXECUTIVE, SECRETARY, CHIEF FINANCIAL OFFICER, AUDITORS AND LEGAL ADVISER OR OF ANY CHANGE THEREIN

FORM 29

PART-I

1 CUIN (Incorporation Number) 0156782

2 Name of Company KUNDIAN HYDEL POWER (PRIVATE) LIMITED

3 Fee Payment Details

1.3.1 Challan Number E-2022-933100 1.3.2 Amount 1320.0

PART-II

Particulars*:

2.1. New Appointment/Election

Present Name in Full (a)	NIC No. or Passport No. in case of Foreign National (b)	Father / Husband Name (c)	Usual Residential Address (d)	Designation (e)	Nationality** (f)	Business Occupation** * (if any) (g)	Date of Present Appointment or Change (h)	Mode of Appointement / change / any other remarks (i)	Nature of directorship (nominee/independent/additional/ other) (j)
Munir Ahmed	6110146898719	Wali Muhammad	House # 1290, Street # 169, Sector G-11/1, Islamabad	Director	Pakistan	Director PAECF	21/06/2021	Appointed /	
Munir Ahmed	6110146898719	Wali Muhammad	House # 1290, Street # 169, Sector G-11/1, Islamabad	Chief Executive	Pakistan	Director PAECF	21/06/2021	Appointed /	

2.2. Ceasing of Officer/Retirement/Resignation

Present Name in Full (a)	NIC No. or Passport No. in case of Foreign National (b)	Father / Husband Name (c)	Usual Residential Address (d)	Designation (e)	Nationality** (f)	Business Occupation** * (if any) (g)	Date of Present Appointment or Change (h)	Mode of Appointement / change / any other remarks (i)	Nature of directorship (nominee/independent/additional/ other) (j)
Shahid Mehmood	3820111622637	Karamat Ali	House No. 182, Officers Colony, Jauharabad, District Khushab. Khushab Punjab Pakistan	Chief Executive	Pakistan		21/06/2021	Retired /	
Shahid Mehmood	3820111622637	Karamat Ali	House No. 182, Officers Colony, Jauharabad, District Khushab. Khushab Punjab Pakistan	Director	Pakistan	Managing Director, PAECF	21/06/2021	Retired /	

2.3. Any other change in particulars relating to columns (a) to (g) above

Present Name in Full (a)	NIC No. or Passport No. in case of Foreign National (b)	Father / Husband Name (c)	Usual Residential Address (d)	Designation (e)	Nationality** (f)	Business Occupation** * (if any) (g)	Date of Present Appointment or Change (h)	Mode of Appointement / change / any other remarks (i)	Nature of directorship (nominee/independent/additional/other)

* In the case of a firm, the full name, address and above mentioned particulars of each partner, and the date on which each became a partner.
** In case the nationality is not the nationality of origin, provide the nationality of origin as well.
*** Also provide particulars of other directorships or offices held, if any.".
**** In case of resignation of a director, the resignation letter and in case of removal of a director, member's resolution be attached
***** In case of a director nominated by a member or creditor the name of such nominating or appointing body shall also be mentioned in column (j), and a copy of resolution from

[redacted]

In case of a director nominated by a member or creditor the name of such nominating or appointing body shall also be mentioned in column (j). and a copy of resolution from the nominating or appointing body be attached.

PART-III

3.1 Declaration:

I do hereby solemnly, and sincerely declare that the information provided in the form is:
(i) true and correct to the best of my knowledge, in consonance with the record as maintained by the Company and nothing has been concealed and
(ii) hereby reported after complying with and fulfilling all requirements under the relevant provisions of law, rules, regulations, directives, circulars and notifications whichever is applicable.

3.2 Name of Authorized Officer with designation/ Authorized Intermediary	Sohail Ishaq	Director
3.3 Signature	Electronically signed by Sohail Ishaq	
3.4 Date (DD/MM/YYYY)	01/02/2022	
3.5 Registration No of Authorized Intermediary, if applicable		

COMPANIES (INCORPORATION) REGULATIONS, 2017
[See Regulation 3]

COMPANY INFORMATION FORM

CUIN (Incorporation Number)

Name of Company: KUNDIAN HYDEL POWER (PRIVATE) LIM

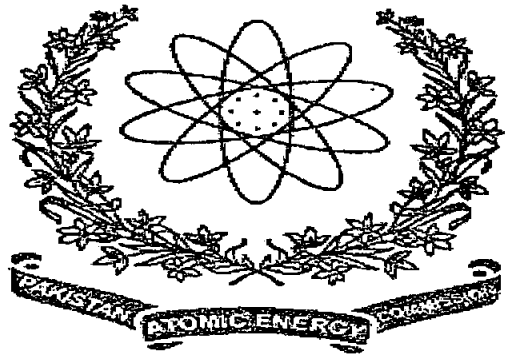
Name	Father/Husband Name	CNIC/Passport No	CUIN/Registration No	Nationality	Occupation	Residential/Registered office address	NTN(where applicable)	Designation	No of shares subscribed
Shahid Mehmood	S/O Karamat Ali	3820111622637		Pakistan	Managing Director, PAECF	House No. 182, Officers Colony, Jauharabad, District Khushab, Khushab Punjab Pakistan 41000		Chief Executive	
Shahid Mehmood	S/O Karamat Ali	3820111622637		Pakistan	Managing Director, PAECF	House No. 182, Officers Colony, Jauharabad, District Khushab, Khushab Punjab Pakistan 41000		Director And Subscriber	1
Tariq Mehmood Qureshi	null Muhammad Yaqoob	6110119859273		Pakistan	Secretary, PAECF	House No. 428, Street No. 82, Sector G-11/3, Islamabad, Islamabad Islamabad Capital Territory (I.C.T.) Pakistan 44000		Director And Subscriber	1
Sohail Ishaq	null Muhammad Ishaq Wayne	6110159678955		Pakistan	Director Projects, PAECF	DHA, Phase-II, House No. 16, Street No. 13, Sector-G, Islamabad, Islamabad Islamabad Capital Territory (I.C.T.) Pakistan 44000		Director And Subscriber	1
PAECF through Shahid Mehmood	null Karamat Ali	3820111622637	165/9/2004	Pakistan	Managing Director, PAECF	House No. 182, Officers Colony, Jauharabad, District Khushab, Khushab Punjab Pakistan 41000		Subscriber (Company)	99997

REGISTERED OFFICE OR CORRESPONDENCE ADDRESS AT THE TIME OF INCORPORATION

Registered office address

Correspondence Address: PAEC Foundation, Adjacent NORI Hospital, , Hanna Road, G-8/3, Islamabad, Islamabad

PAKISTAN ATOMIC ENERGY COMMISSION FOUNDATION



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INTRODUCTION

PAEC Foundation (PAECF) was established in 1994 under Charitable Endowments Act 1890 with approval of the Federal Government and its charter was notified in the Gazette of Pakistan vide SRO No. 384(I)/94 dated 12.5.1994. As a self-financing organization the main function of Foundation is to set up profit-oriented units for generation of income to cater for the welfare measures and benefits of PAEC employees in particular and poorest of poor people in the adjoining areas in general. It was initially provided with seed money from GoP/PAEC and started as a small nucleus of welfare for PAEC employees and now its activities have multiplied over the years with continued progression.

BOARD OF GOVERNORS

The Foundation is administered by Board of Governors (BoG) consisting of following members including the Chairman, by virtue of their offices:

1.	Chairman, PAEC	Chairman
2.	Member (Technical), PAEC.	Member
3.	Member (Fuel Cycle), PAEC.	Member
4.	Member (Engineering), PAEC	Member
5.	Member (Systems), PAEC	Member
6.	Member (Power), PAEC	Member
7.	Member (Admin), PAEC	Member
8.	Member (Materials), PAEC	Member
9.	Member (Finance), PAEC	Member
10.	Member (Science), PAEC	Member
11.	Joint Secretary, Ministry of National Health Services, Regulations and Coordination	Member
12.	Managing Director, PAEC Foundation	Member
13.	Secretary, PAEC Foundation	Member/Secretary

2. The Chief Executive/Managing Director and Secretary of the Foundation will be nominated by the Board.

AIMS & OBJECTIVES

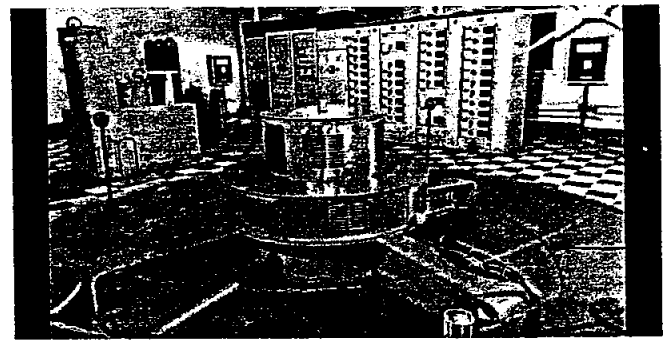
The property or income of the Foundation may be applied for all or any of the following purposes:

- To defray all proper costs, charges and expenses of or incidental to the administration of the Foundation.
- To extend and improve medical facilities to the beneficiaries and their dependents in addition to the Pakistan Atomic Energy Commission Employees Medical Rules.
- To advance, whether as a loan or stipend, grants to the dependents for the purpose of education in approved Institutions.
- To acquire land for construction of houses of various categories and their sale on terms and conditions to be decided by the Board, to the beneficiaries.
- To provide lump-sum grant, at a rate to be decided by the Board in case of death/disability/natural calamity, to a beneficiary.
- To finance, open, run, aid, promote and establish profit oriented units for generation of income for the Foundation to benefit the beneficiaries and their dependants.
- To establish, maintain and run Schools, Vocational Training Centers, community center, clubs, Hospitals etc.
- To form the basis of efficient welfare organizations for the beneficiaries in the time of peace and war.
- To provide any other facility or help which the Board may decide from time to time for the beneficiaries.

REVENUE GENERATION

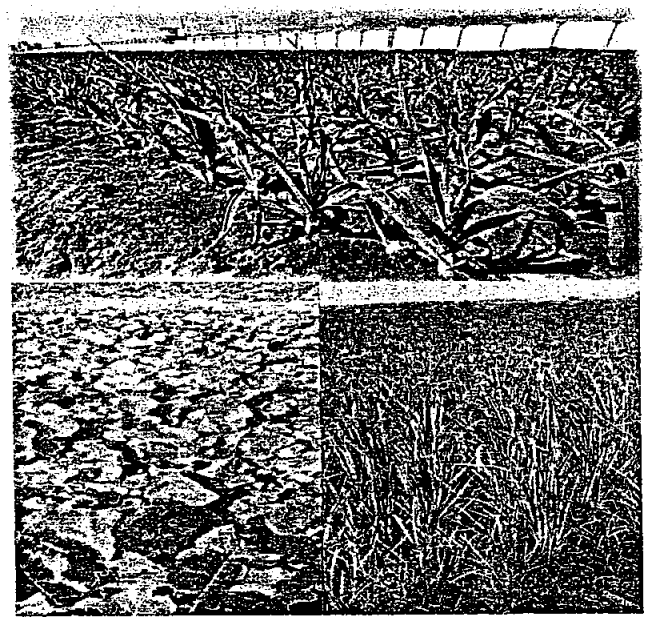
Initially Govt. of Pakistan provided a seed money for establishment of the Foundation and now the major source of revenue of PAECF are:-

Hydel Power Plants at Chashma



Foundation has established small Hydel Power Plants on the out-fall canals of Chashma Nuclear Power Plants. Electricity generated by these plants would be sold directly to local setups of PAEC without any connection to National grid under a PPA to be signed between Foundation and PAEC. These plants will not only be a major source of revenue for Foundation but also provides emergency/standby power to PAEC Establishments.

Fallow land with PAEC projects for cash crops/vegetables.



PAEC fallow land at Chashma and Wanbuchran has been given on lease and fallow land at Lalwala, Chowkiwala, Muzafargarh and DG Khan is being used for cultivation of crops. Major crops being cultivated are Wheat, Rice, Canola, Mong bean, Garlic, Potato, Maize etc. During all these years, PAECF has gained valuable experience in cultivation of lands and other agricultural practices. Thus its foremost aim is to introduce state of the art practices as follows:

a) Drip Irrigation and tunnel farming in its lands.

b) Seed multiplication facilities where quality seeds developed in the labs may be reproduced for large scale production thus meeting ever-rising demand of seeds and ensuring food security in the country.

c) Mechanized farming and agricultural practiced whereby modern machines be used.

Foundation Travels, Islamabad

Foundation Travels was Established in 1995 to provide Air travel services to PAEC employees. Subsequently the services were extended to SPD and other strategic organizations. In addition, private customers are also being entertained

Pharmacies

Foundation Pharmacies have been established as a welfare measure to facilitate the PAEC employees and local population to have quality medicines on discounted rates. Chashma Pharmacy was established in 2009, DG Khan in 2012, Khushab in 2013, and Islamabad in 2014

Fuel Filling Stations

Foundation established Fuel Filling stations at Chashma and DG Khan for the supply of POL at government rates with full measure.

Donations

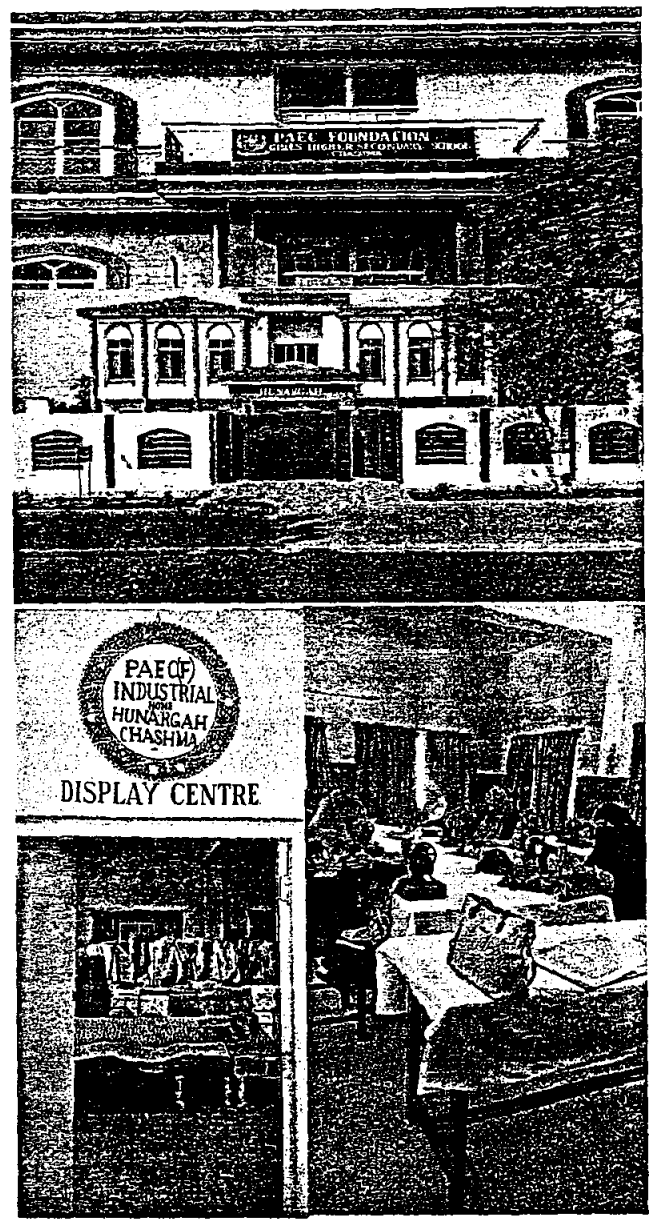
Voluntary endowments from PAEC employees or any other private individual or organization. The financial contributions from PAEC employees are optional. The rates of contribution are revised from time to time by the BoG.

WELFARE PROGRAMMES

In addition to the income generation projects, Foundation is also working on purely welfare projects:

Education

In the Education sector, PAECF is playing its part by imparting free quality education to the children of low-paid workers through two schools namely Foundation Girls Higher Secondary School, Chashma and Foundation Primary School, Karachi. Six Ladies Industrial Homes called Hunargah have been established at PAEC Colony areas to provide vocational and skill development training to the ladies relating to cutting & sewing, cooking and beautician. On the religious side, about 10 teachers are making their contribution in imparting religious education like Tajweed and Hifz. On the other hand, in order to encourage the PAEC employees to educate their children, PAECF has many schemes like merit scholarships, fee reimbursements and rewards to the position holders in Board and University.



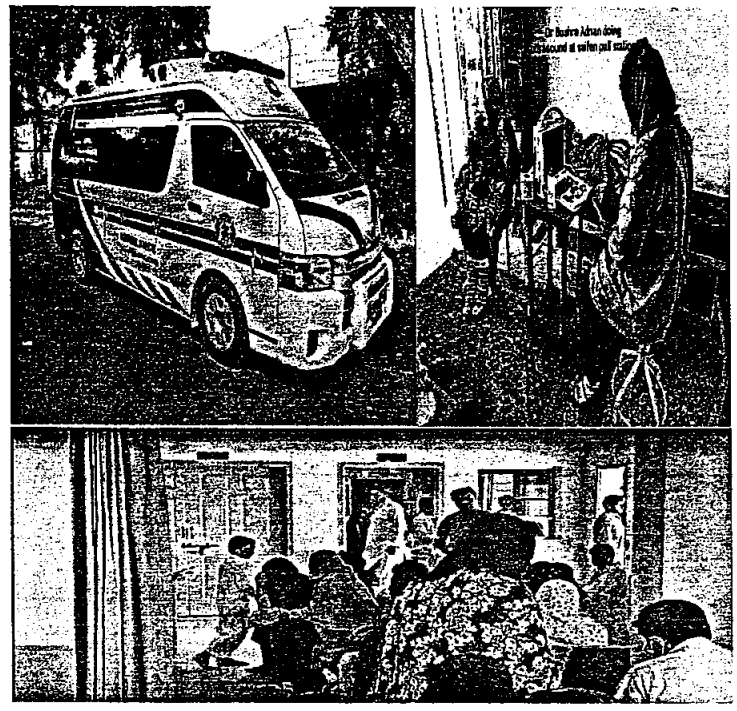
Financial Assistance

PAECF is achieving its objectives as defined above through its welfare schemes for the welfare of the beneficiaries. These welfare schemes are carried out to provide financial assistance to widow/parents of the deceased employees of PAEC and marriage grants

for self-marriage of low paid employees as well as grant for daughter marriage to staff employees. Daughter marriage grant is admissible for all daughters. Foundation also contributes towards in arrangements of various sports facilities/functions at departmental/inter-departmental level.

Health

Three Mobile Dispensaries are offering free medical consultation and medicines to the local population in the suburb of PAEC sites at Chashma, Muzaffargarh and Karachi. It is underlined that services of Chashma Mobile Dispensary have been extended to other remote sites. PAECF provides free medicines to the PAEC Dispensaries at remote Sites. Facilitating residents of rural area of Rawalpindi (Rawat), a Dispensary is working with one Medical Officer and a Dispenser has been engaged on part-time basis to attend the patients in evening. Pharmacies are located at Chashma and D.G Khan and provide medicines to the PAEC employees in the colony areas.



Interest Free Loans

PAECF advances interest free loans on account of Daughter's marriage, genuine needs (acute financial needs such as some dire medical needs etc.) and education loans in order to facilitate the workers whose two or more children are studying in professional disciplines at any HEC recognized institution.

Overall Welfare Activities (2018-2020)

Description of Activity	Total Program Cost (Rs.)	Total Program Beneficiaries
Merit Scholarships	27,600,000	1234
Girls School Chashma	92,550,000	2720
Girls School Karachi	24,070,000	779
Fee Support	23,940,000	2863
Award for Position Holders	300,000	11
Hunargahs	61,790,000	700
Day Care Center	1,870,000	
Grant for poor students	13,390,000	2981
Religious Education	14,880,000	422
Medical – Assistance	900,000	18
Medical – Dispensary (Rawat)	1,550,000	1533
Falahi Dispensaries	18,750,000	56119
Distribution of Medicines	6,170,000	52436
Marriage Grants – Daughters	137,450,000	2603
Marriage Grants – Self	105,980,000	2284
Widows / Parents	13,350,000	235
CREW	2,710,000	989
Religious Festivity	20,590,000	10298
Chashma Colony Welfare Fund (CNPP)	30,000,000	
Miscellaneous Welfare Expenditure	31,270,000	1215
Daughter Marriage	8,390,000	541
Genuine Needs	43,260,000	
Children Education	5,100,000	

FEASIBILITY STUDY

PROJECT: KUNDIAN HYDEL POWER PLANT CHASHMA MIANWALI (5MW)

Contents

1. INTRODUCTION

The objective of this feasibility analysis is to walk around the Plant design, Procurement and construction including civil works of 5 MW Kundian Hydel Power Projects Chashma, Mianwali, Punjab. KUNDIAN HYDEL POWER (PRIVATE) LIMITED, (the "Company"), was incorporated on August 31, 2020 as a private limited Company under the Companies Act 2017, and subsequently work commenced on the project.

The financial viability of the hydropower plant is examined using the integrated appraisal structure (integrated approach uses IRR & NPV appraisal techniques) which analyzes the project and its desirability in different perspective. The project magnetism will be examined from the investor's point of view and bankers' judgment while evaluating the cost of power and energy generated.

Following is analyzed in this chapter:

1. What sources of financing will be used to cover the project's costs?
2. What are the features of this kind of financing?
3. Is there any sufficient working capital in the project?
4. What is the contribution of the project to the investors?
5. What are the risks of the project and how can we mitigate it in order to guarantee the viability and sustainability of the project?
6. Is the project financially viable in terms of enough net cash flows?

2. METHODOLOGY

It is assumed that one EPC Contractor would execute the entire Civil, E&M and Structural Steel works. Single source EPC Contract has many advantages over split scope contracts. The EPC Contractor may, however, engage sub-contractors for specialized jobs that include supply of materials, powerhouse electrification, Transmission Line/Interconnection etc.

The site works shall be executed in accordance with the construction management plan. The construction activities include care and handling of water, bulk excavation and disposal, concrete mixing and placing and structural steel works. For preparation of quality concrete, batching plant shall be used.

Working conditions at the project site are expected to be excellent. Care and handling of water in the excavated area may be a construction hazard for which extra resources would be needed.

3. CONSTRUCTION MEANS

For all works, conventional construction methods shall be applied. Surface excavations require conventional earth moving equipment only. The construction work shall start with the excavation of temporary diversion channel on the left side of the canal. The majority of the work force shall be local, with site laborers and semiskilled labor available from the project area and skilled labor also coming from the region as well as from other parts of the Country. Foreign experts shall be hired for special tasks, especially that associated with installation and testing of major equipment (if necessary).

4. PROJECT COST

The project cost estimate involves preliminary works, complete civil and electromechanical works, installation, testing and commissioning charges of mechanical items, cost of procuring services of engineering & project management consultant and acquisition of land.

A. This work comprises a general description of the specific item of the hydel power plant civil works for all concrete structures element such as.

1. Construction of penstock
2. Construction of intake structure with hoist
3. Construction of spillway with hoist
4. Powerhouse (elbow concrete draft tube, spiral case, wicket gate, concrete around stay ring case, generation pier, surrounding walls, Turbine bed, Power house roof)
5. Construction of tailrace structure with hoist

B. All structure works shall be executed as indicated on the drawings and in conformity with the lines, grade and dimension as specified. The material, equipment, workmanship and construction methods would conform to the best engineering practices and after obtaining due approval of the Engineer.

C. For elevated structure such as hoist of intake and tailrace special care and attention shall be given to the elevation and alignment indicate in the project drawings.

5. MAIN BILL OF QUANTITIES (BOQ'S)

The BOQs of civil works as presented in have been worked out from the proposed project layout plan and quantities furnished after preliminary design of the components of the power plant. All the items are quantified on the basis of early engineering carried out at this stage and are expected to be changed during execution phase. Similarly, the prices of electromechanical works are furnished on the basis of preliminary design.

Civil Works

1. General layout of the site
2. General arrangement of the power house
3. Modification work drawings
4. Longitudinal & section drawing of the power house, auxiliary powerhouse and intake structure at each level showing reinforcement.
5. Earth work and approach means i.e. stair case, handrails and metal works(access road to power house is not included)

6. Diversion of water during construction.
7. Architectural work ,(office kitchen, details of roof ,floor ,windows, doors and finish)
8. Layout of water supply & sewage layout
9. Layout of main pipe for water, oil and air.
10. Pipe arrangement in power house ,generator pit, turbine pit for drainage.
11. Arrangement of embedded pipe & parts
12. Cooling water arrangement

Mechanical drawings

1. Layout of gates, hoisting system.
2. Arrangement of low and high pressure compressed air line.
3. Hydraulic measurement schematic showing location of instruments.
4. Arrangement of track rack, draft tube.
5. General arrangement of E & M equipment.
6. Governor oil bearing & lubrication drawing.

Electrical drawings

1. Single line drawings of power house.
2. Arrangement of grounding & lightening protection.
3. Arrangement of 6.3 kV & 11kV switchboards.
4. Arrangement of 6.3kV & 11kV relay protection , control equipment and measuring instrument.
5. Single line diagram of LV powerhouse.
6. Single line diagram of DC supply system.
7. Arrangement of lightening system including emergency system.

Note: The drawings submitted will include the information specified above and may not have the same numbers and title of the drawings.

The contractor shall submit the documents, drawing and other information before the unit put into the trail operation which shall include but not be limited to the following :

Drawing and descriptions:

1. Schematic layout, protection and control single drawings.
2. Drawings and description of assembling of the turbine, gates, cranes, generator, thrust and guide bearing ,transformers, switchboards, cooling and lubricating system.

Documents brochures and literature:

1. Descriptive literature and brochures on turbines, gates ,crane , generator exciters, transformers, switchboards etc.
2. Descriptive literature on governor and speed governing system.
3. Descriptive literature on the type of excitation system as proposed.
4. Descriptive literature on the unit control and protection system.

The contactor shall submit O and M manual three months before the completion of work.

6. CAPITAL EXPENDITURE BREAKUP

Schedule 1

Sr. No	**Description**	Origin	QTY	Unit Price	Total (PKR)
1.1	Kaplan Turbines including Inlet Wicket Gates, Governor, Mechanical embedded portions of Spiral case, Draft Tube etc.	China	2e	222,880	445,760
1.2	Overhead Travelling Cranes in Machine Hall and Work shop.	China	1	89,579	89,579
1.3	Auxiliary Mechanical System including Facilities for Compressed Air System, Hydraulic System, Dewatering System, Oil Handing Equipment, Fire Fighting System, Potable, Cooling and Service Water System	China	1	100,028	100,028
1.4	Generator Preferably with 11 kV Generation Including Excitation System Voltage Regulation System, Control and Protection System	China	2	413,189	826,377
1.5	Generator Step-up Transformers (incase of 6.3 kV generation) and Auxiliary System Protection	China			
1.6	200 kVA X 2, 11/.4 kV Station Auxiliary Transformers and other step down transformers	China	Sets	30,125	30,125
1.7	Unit Control System (UCS), Supervisory Control and Data Acquisition (SCADA)	China	Sets	151,137	151,137
1.8	Metering Panel With MHW and MVARH meter, CT's and PT's including Backup Metering Panel	China	Sets	4,016	4,016
1.9	100 kVA Emergency Diesel Generator amd Auto Transfer Switch	China	1	48,069	48,069
1.10	Fire Alarm and Fire Detection and Alarm System	China	1	21,995	21,995
1.11	Cable Medium Voltage 11kV and Low Voltage	China	Sets	107,605	107,605
1.12	Low Voltage AC System including Electrification Light, Wiring and panel boards etc.	China	Sets	30,641	30,641
1.13	Low Voltage DC system including Batteries, charger, wiring and panel board	China	Sets	25,710	25,710

1.14	Earthling and Lightening Protection	China	Sets	10,624	10,624
1.15	Project Instrumentation(Preferably 24v DC)	China	Sets	1,408	1,408
1.16	Mandatory Spare Parts (5 Years)	China	Sets	26,360	26,360
1.17	Gates including Trash Racks with motors and Hoist Mechanism	China	Sets	290,601	290,601
	TOTAL Schedule No. 1				**2,210,035**

Schedule 2

Sr. No	**Description**	Origin	QTY	Unit Price	Total (PKR)
1.11	Fire Alarm and communication Equipment including Fire Detection and Alarm System, Telephone Exchange, with Internal and External Telephone Lines	Pak	Sets	3,046	3,046
1.13	Low Voltage AC System including Electrification Light, Wiring and panel boards etc.	Pak	Sets	21,946	21,946
1.15	Earthing and Lightening Protection	Pak	Sets	16,454	16,454
1.17	Mandatory Spare Parts	Pak	Sets	44,640	44,640
	Total Schedule No. 2				**86,086**
	After 13% Rebate on Schedule 2				**74,895**

Schedule 3

Sr. No	**Description**	Origin	QTY	Unit Price	Total (PKR)
3.1	Detailed Engineering, design services and production of drawings of Civil works	Pak/China		137,786	5,385,766
3.2	Design and Erection Sequence and Production of Drawings for E&M Works	China		137,786	
	Total Schedule No. 3 in Pak Rs and US$				**5,385,766**

SPILL WAY STRUCTURE

This structure shall be constructed as intake structure providing of supporting wall, grooves and slab to the true line, grade and dimension as per drawings. After fixing of slots in the groove when concrete attains enough strength the gate shall be lowered in the groove stat. Construction of hoist shall be carried out as indicated in the drawing and same procedure shall be followed as intake hoist.

INTAKE STRUCTURE

This structure comprises for the supply of water to power plant directly from canal. It controls and functions as top log protects the waste material from entering in the power house through trash rack gate and the main gate function for the supply of water. When plant maintenance is required then the gate shall be closed to stop water entering penstock.

- For the construction of intake structure outer walls and bed shall be provided by the Employer.

POWER HOUSE CONSTRUCTION

It comprises construction of diffusion draft tube, spiral case, wicket gates, concrete around stay ring case ,generator pier, walls, turbine floor and power house roof.

Water from penstock with gravitational force enters in the spiral case through wicket gate where water runs the turbine connected with generator to produce electricity.

The sequence of construction of civil works for power house shall be as under:

1. Bed preparation
2. Construction of draft cone tube
3. Spiral case embedded parts and concrete
4. Wicket gate
5. Turbine Floor
6. Concrete around stay ring case
7. Construction of outer walls
8. Generator pier
9. Power house roof

The staff of electrical/mechanical and civil works together as a team fully cooperating with each other.

Schedule 4

Sr. No	**Description**	Origin	QTY	Unit Price	Total (PKR)
4.1.1	Water Task 2 Nos for cooling water system (340 cu meter each) with refiling arrangements through appropriate capacity 4 Nos deep well turbine pumps including developments of Bore complete in all respect		2 Sets	16,689,400	33,378,800
4.1.2	Intake Structure		2 Sets	36,314,997	72,629,994
4.1.3	Penstocks		2 Sets	27,427,796	54,945,592
4.1.4	Power House		Sets	87,855,072	87,855,072
4.1.5	Electric power supply including 11LV Transmission Line (Approximately 8Km) & connection to existing 132 kv Grid connection with VCB panel (two		Sets	46,982,495	46,982,495

	numbers one being spare) in synchronized with WAPDA 132 kv Bus bar				
4.1.7	Installation, testing and commissioning of all Plant and Equipment (GCC 23.5)		Sets	7,385,330	7,385,330
4.1.8	Mobilization and Demobilization			6,000,000	6,000,000
	Total for Schedule No. 4				**309,177,283**
	Total After 13% Rebate on Schedule 4				**268,984,236**

Schedule 5

Sr. No	**Description**	Origin	QTY	Unit Price	Total (PKR)
1	Plant and Mandatory Spare Parts Supplied from Abroad			2,210,035	
2	Plant and Mandatory Spare Parts Supplied from Pak			74,895	
3	Design Services and Erection Cost			275,572	5,385,766
4	Civil Works, Installation and other Services				268,984,236
	Total Price of Bid in Respective Currencies			2,560,502	274,370,002
	Conversion of US$ Portion in Pak Rupees @Rs 107/US$				**273,973,695**
	GRAND TOTAL PRICE OF BID IN PAK RUPEES				**548,343,697**
	The US$ portion has to be paid in US$ and Pak Rupees in Pak Rupees				

13. TOTAL PROJECT COST

Total Project Cost

Description	Amount
Plant and Machinery	548,343,697
Office Equipment	2,444,724
Furniture & Fixture	467,532
Vehicle	16,626,145
Staff Homes	15,965,979
Total	583,848,077

14. PROJECT FINANCING

The complete Plant design, Procurement and construction including civil works of 5 MW units Kundian Hydel Power Projects project will be financed by the in following manner.

Name	Amount
Pakistan Atomic Energy Commission Foundation	146,000,000
Pakistan Atomic Energy Commission	434,000,000
Total Finance	580,000,000

Pakistan Atomic Energy Commission Foundation is the only shareholder of company and the whole project will be finance by it resources and no other funds for financing will be involved

15. PROJECT LIFE

Expected operation life of the project is estimated to be 25 years.

16. WORKING CAPITAL FINANCING

Any working capital requirement of the project will also be financed by the parent organization.

17. DEBT SERVICE

All the advance and debt received from the principal shareholder of the company to finance the project are assumed to be at the rate of 13%.

18. OPERATION COST

Operation cost includes the following:

Description	Amount
Pay & allowances	65,000,000
Repair & maintenance	750,000
Repair & maintenance - vehicles	700,000
Operating & maintenance cost	4,440,000
Utilities	742,000
Postage, telephone & telegram	127,000
Printing & stationary	50,000
Entertainment	300,000
Travelling expenses	200,000
POL	2,000,000
Miscellaneous expenses	20,000,000
	94,309,000

19. ADMINISTRATIVE COST

Admin Expense	
Description	Amount
Pay & allowances	9,000,000
Medical expenses	35,000
Vehicle running & maintenance	500,000
Travelling expenses	150,000
Repair & maintenance	125,000
Utilities	220,000
Postage, telephone & telegram	170,000
Printing & stationary	70,000
Legal & professional charges	200,000
Security expense	88,000
Entertainment	50,000
Newspapers & periodicals	5,000
Audit fee	180,000
POL	1,500,000
Office supplies	40,000
Provision for bad debts	50,000
Total	**12,383,000**

20. DEPRECIATION SCHEDULE

Period	Plant and Machinery	Office Equipment	Furniture & Fixture	Vehicle	Staff Homes	Total
Rate	10%	10%	10%	20%	10%	
Year 0	548,343,697	2,444,724	467,532	16,626,145	15,965,979	583,848,077
Depreciation	54,834,370	244,472	46,753	3,325,229	1,596,598	60,047,422
Year 1	493,509,327	2,200,252	420,779	13,300,916	14,369,381	523,800,655
Depreciation	49,350,933	220,025	42,078	2,660,183	1,436,938	53,710,157
Year 2	444,158,395	1,980,226	378,701	10,640,733	12,932,443	470,090,498
Depreciation	44,415,839	198,023	37,870	2,128,147	1,293,244	48,073,123
Year 3	399,742,555	1,782,204	340,831	8,512,586	11,639,199	422,017,375
Depreciation	39,974,256	178,220	34,083	1,702,517	1,163,920	43,052,996
Year 4	359,768,300	1,603,983	306,748	6,810,069	10,475,279	378,964,379
Depreciation	35,976,830	160,398	30,675	1,362,014	1,047,528	38,577,445
Year 5	323,791,470	1,443,585	276,073	5,448,055	9,427,751	340,386,934

21. REVENUE

The project shall sell all of the units produced to Pakistan Atomic Energy Commission, which is the Ultimate Beneficial Owner of KUNDIAN HYDEL POWER PRIVATE LIMITED at rates which has been mutually decided as per the agreement between them. Project will generate on average 2,160,000 KWH of electricity

Production Capacity	5	MWHr
	43,200	MWHr/Year
	43,200,000	KWHr/Year
Capacity Utilization	60%	
Estimated yearly Production	25,920,000	KWHr/Year
Estimated monthly Production	2,160,000	KWHr/month

Month	KWH	Net Income	Avg. Rate
January-21	2,160,000	25,920,000	12
February-21	2,160,000	25,920,000	12
March-21	2,160,000	25,920,000	12
April-21	2,160,000	25,920,000	12
May-21	2,160,000	25,920,000	12
Jun-21	2,160,000	25,920,000	12
Jul-21	2,160,000	25,920,000	12
Aug-21	2,160,000	25,920,000	12
Sep-21	2,160,000	25,920,000	12
Oct-21	2,160,000	25,920,000	12
Nov-21	2,160,000	25,920,000	12
Dec-22	2,160,000	25,920,000	12
G. Total	25,920,000	311,040,000	

22. YEARLY REVENUE PROJECTION

Sr No	Year	Avg KWH Production	Net Income
1	1	25,920,000	311,040,000
2	2	25,920,000	317,260,800
3	3	25,920,000	323,606,016
4	4	25,920,000	330,078,136
5	5	25,920,000	336,679,699
6	6	25,920,000	343,413,293
7	7	25,920,000	350,281,559
8	8	25,920,000	357,287,190
9	9	25,920,000	364,432,934
10	10	25,920,000	371,721,593
11	11	25,920,000	379,156,024
12	12	25,920,000	386,739,145
13	13	25,920,000	394,473,928
14	14	25,920,000	402,363,406
15	15	25,920,000	410,410,674
16	16	25,920,000	418,618,888
17	17	25,920,000	426,991,266
18	18	25,920,000	435,531,091
19	19	25,920,000	444,241,713
20	20	25,920,000	453,126,547
21	21	25,920,000	462,189,078
22	22	25,920,000	471,432,860
23	23	25,920,000	480,861,517
24	24	25,920,000	490,478,747
25	25	25,920,000	500,288,322

23. PROFIT AND LOSS (AFTER START OF OPERATION)

PARTICULARS	Year 5 RUPEES	Year 4 RUPEES	Year 3 RUPEES	Year 2 RUPEES	Year 1 RUPEES
INCOME					
Sales - net	336,679,699	330,078,136	323,606,016	317,260,800	311,040,000
Less: Cost of sales	114,633,179	109,174,456	103,975,673	99,024,450	94,309,000
Gross income	222,046,520	220,903,680	219,630,344	218,236,350	216,731,000
EXPENDITURE					
Administrative expenses	20,927,389	19,024,899	16,383,550	14,661,903	12,383,000
Welfare expenses	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000
Depreciation	38,577,445	43,052,996	48,073,123	53,710,157	60,047,422
Bank charges	25,367	23,061	14,584	6,151	6,760
	69,530,201	72,100,956	74,471,257	78,378,211	82,437,182
Unappropriated profit/(loss)	152,516,319	148,802,724	145,159,086	139,858,139	134,293,818
Profit appropriated	46,613,055	43,642,179	40,727,269	36,486,511	32,035,054
Markup to sponsor	75,400,000	75,400,000	75,400,000	75,400,000	75,400,000
Net profit/(Loss)	30,503,264	29,760,545	29,031,817	27,971,628	26,858,764

24. BALANCE SHEET (AFTER START OF OPERATION)

ASSETS	Year 5 RUPEES	Year 4 RUPEES	Year 3 RUPEES	Year 2 RUPEES	Year 1 RUPEES
NON-CURRENT ASSETS					
Property, plant & equipment	340,386,934	378,964,379	422,017,375	470,090,498	523,800,655
CURRENT ASSETS					
Other current assets	103,365	51,683	25,841	12,921	6,460
Cash & bank balances	393,365,459	322,321,878	247,984,520	169,700,455	87,108,173
	393,468,825	322,373,560	248,010,361	169,713,376	87,114,634
TOTAL ASSETS	**733,855,758**	**701,337,939**	**670,027,736**	**639,803,874**	**610,915,289**
LIABILITIES					
100,000 ordinary shares @ Rs. 10/- each.	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
Sponsor funds	580,000,000	580,000,000	580,000,000	580,000,000	580,000,000
Accumulated Profit	144,126,017	113,622,753	83,862,209	54,830,391	26,858,764
	725,126,017	694,622,753	664,862,209	635,830,391	607,858,764
CURRENT LIABILITIES					
Creditors, accrued & other liabilities	8,729,741	6,715,185	5,165,527	3,973,483	3,056,525
Provision for Taxation	-	-	-	-	-
Total Liabilities	**733,855,758**	**701,337,939**	**670,027,736**	**639,803,874**	**610,915,289**

26. PROJECTED INCOME.

Year	Revenue	Cost of Operation	Admin Expense	Cash Generation
1	311,040,000	94,309,000	82,437,182	134,293,818
2	317,260,800	99,024,450	78,378,211	139,858,139
3	323,606,016	103,975,673	74,471,257	145,159,086
4	330,078,136	109,174,456	72,100,956	148,802,724
5	336,679,699	114,633,179	69,530,201	152,516,319
6	343,413,293	120,364,838	70,920,805	152,127,650
7	350,281,559	126,383,080	72,339,221	151,559,258
8	357,287,190	132,702,234	73,786,005	150,798,951
9	364,432,934	139,337,345	75,261,725	149,833,863
10	371,721,593	146,304,213	76,766,960	148,650,420
11	379,156,024	153,619,423	78,302,299	147,234,302
12	386,739,145	161,300,395	79,868,345	145,570,405
13	394,473,928	169,365,414	81,465,712	143,642,802
14	402,363,406	177,833,685	83,095,026	141,434,695
15	410,410,674	186,725,369	84,756,927	138,928,379
16	418,618,888	196,061,638	86,452,065	136,105,185
17	426,991,266	205,864,720	88,181,107	132,945,440
18	435,531,091	216,157,956	89,944,729	129,428,407
19	444,241,713	226,965,853	91,743,623	125,532,236
20	453,126,547	238,314,146	93,578,496	121,233,905
21	462,189,078	250,229,853	95,450,066	116,509,159
22	471,432,860	262,741,346	97,359,067	111,332,447
23	480,861,517	275,878,413	99,306,248	105,676,855
24	490,478,747	289,672,334	101,292,373	99,514,040
25	500,288,322	304,155,951	103,318,221	92,814,151

27. PAY BACK PERIOD, NET PRESENT VALUE AND IRR

Year	Cash Flow	Discounted Cash Flow	Cumulative Cash Flow
	Discount Rate	13%	
0	(583,848,077)	(583,848,077)	
1	134,293,818	118,844,087	118,844,087
2	139,858,139	109,529,438	228,373,524
3	145,159,086	100,602,528	328,976,053
4	148,802,724	91,263,497	420,239,550
5	152,516,319	82,779,748	503,019,298
6	152,127,650	73,069,729	576,089,027
7	151,559,258	64,421,876	640,510,903
8	150,798,951	56,724,513	697,235,415
9	149,833,863	49,877,421	747,112,836
10	148,650,420	43,790,682	790,903,517
11	147,234,302	38,383,637	829,287,154
12	145,570,405	33,583,950	862,871,104
13	143,642,802	29,326,761	892,197,865
14	141,434,695	25,553,933	917,751,798
15	138,928,379	22,213,363	939,965,161
16	136,105,185	19,258,372	959,223,533
17	132,945,440	16,647,150	975,870,684
18	129,428,407	14,342,261	990,212,945
19	125,532,236	12,310,192	1,002,523,137
20	121,233,905	10,520,957	1,013,044,094
21	116,509,159	8,947,728	1,021,991,821
22	111,332,447	7,566,517	1,029,558,338
23	105,676,855	6,355,880	1,035,914,218
24	99,514,040	5,296,655	1,041,210,873
25	92,814,151	4,371,728	1,045,582,601
	NPV of Project	461,734,524	
	Internal Rate of Return	25%	

Project will achieve pay back in its 6th year of operation; Net present value of the project in twenty-five year of life of the project will be PKR 461 Million at an expected IRR of 25%.

28. SOCIAL AND ENVIRONMENTAL IMPACT

KHP seem to be environment friendly. It has no or minimal impact on social and environment. The total layout plan of the project is located with in the boundary premises of Chashma NPP so proposed project layout plan does not involve any relocation and resettlement during the land acquisition.

The investigations at site have shown that in general the realization of the project is possible at the sit from an environmental point of view and no adverse impact on the existing flora and fauna at site is expected. The facility will not emit any solid liquid and gaseous waste during the entire life of the project and thus the power will be generated without polluting the environment of the surrounding.

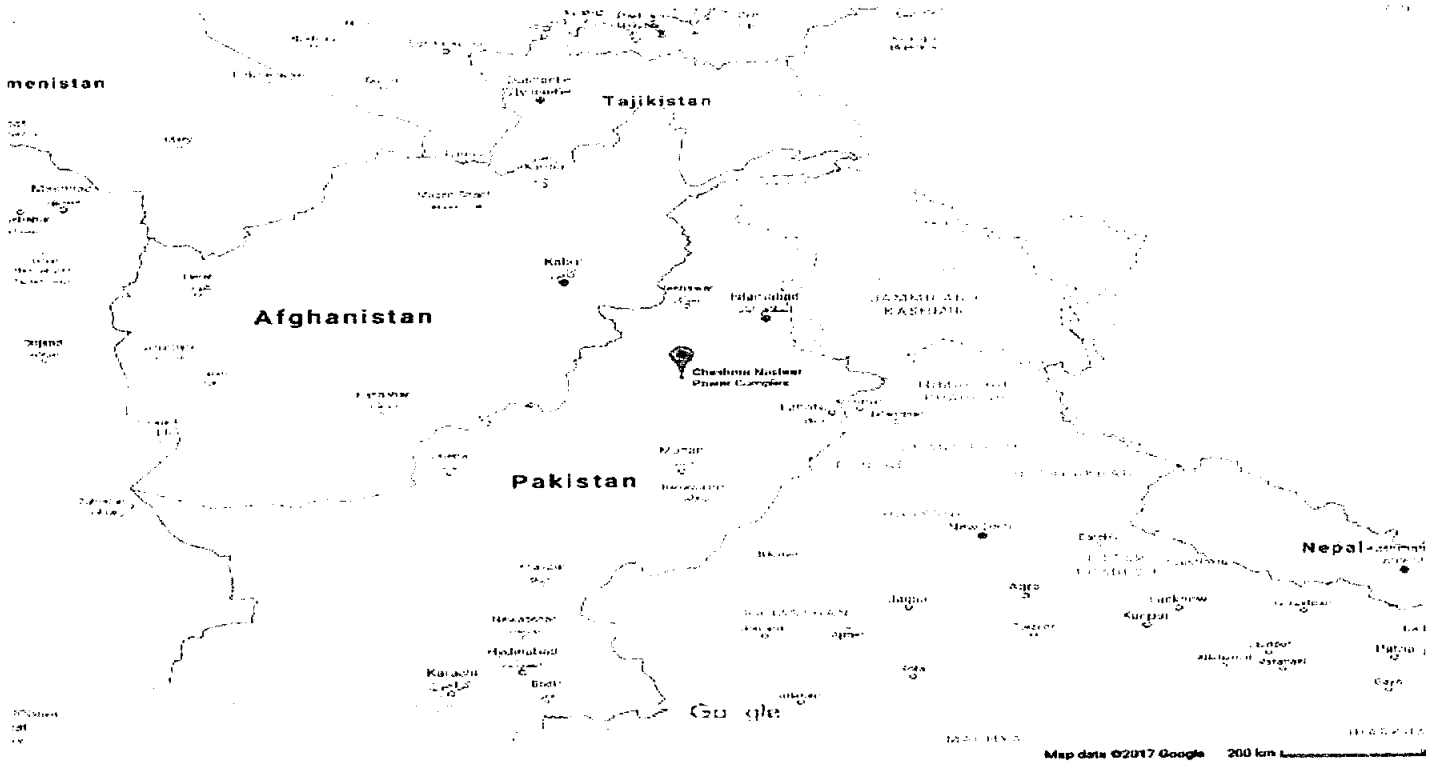
As the project is located in the security sensitive and population sparse area the potential of social interaction between construction worker and local population is nonexistent therefore the deterioration of community health, safety, due to people interaction and behaviors is not applicable. There will be no spread of communicable diseases.

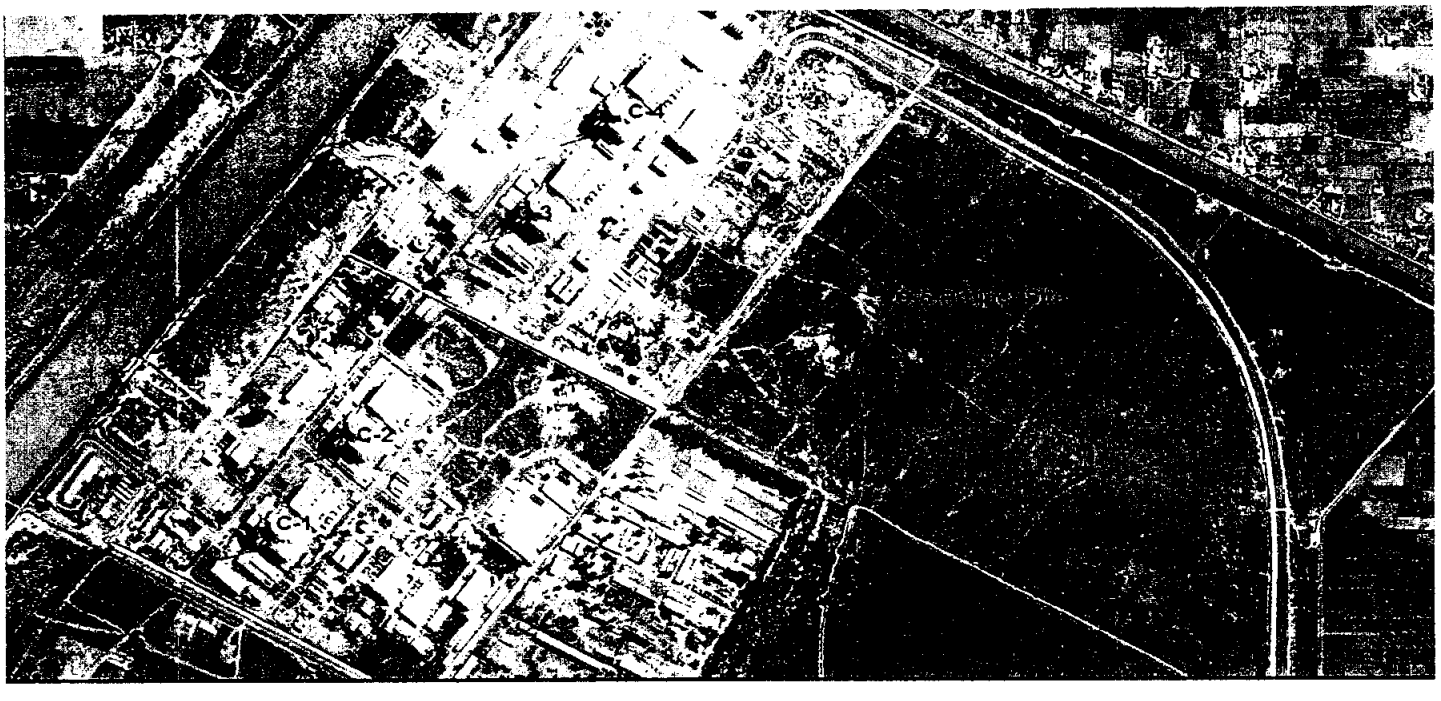
The contractor shall be required to employ full time qualified safety officer for the construction phase of the project. The contractor shall carry out a risk management and then develop a site and project specific safety management plan aimed at prevention of accident, injuries for both construction and operation.

Environmental management plan (EMP) provided with document which identifies activities and monitoring indicators associated with good institutional health and safety. Installation of the proposed Power Plant would require the project proponent to undertake management of following environmental and social issues during the development, construction and operation phases of the project.

- Change in landscape. Change in landform, topography and geomorphology;
- Impact on geology; Noise; Change in air quality;
- Transportation activities; equipment mobilization, transport and storage of construction material;
- Water consumption and waste water generation;
- Construction waste generation and disposal.
- Emissions from emergency power equipment and heat generation;
- Emissions during transportation;
- Handling and management of waste during operations;
- Documenting and developing occupational accidents. diseases and incidents
- Developing emergency prevention preparedness and response arrangement. The Project is financially feasible. Proposed tariff is reasonable. The project can be developed.

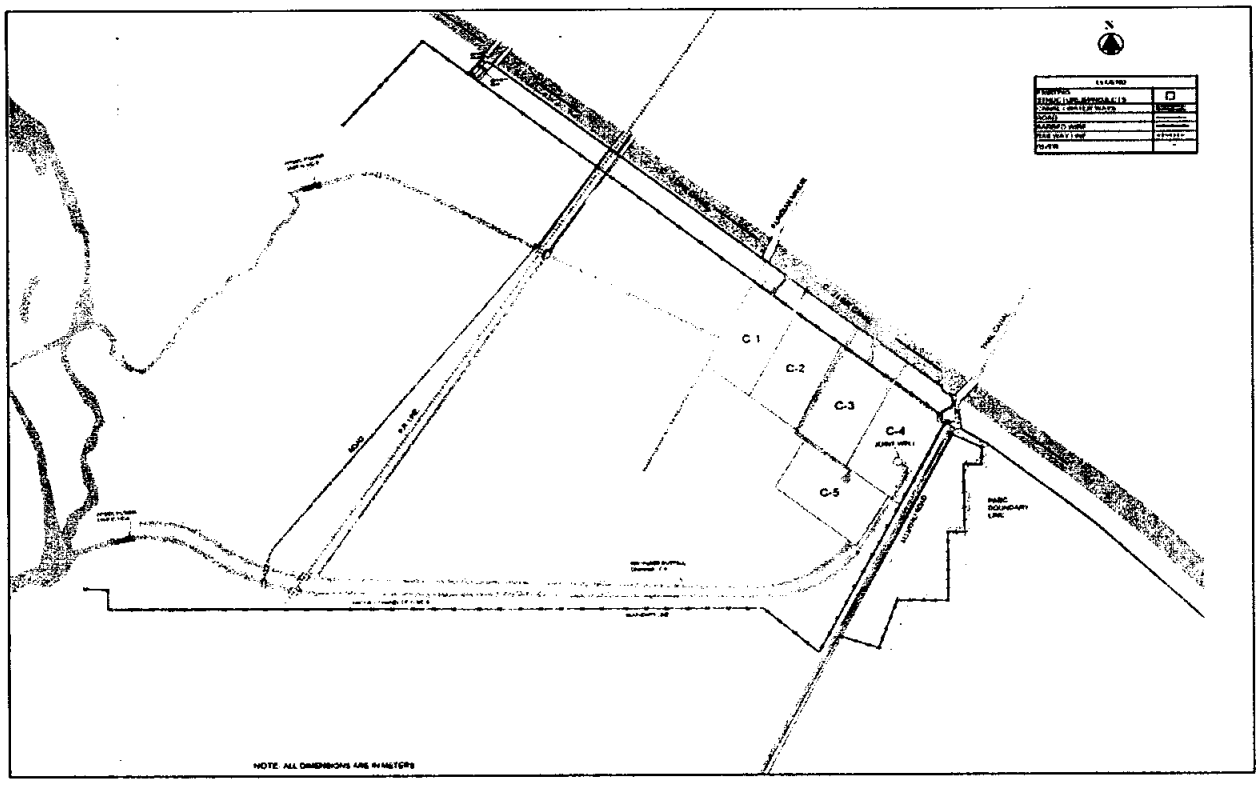
29. LOCATION & LAYOUT MAPS OF PROPOSED PROJECT





Topographic Survey of Site Area

Water Intake & Outfall Plan Layout



TECHNICAL DETAILS, OPERATIONAL DESIGN OF THE FACILITIES

Annexure A: Submittals

1 List of drawings accompanied by description (soft and 2 Nos hard copies):

A Civil Work

1. General layout of the site
2. General arrangement of the powerhouse
3. Modification work drawings
4. Longitudinal & section drawing of power house, auxiliary powerhouse and intake structure at each level showing reinforcement.
5. Earth work and approach means i.e. stair case, handrails and metal works (access road to powerhouse is not included).
6. Diversion of water during construction.
7. Architectural work, (office, kitchen, details of roof, floor, windows, doors and finish).
8. Layout of water supply & sewage layout.
9. Layout of main pipe for water, oil and air.
10. Pipe arrangement in powerhouse, generator pit, turbine pit for drainage.
11. Arrangement of embedded pipe & parts.
12. Cooling water arrangement.

B Mechanical drawings

1. Layout of gates, hoisting system.
2. Arrangement of low & high pressure compressed air line.
3. Hydraulic measurement schematic showing location of instruments.
4. Arrangement of trash rack, draft tube.
5. General arrangement of E & M equipment.
6. Governor oil bearing and lubrication drawing.

C Electrical drawings

1. Single line drawings of powerhouse.
2. Arrangement of grounding & lightning protection.
3. Arrangement of 6.3kV & 11 kV switchboards.
4. Arrangement of 6.3 kV & 11 kV relay protection, control equipment and measuring instrument.
5. Single line diagram of LV powerhouse.
6. Single line diagram of DC supply system.
7. Arrangement of lightning system including emergency system

Note: The drawings submitted will include the information specified above and may not have the same numbers and title of the drawings.

D. The contractor shall submit the documents, drawing and other information before the unit put into trial operation which shall include but not be limited to the following:

Drawings and Descriptions:

i. Schematic layout, protection and control single drawings.
ii. Drawings and description of assembling of the turbine, gates, cranes, generator, thrust and guide bearing, transformers, switchboards, cooling and lubricating system.

Documents, brochures and literature:

i. Descriptive literature and brochures on turbine, gates, crane, generator exciters, transformers, switchboards etc.
ii. Descriptive literature on governor and speed governing system.
iii. Descriptive literature on the type of excitation system as proposed.
iv. Descriptive literature on unit control and protection system.

E. The contractor shall submit O and M manual three months before the completion of work.

9. Annexure B

9.1.0 GENERAL REQUIREMENTS

1.0.1 WORKMANSHIP

Workmanship and general finish shall be in accordance with the requiremen specified in the contract.

1.0.2 STANDARDS

Design, manufacture, rating characteristics, tests etc. of all electrical and mechanica equipment shall strictly comply with the codes and standards mentioned in th contract.

1.0.3 SUBMITTALS

Subject to the Technical Specifications Appendix–I.

1.0.4 MATERIALS

All materials shall be of the highest grade, free from defects and imperfections, of the classification and grade designated, and conform to the requirements of the International Standard Specifications.

A. COPPER, ELECTRICAL

Copper used for electrical buses and rigid connections shall conform to ANSI Standard or equivalent Chinese standard. Specification for Copper Bus Bar and Shapes.

B. ALUMINIUM ALLOY ELECTRICAL

Aluminum alloy if used shall be subject to approval of the Employer.

1.0.5 SCHEDULE OF DELIVERY AND ERECTION

The Manufacturer shall submit the "Time Schedule" of manufacturing/delivery and erection of different equipment and commissioning date.

1.0.6 OPERATION AND MAINTENANCE MANUAL

The Manufacturer shall submit O & M Manual three months before the completion of work.

9.1.1 ELECTRIC WELDING

1.1. GENERAL

Welding of metal work shall conform to American standard or equivalent Chinese standard.

1.2 WELDING

The technique of welding employed, the appearance and quality of the welds made, and the methods used in correcting defective work shall conform to American standard or equivalent Chinese standard. Gas metal welding shall not be used.

9.2 TURBINES

2.1 SCOPE OF WORK

The manufacturer shall design, manufacturer, supply, erect and commission the unity and all other allied equipment. The manufacturer shall also supply erection and maintenance equipment and essential spares listed as Appendix–II to the Technical Specifications.

2.2 STANDARDS

The turbine design shall strictly meet the requirements of International Electromechanical Commission (IEC) publications:

IEC-609 for 'Cavitation pitting evaluation in hydraulic turbines'.

IEC-41 for the field acceptance test of hydraulic turbines.

Relevant IEC or equivalent for tests on turbines governors.

National Electrical Manufacturer Association NEMA-MG 5.2.

2.0.3 DESIGN AND WORKING STRESS

All hydromechanical equipment shall be designed and constructed in accordance with the latest standard of Chinese, IEC or equivalent international standards. The maximum unit stresses in rotating parts of turbine due to run away speed shall not exceed 66.7% of the yield strength.

9.3 GOVERNOR SYSTEM

A . General

Due to small capacity of the power station the frequency regulation will be limited. Keeping in view, the operation conditions Proportional Integrated Derivative (PID) electronic hydraulic governor as specified is acceptable.

B . Governor System Capacity

For rapid shut down the governor shall operate the wicket gates with closing speed corresponding to the shortest closing time, of secs from 100% to 40% gate opening and (100% stroking) to match the maximum speed rise. The speed shall be stepwise reduced near the closing position.

C . Speed Droop

The permanent speed droop shall be adjustable on the governor head a unit control panel between 0 to 6%.

D . Governor Stability

1. The governor system shall provide stable operation of the turbine for all operating conditions.

2. The governor system shall be deemed stable, if the hydraulic system of

turbine and water conduit is inherently stable, when the magnitude of the sustained speed oscillation attributed to the governor does not exceed plus or minus 0.3% of rated speed with the generator operating at rated speed and no load or operating at rated speed and isolated sustained load, with the governor speed droop regulation set at 2-5 %.

E. **Servomotor Dead Time**

The elapsed time from the initial speed change of the turbine to the first movement of the wicket gates or runner servomotor at sudden load change of more than 10% of the full load rating of the turbine shall be achieved.

F GOVERNOR PRESSURE OIL CIRCUIT

The pressure oil supply system shall be complete in all respect for the turbine speed governing system. The supply shall inter alia include pumps, air oil tanks, servo valves, oil sumps and complete electro-hydraulic control equipment. The speed governing system to be described and schematic diagrams submitted.

9.4 SPEED RISE VARIATIONS

1. The guaranteed maximum speed rise at load rejection of full load or partial load shall not exceed 60% of rated speed.
2. The inertia moment of generator C G^2 to be specified.
3. The time delay process to stabilize rated speed after full load rejection to be specified.
4. Graph showing pressure and speed-rise on full load rejection to be provided.

9.5 CAVITATION GUARANTEE

A. Cavitation guarantee shall be given for maximum cavitation pitting depth and for maximum area damaged by cavitation pitting.

B. At the end of the period of guarantee the surface of each of the components of the turbines (runner blades, runner hubs and discharge rings) shall be such that:

1. No cavitation pit exceeds a depth of 3 mm after grinding of the pit to recover sound material.
2. The total damaged area of every individual component determined in

accordance with the methodology specified in the IEC Publication 609 does not exceed 5% of the total area of the component.

C. Guarantee period shall be 8000 working hours within the operation range as defined in Fig. 2 of IEC Publication 609.

D. If inconsistencies among A, B, C, the IEC standards will govern.

9.6 CRACK GUARANTEE

The Contractor shall guarantee all turbine components against crack formation for a period of not less than 16000 operating hours, from the date of taking over of the corresponding turbine.

9.7 EFFICIENCY GUARANTEE

The manufacturer shall guarantee the efficiency of the turbine as specified.

9.8 Control Modes

1. LOCAL CONTROL of individual components of the governor system shall be possible for testing, commissioning and maintenance purposes as far as practicable.
2. UNIT CONTROL from the unit control panel shall be possible for starting (except synchronizing), loading and stopping the generating unit.
3. CENTRAL CONTROL from the control room will be the normal mode of control.

9.9 TESTS

Shop tests, field tests and commissioning tests and all other tests shall be performed as per international standards and may be witnessed by the Employer. List of tests to be performed are given in Annexure–C.

9.10 OIL, WATER AND AIR SUPPLY SYSTEMS

10.1 LUBRICATION SYSTEM

Complete scheme for lubrication system for all bearings and other parts shall be designed and provided. Layout drawing of the system may be supplied. Oil treatment

plant description and literature may be provided.

10.2 COOLING WATER SYSTEM

Cooling water scheme shall cover cooling of bearings and other parts of turbine as well as generator. The ambient temperature of water may be takes as 40^{0} C.

10.3 COMPRESSED AIR SYSTEM

Compressed air system shall cover supply to turbine shaft seals, generator brakes etc. separate high pressure air system for governor tanks shall be preferred.

Drawings and descriptions of complete system to be supplied.

10.4 DEWATERING

Drawings and description showing location and arrangement of pumps to be submitted. Number and capacity of pumps shall be given.

10.5 DRAINAGE

Drawings and description of drainage system to be provided. Capacity the main supplementary pumps to be given. Float switches and levels to be indicated.

10.6 WATER SUPPLY AND SEWAGE SYSTEMS

Details of the facilities should be provided including:

i. Ground water collection and storage system

ii. Treated water system

iii. Service water system

iv. Sewage disposal system

10.7 FIRE FIGHTING SYSTEM

Detail of the system to be described. It should include:

i. Water hydrant (not applicable for this project)

ii. Mobile trolley

iii. Fixed on wall fire extinguishers etc.

9.11 **H.V.A.C.**

General layout of H.V.A.C. system giving description and capacity of equipment to be provided.

9.12 GENERATOR PROTECTION

12.1 **Minimum requirement for Generator Protection are;**

- Loss of excitation relay
- Negative phase sequence relay
- Over voltage relay
- Reverse power relay
- Over current relay
- Stator temperature relay
- Stator ground fault relay
- Rotor ground fault relay
- Volt/Hertz relay
- Voltage balance relay
- Overall differential relay

The relays shall operate by 220 V DC or 230 V AC supply.

12.2 BRAKES

Each generator shall be provided with air "Brakes" mounted on lower bracket of generator and to be applied at 25% to 30% of the rated speed.

12.3 COOLING SYSTEM

Generator cooling system to be specified in detail.

12.4 HEATING

Heaters or dehumidifier shall be provided to prevent condensation when the unit is stopped for maintenance or repair for long period.

12.5 UNIT CONTROL SYSTEM

All supervisory and control system shall be provided in unit control board (UCB).

The UCB shall have:

- Unit control and signaling
- Emergency stop system
- Alarm and annunciation
- Synchronizing equipment
- Temperature monitoring and indication

12.6 LOGIC MULTICONNECTOR MODULES (LMC) CONTROL SYSTEM

Not applicable for this project.

12.7 EMERGENCY STOP SYSTEM

The emergency stop system shall be independent of the normal unit control system.

The emergency stop system shall consist of:

- Electrical stop system or Mechanical

12.8 INSULATION CLASS

Winding insulation shall be class F.

9.13 MV SWITCHGEAR

13.1 REFERENCE STANDARDS

The switchgear, including the operating devices and the auxiliary equipment which form an integral part of it shall be designed, manufactured and tested in accordance with IP and IK Class and the following International Electro-technical Commission (IEC) Publications as amended, to date:

IEC 56 Specification for high voltage alternating current circuit breakers.

IEC 185 Specification for current transfer.

IEC 186 Specification for voltage transformer.

And other standards related to 11 kV switchgears as mentioned in Technical Bid Doc Section IX

13.2 TYPE

Vacuum Type 11 kV Breakers are acceptable, but the characteristics shall match with 11 kV Breakers provided at the other end.

13.3 RATINGS

Circuit breakers shall have the following ratings:

1.	Nominal voltage, kV	11
2.	Rated Maximum, kV	17.5
3.	Frequency Hz	50
4.	Continuous current amperes as may be determined	
5.	Interrupting capability: (to be provided later on)	
	a. Rated short circuit current, kA	
	b. Rated peak withstand current, kA	
6.	Low frequency withstand, kA	
7.	Impulse withstand, full wave, kV.	

9.14 L.V. CIRCUIT BREAKERS

Circuit breakers shall be of the indoor air-insulated type, accomplishing the interruption of the circuit in air with suitable means for confining and extinguishing the arc of interruption. Circuit breakers for 3-phase circuits shall be 3-pole single-throw.

9.15 ELECTRIC MOTORS

15.1 GENERAL

The Manufacturers shall determine the number and capacity of motors for different duties to meet the requirements of main and auxiliary equipments.

15.2 STANDARDS AND CHARACTERISTICS

Electric motors shall conform to the requirements of the applicable IEC standards for motors and generators and shall be suitable for continuous operation at 230 V single

phase or 400 volts three-phase plus or minus 10 percent, 50 Hz. With capacity speed and voltage characteristics suitable for full voltage starting and accelerating the driven load with starting current not more than six times rated current with temperature rise not to exceed that specified in the standard for the class of insulation and type of frame employed, above an ambient temperature of 40°. Unless otherwise specified.

15.3 INSULATION CLASS

Insulation shall be Class B 80° C rise and have at least two alternatively dipped and baked coats of high grade varnish and finally treated with at least one coat of non-brittle non-hygroscopic enamel or varnish. The insulation shall be suitable for damp locations for considerable fluctuations in ambient temperature.

9.16 INSTRUMENT AND CONTROL EQUIPMENT GENERAL

A. Most of the equipment shall be pre-assembled in the factory. Sensitive instruments can be shipped separately and mounted later.

B. All components where applicable are to be tropicalize.

C. No failure should be produced by the influence of the local climate, even when the air conditioning systems of the powerhouse are out of service.

9.17 Relays

The relays installed and supplied with the different protection and control equipment shall conform to relevant IEC Standards or equivalent International Standards. Generally the following requirements shall be satisfied.

A. The number of different types of relays shall be as per requirements and shall be adjusted to a uniform specification. Each relay adjustment shall be clearly specified in the maintenance manuals.

B. Adjustments which are unspecified are not permitted. Armature residual studs rather than screws shall be used wherever possible. Coils shall not be wound with wire finer than 0.08 mm in diameter without specific approval.

C. Contac materials shall, without doubt, be suitable for the function they are required to perform. Stated relay life shall be of the international requirements.

D. All relays shall be clearly marked with their schematic designation, together with labels giving their code, resistance, etc.

E. Relays must be protected from dust either by individual covers or covers protecting a group of relays, e.g. a relay subrack.

9.18 INDICATING INSTRUMENT

A. All indicating instruments shall be of the flush mounted, back connected, dustproof and (heavy duty where necessary) switchboard type.

B. Scale plates shall be white with black pointer and markings. The glass shall be anti-glare type.

C. All indicating instruments shall have a frame size of Chinese practice. The maximum error shall not be more than one and a half (1.5) percent of full scale range.

D. All instruments shall be scaled according to the required values.

E. The instruments shall bear on the scale plate their markings, symbols and designation.

9.19 INDICATING LAMPS AND PUSH BUTTONS

A. Unless otherwise specified, indication lamps and luminous push buttons for control boards shall be of the switchboard type insulated for 220 V DC, service voltage with appropriate engraved coloured caps. Coloured caps shall be made of a material which will not be softened by the heat from the lamps.

B. The push button contacts shall have the required current rating for the controlled devices.

C. The colours shall be as follows as far as possible:

1.	Push button with back indication	white
2.	Indicating lamps	white
3.	Abnormal positions of selector and test switches	yellow
4.	Disturbance lamps	red
5.	Push button for emergency tripping	red

D. The indicating lamps and remote indication lamps should only be illuminated if the selector switch for service mode is switched on (normal indications being not illuminated).

9.20 THERMOMETERS

The Contractor shall provide the design and description of thermometers.

10. Annexure C

10.0 TEST FOR ELECTRICAL AND MECHANICAL EQUIPMENT

The E&M equipment shall be subjected to International Tests as under (some of the tests shall be performed during the defect liability period).

10.1 TURBINES

1.1 FIELD STAGE TESTS

A. Design erection of turbine and all its auxiliaries, the contractor shall test the turbine, governor and accessories in accordance with the requirements of the IEC Specification 34 and other International Standards.

B. Field tests on turbine, governor system and accessories shall include, but not be limited to, the following tests:

1. Functional tests of auxiliaries and protective devices.
2. Calibration of all gauges and instruments.
3. Operation of governor pumping set including performance test.

1.2 COMMISSIONING TESTS

A. GENERAL

i. Prior to placing unit into commercial operation, commissioning tests shall be performed on the generator and turbine unit. These tests will be coordinated by the Engineer but the Contractor shall assume full responsibility for the operation and safety of the plant.

2. The test instruments provided by Employer shall be of the latest model and type available with the precision required to conduct the specified tests.

3. The commissioning tests shall include, but not be limited to, the following:

   a. Alignment and rotation checks in the dry
   b. Governor operation.
   c. Initial wet run to ensure satisfactory operation.
   d. Bearings test run.

e. Proving of interlocks and indications.

f. Tripping tests for turbine.

g. Load and overload tests.

h. Load rejection and load acceptance tests.

i. Investigation of any objectionable vibrations, pressure surges or noise under any operating conditions.

j. Speed rise and pressure rise tests, for load rejection at 25%, 50%, 75% and 100% of full load.

k. Index test for determining relative turbine discharge and efficiency.

B. RUNWAY SPEED TEST

An overspend test shall be made on turbine-generator unit to demonstrate that all parts of the turbine will successfully withstand the stresses incidental to its operation at the no-load runway speed. The unit will be operated at this speed for a period as may be determined.

1.3 OUTPUT ACCEPTANCE TEST

A. After commissioning tests have been satisfactorily completed the Engineer in cooperation with the Contractor will conduct output tests to determine whether or not the output guarantees are fulfilled. The output tests will be conducted in accordance with the IEC Publication 41 and other International Standards.

B. The final results of such tests shall be subject to acceptance by the Engineer and shall fulfill the guarantees stated in the Contract.

10.2 GOVERNOR SYSTEM

2.1 GENERAL

The governor system shall provide stable operations of turbines runner in all conditions. The magnitude of oscillation shall be within limits of specified speed variations.

2.2 SHOP TESTS

A. The governor system shall be assembled and tested in the workshop as far as practicable.

B. All applicable tests listed in IEC standards.

2.3 FIELD TESTS

A. Field testing after erection shall be carried out as far as applicable in accordance with IEC standards.

B. The entire oil pressure system shall be tested under hydrostatic pressure of 150% of maximum governor oil pressure.

10.3 GENERATOR AND EXCITERS

3.1 GENERAL

A. During erection of generator and its auxiliaries, the contractor shall make tests on the generators to verify that the plant meets the requirements of the specifications, the guarantees and the standards. The testing shall be in accordance with the conditions of contract and the requirements of the IEC Standards.

B. Unless otherwise specified, the contractor shall make all tests in coordination with the Engineer. Employer ought to supply all labour materials, equipment, instruments, meters, gauge and all required equipment to make the tests. Contractor shall record the results of the tests and shall assume full responsibility for the operation and safety of the plant during all tests. The contractor shall prepare reports of all tests and these reports shall be incorporated into the Instruction Manuals.

C. The categories of field tests and the detailed list of tests to be made are specified herein:

a. Filed Stage Tests shall be made on parts of plant, sub-assemblies and auxiliary systems to demonstrate that the item has been properly erected and functions properly and is ready is ready for commissioning Tests.

b. Commissioning Tests shall be made on all parts and the completed generators and accessories to demonstrate that all equipment meets the requirements of

c. Final Acceptance Tests shall be made on a completed generator to determine that the maximum temperature rise of the parts of the generator will not be exceeded when rated load is generated.

10.4 COMMISSIONING TEST

4.1 GENERAL

The Contractor shall make all commissioning tests on the complete generators with their associated turbines. These tests shall be made prior to placing unit into commercial operation. The Contractor shall cooperate with the Engineer and others to permit all necessary tests to be performed. The commissioning tests shall include but not be limited to the following tests.

4.2 ROUTINE COMMISSIONING

Generator shall be subjected to the following routine tests:

1. 1000 V DC meager test for insulation resistance of the windings.
2. The armature shall be dielectric tested in accordance with IEC 34, one phase at a time with other windings grounded. The field winding shall be given a dielectric test in accordance with IEC 34.
3. Resistance test of armature and field windings.
4. Tests of excitation system equipment for operation, adjustability, sensitiveness and response.
5. The generator shall be subjected to load rejection tests in steps of loading up to and including maximum continuous output.

10.5 PROVISIONAL ACCEPTANCE TEST

After commissioning tests have been satisfactorily completed, the Engineer in cooperation with the contractor will conduct the tests scheduled below to determine whether all contractors' guarantees and requirements of these specifications have been fulfilled. The test shall be made in conjunction with the turbine tests, and except as otherwise specified herein, the tests shall be made in accordance with the applicable requirements of IEEE Test Producers for Synchronous Machines No. 155 and IEC, Standards. The tests will be scheduled for maximum rated output to be obtained.

11. Annexure D

11.0 CIVIL WORKS

A CONCRETE FLUME

The Employer shall perform the pressure test after the completion of the project at his cost. In case of leakage/seepage at joints, the Contractor shall repair the joints and retest at his cost.

B PENSTOCK – SPIRAL CASE JOINT

Design and description with set of drawings to be provided.

C ACCESSORIES

Standards accessories provided on each transformer shall include:

a. Lifting hooks

b. Jack bosses

c. A nameplate

d. Grounding pads

D TESTS

The Contractor to specify field tests to be performed on commissioning.

E PROTECTION

The Contractor shall provide standard protections which shall include gas pressure relay.

Tap change limit. (+/-) 2-1/2% (in 5 steps)

F OPERATION SUPERVISION AFTER FINAL ACCEPTANCE

The Contractor shall provide top supervision of representative of Principal (HNAC) for at least a period of three (03) months of initial commercial operation by the Owner.

7 Equipment testing, trial operation and commissioning

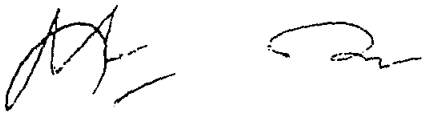
7.1 Equipment testing

Before the shipment, shop tests shall be carried out on each part before assembling at works. Field tests shall be carried out on different parts, during and after the installation of turbine, generator and their subsidiary equipment as described in Annex-C. Commission test shall be carried out before linking to system as per IEC standards or equivalent Chinese standards.

7.2 After the above tests completed, the unit shall be fed into grids for 72 hours operation.

7.3 The employer shall deliver completion certificate to the contractor after data such as drawings and manuals of unit operation, maintenance and overhaul are delivered and trail operation reach 72 hours run without break. From then on, the unit is formally taken over by the employer and put into commercial operation.

7.4 Please refer to all pertinent clauses mentioned in the Bid Docs Section 1 to 9



12. Basic Specifications, Data and Parameters for E&M Equipment

12.1 BASIC SPECIFICATIONS, DATA AND PARAMETERS

No.	Name	Type
	Generator	
1	Type	SF2500-24/3250
2	Rated power	2500kW
3	Max. Power	2750kW
4	Rated voltage	11 kV
5	Rated current	154.4A
6	Rater power factor	0.85 (lagging)
7	Rated frequency	50Hz
8	Rated speed	250 r/min
9	Runaway speed	467 r/min
10	Phase number	3
11	Stator connection	Y
12	Rated excitation voltage	190V
13	Rated excitation current	286 A
14	Excitation mode	Silicon-controlled static excitation
15	Rotation direction	clockwise in top view
16	Short circuit ratio	≥1.06
	Stator core	
17	Outside diameter of stator core	Da =Ø3250 mm
18	Inside diameter of stator core	Di =Ø2830 mm
19	Length of stator core	Lt = 350 mm
20	Air gap	δ = 8mm
	Resistance and reactance	
21	Resistance of stator winding at75℃	Rl(75) = 0.62Ω
22	Resistance of rotor winding at75℃	R2(75) = 0.58 Ω
23	Direct axis synchronous reactance	xd ≤106%
24	Direct axis transient reactance	xd' ≤28.6%
25	Direct axis super-transient reactance	xd'' ≥19.7%

No.	Name	Type
45	Maximum magnetic flux density of magnetic pole	1.28T
46	Outline dimension of rotor	φ2814 mm
47	Earthing capacity	0.045μF
48	Total weight of rotor with shaft	22.2 t
	Main shaft	
49	Material & grade	45# forging steel
50	Torque transmission method	Shrinkage fitting
	Bearing	
	Pilot bearing	
51	Material of thrust shoe	ZChSn11Cu6
52	Type	Cylinder bearing
	Mechanical braking device and high-pressure-oil jacking device	
53	Quantity of brake	4
54	Speed relative value when putting into mechanical braking	50~75 r/min
55	Working pressure of compressed air	0.5~0.6 Mpa
56	Air volume when braking	3L/S
57	Time from generator rated speed to stalling	≤1200S
	Insulation material	
58	Conductor insulation of stator winding	glass-mica tape
59	Joint insulation of stator winding	glass-mica tape
60	Insulation of excitation winding	glass tape
61	Noise at 1m away from generator casing	<85dB
62	Per-phase capacitance current of generator	0.053 μF

No.	Name	Type
	Reliability index of generator	
63	Availability	>99%
64	Continuous operating time without fault	>8000h
65	Interval time for overhaul	>5 years
66	Service life before retirement	>50 years
67	Total weight of generator	43

12.2 PERFORMANCE GUARANTEE OF HYDRAULIC GENERATOR & ITS AUXILIARIES

No.	Name	Type
1	Availability of generator and its auxiliaries	≥99%
2	Efficiency	≥95%
3	AC withstand voltage	25kV
4	Impact withstand voltage	33KV
5	Telephone harmonic factor (THF) online voltage	< 1.5%
6	Generator flywheel torque	60 $t.m^2$
7	Voltage wave-form distortion ratio	<5%
8	**Maximum temperature rise**	
9	Stator iron core	100K (embedded thermometer checking method)
10	Stator winding	100K (embedded thermometer checking method
11	Rotor winding	105K (resistance method
12	Maximum temperature of thrust bearing	55 ℃
13	Maximum temperature of guide bearing	65 ℃
14	Average sound pressure level above 1m away from generator upper cover plate	85 dB(A)
15	Maximum lifting weight of rotor with shaft is not excess (exclude lifting tool)	22 t

16	Lifting weight for whole stator	11

12.3 Operating Performance

Operating under the rated operating condition, the efficiency of the generator is not less than its design value. Insulation of the stator and the rotor of the generator is F Grade. For fire CO2 will used fire extinguisher (20 sets portable) with a capacity of 4~5 Kg each

12.4 The generator

The generator contains mechanical break and air driven reset mechanism with air pressure of 0.5~0.6 MPa . Status of the system will be displayed through indication window.

The generator can operate for 2 minutes under the run away speed and no harmful deformation will occur.

When cooling air temperature is under 35 ℃ and generator is operating at its rated power. the temperature of generator stator winding is not more than 140℃ and the temperature of rotor is not more than 150℃ (measured by resistance method).

The generator contains hydraulic rotor jacking system in order to establish oil film within stationary and rotating parts of the thrust bearing in case of startup after a shutdown of more than 24 hours. The system will be reset through electric motor (16MPa oil system, potable) or as enumerated by the manufacturer.

12.5 Generator Structure

The generator consists of stator, rotor, upper bracket, lower bracket, collector, brush holder, oil water system, temperature indication system braking system and jacking system etc.

12.5.1 Stator

Stator consists of frame, stator core and windings. Stator core is laminated with high-grade cold-rolled non-direction siliconized steel sheet.

The punched sheets of stator should be pained insulating varnish after removed burr in order to decrease eddy current loss. Stator winding shall be of laminated winding with class F

clockwise U V and W from overlook.

12.5.2 Excitation System

Technical Data of Excitation Device

No.	Name	Type
1	Type	PWL—4C
2	Excitation Mode	Controllable silicon static excitation
3	Rated Excitation Voltage	190V
4	Rated Excitation Current	286A
5	No-Load Excitation Voltage	62v
6	No-Load Excitation Current	136A
7	Start Excitation Source	DC220V
8	Automatic Voltage Adjusting Range of No-Load Generator	10%~130%
9	Manual Voltage Adjusting Range of No-Load Generator	10%~130%
10	Voltage Adjusting Precision	<0.5%
11	Excitation Transformer Type	Dry Type
12	Operating Power	180kVA

Excitation Device functions

- Maximum excitation restriction;
- Low excitation restriction;
- Over Voltage Protection;
- Strong excitation accumulating time restriction.
- The whole excitation system is put into a control board.

12.6 Governor

Technical Data

No.	Name	Type
1	Type	YWT-3000-16MPa
2	Pressure Oil Tank Volume	100L
3	Working Pressure	16MPa
4	Frequency Measurement	5~75Hz
5	power	AC220V and. DC 220V
6	Oil pump	2 units (AC380V)

Functions and Features: :

A. Auto/Manual: Start, stop, operation, frequency control, increase or decrease load and emergency shutdown.

B. Auto and manual functions can be implemented locally or remotely.

C. Start and shutdown of unit according to the setting program.

D. Parallel PID regulating mode. .

E. Increase or decrease load rapidly and accurately. .

F. Mechanical open limit mechanism.

12.7 MV Switch Board and PT CT

A. The switchboard including the operating devices and the auxiliary equipment. 11kV switch board adopted as per plant design. Metal close MV switchboard.

B. Vacuum circuit breaker for medium voltage level with 220 DC operating voltage.

C. The connection from generator to MV switch board is XLPE insulated copper cable.

D. Voltage Transformer: Single Phase Type, Voltage of secondary winding is 100V.

E. Current Transformer: Single Phase Double Winding Type, Current of secondary winding is 5A.

6.8 11kV RATINGS

Circuit breakers shall have the following ratings:

No.	Name	Type
1	Nominal voltage,	11 kV

2	Rated Maximum	17.5 kV
3	Frequency	50 Hz
4	Continuous current amperes	630A/1600A
5	Interrupting capability : (to be provided later on)	
6	a. Rated short circuit current	20 kA/25kA
7	b. Rated peak withstand current	50 kA/50 kA
8	Power frequency withstand voltage (1min)	42 kV/42 kV
9	Impulse withstand, full wave	60 kV/60 kV

Above information for 11 kV circuit breakers will be supplied.

12.9 0.4kV RATINGS 0.4kV

No.	Name 名称	Type型号
1	Rated insulation voltage	1000V
2	Rated working voltage	400V/50Hz
3	Protection degree	IP4X

12.10 Lightning Protection and Grounding

A. Direct Lightning Strike Protection Measure

Lightning strip is mounted on the main and subsidiary power house and connected with grounding grids to strengthen the dispersing function of the lightning strip. The lightning rod and lightning arrestor are also equipped to protect the outlet equipment.

B. Lightning in break wave protection measure

Zinc oxide lightning arrestor is equipped at the high voltage Line.

C. Grounding

The neutral grounding bodies are fully utilized and all metal structures shall be connected with the main grounding body. An artificial grounding grid, which mainly depends on the ground, is constructed in the power house to reduce risks of potential difference.

12.11 Service Electricity System

A . Power Supply

Service electric power mainly supply electricity to equipment such as service machine, illumination and DC system. A dry type transformer is connected to the system. Exact specifications of the service transformer is two units , 200KVA, 11KV/0.4V, dry-type.

B. Electric Motors

The contractor shall determine the number and capacity of motors for different duties to meet the requirement of main and auxiliary equipment. Electric motors shall conform to requirement of applicable Chinese standard for motors and generators and shall be suitable for continuous operation at 230V single phase and 400V three phase plus or minus 10 %, 50 Hz, insulation shall be class-B.

C. DC System

(1). The battery shall bear the power supply. In the event that voltage of battery is below the setting value, a signal will be sent to the control system.

(2). The DC power supply system will be specified by the contractor. It will consist of rectifiers, insulation monitor, voltage monitor, indication, control and protection system.

(3). The DC power supply system adopted PZL-02 type with battery and rectifiers, and insulation monitor and voltage monitor equipment are furnished as well. In the equipment, the storage battery is Lead acid battery with the rated capacity of 200AH (maintenance free for 7 years)

12.12 Illumination system

A. Normal lighting .

The lamps consist of fluorescent lamp, ceiling lamp, incandescent lamp, powered by L.V. control board, and the control board is also furnished.

If service power is completely interrupted, power of main spots will be supplied

temporarily by storage batteries.

12.13 Diesel generator

Protection provided to avoid simultaneously operation of diesel generator with auxiliary power supply.

12.14 Relay protection and measuring meters

12.14.1 General

A. Most of equipment shall be pre-assembled in the factory. Sensitive Instruments can be shipped separately and mounted later.

B. All components where applicable are to be tropicallize.

C. No failure should be produced by influence of the local climate, even when the air conditioning system of the power house is out of service.

D. The number of different type of relay shall be as per requirements and shall be adjusted to a uniform specification. Each relay adjustment shall be clearly specified in the maintenance manual.

E. Adjustments which are unspecified are not permitted. Armature residual studs Rather than screws shall be used wherever possible.

F. Contact materials shall, without doubt, be suitable for the function they are required to perform.

G. All relay shall be clearly marked with their schematic designation, together with labels giving their code, resistance etc.

H. Relay must be protected from dust either by individual covers or covers protecting a group of relay e.g. relay sub rack.

12.14.2 Relay protection

Protection for the generator

Necessary protection will be provided as per Chinese standard

Protection for 11kV transmission line

Because 11kV outgoing line is short, if unit weight of power resource at other terminal is

rather heavy, common current and voltage protection is hard to meet the demand of sensitivity and flexibility. Method of Voltage-Current Snap Relay and Voltage-Current Definite Relay are considered to adopt at the stage. If above protection could not meet the demand, line longitudinal differential protection should be adopted.

Remarks: For purpose of further design, relevant data of system shall be provided correctly by employer, such as: Short line from the station to the other terminal, and its length and erection mode, adjustment parameter of the protection at the other terminal, system requirement on the relay protection by grid.

The fuse protection shall be used for the service transformer and excitation transformer.

12.14.3 Measuring meter

1) Generator

one (1) synchronizer

one (1) voltmeter with switch,

two (2) voltmeter without switch,

one (1) ammeter,

one (1) active wattmeter,

one (1) reactive wattmeter,

one (1) active kWh meter,

one (1) excitation meter,

one (1) excitation voltmeter,

two (2) frequency meters.

Note) One meter will cater for all above parameters

2) Transmission line:

three (3) ammeters,

one (1) active wattmeter,

one (1) active energy meter,

one (1) reactive energy meter

Note) One meter will cater for above parameters and two(2) active kWh meter,

3) 11kV bus 11kV

one (1) frequency meter,

one (1) voltmeter with switch,

one (1) voltmeter with button switch (to inspect grounding of 11kV single panel).

4) 0.4/0.23 kV bus of service electricity supply

one (1) voltmeter with switch, three (3) ammeters,

12.14.4 Power cable and control cable

Power cable: all the electrical cable is XLPE insulated copper cable. MV cable

LV cable is four cores copper power cable.

Control cable is KVV PVC insulated copper cable.

12.14.5 Station Water Services System

Because the temperature of the water discharged from the nuclear power because station is 40° C, not suit for generator. So need to look for another water source for cooling water of generator through borehole of 90 meter depth, two boreholes for each project.

12.14.6 Oil System Equipment

Cycle and cooling equipment and governor pressure oil system equipment needed by the unit lubricating system shall be supplied. One pressure oil filter installed in the station.

12.14.7 Compressed Air System

Two air compressors and one $2m^3$ middle pressure air pot shall be supplied. Pressure of low pressure air is 0.7MPa, and in order to improve the operation reliability of the system or as given by the designer/Chinese Principal.

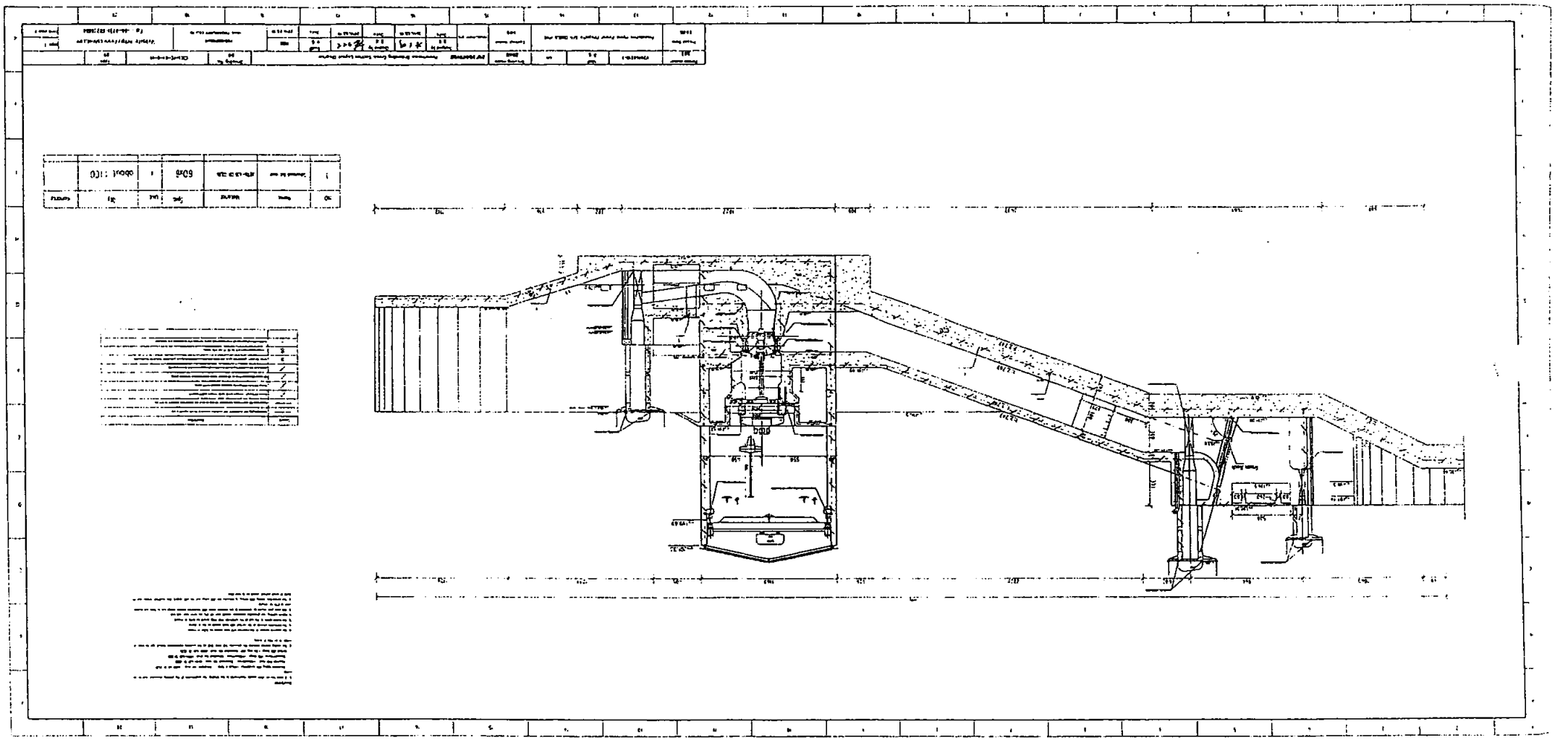
12.14.8 Miscellaneous

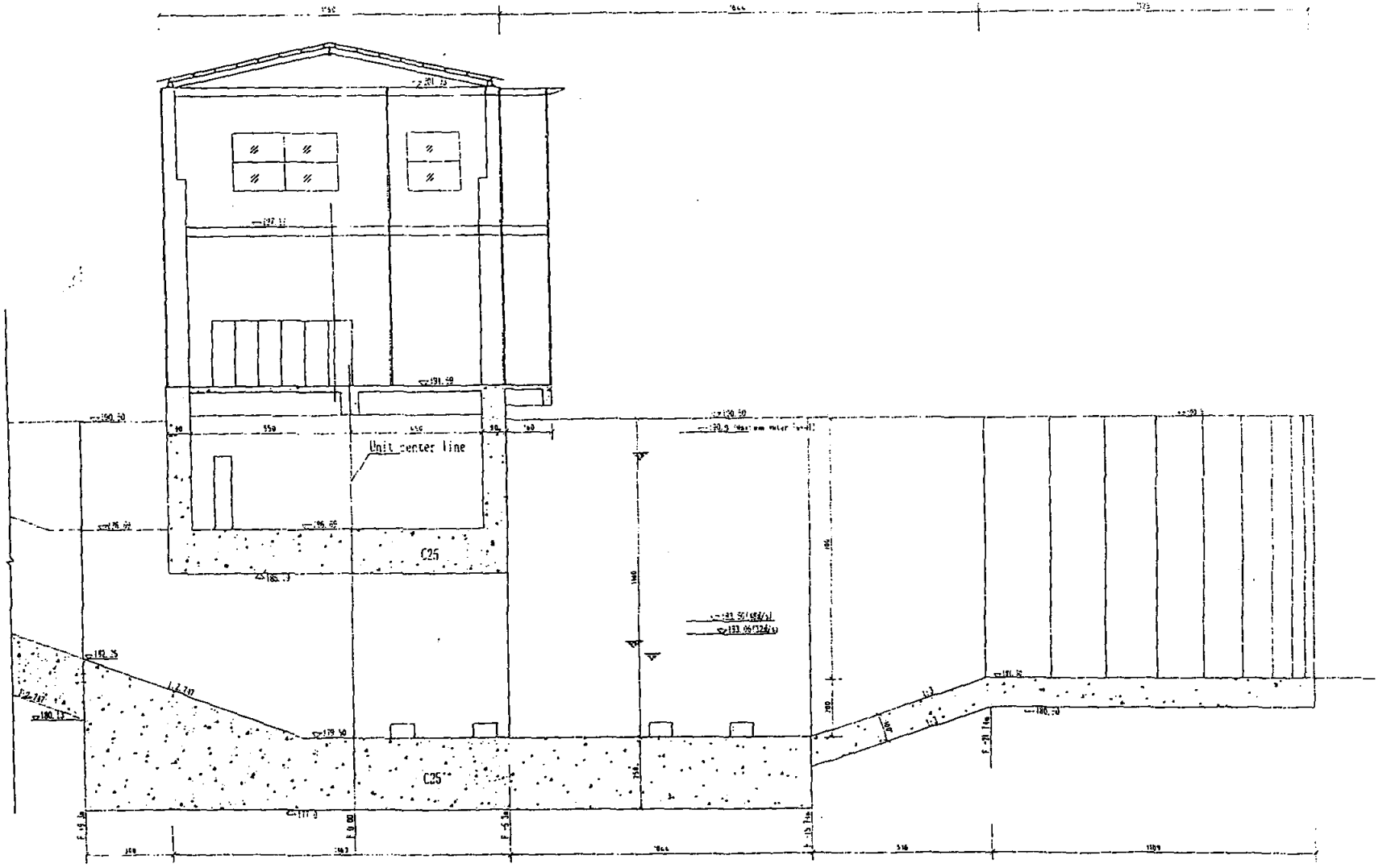
The Contractor shall design dewatering and drainage systems and provide related

equipment.

The Contractor shall provide 10 fixed wall fire extinguishers and 20 for generator area.

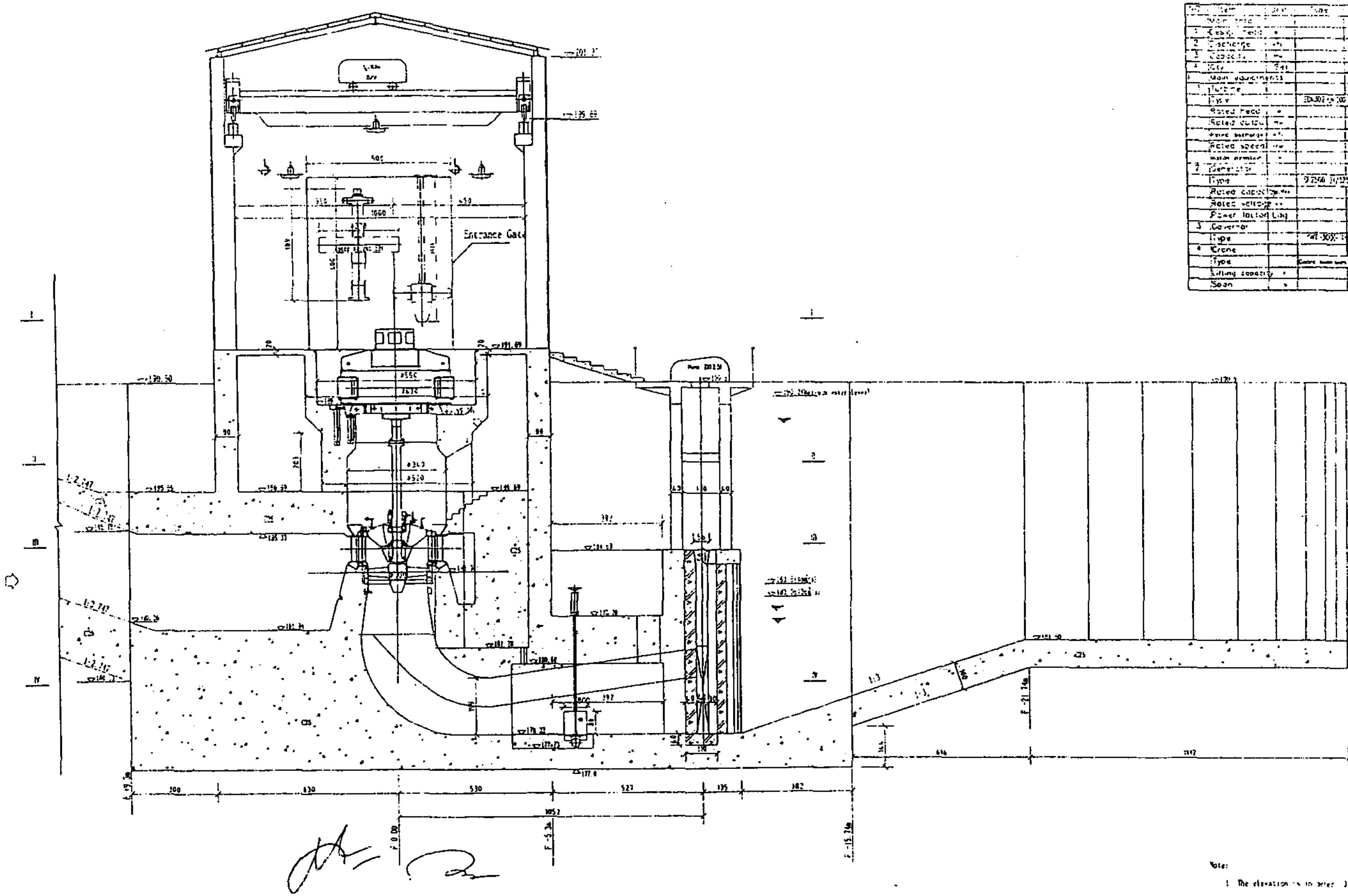
Air conditioners will be provided for the central control room and offices.





Note:

1. The elevation is in meter. Dimension is in centimeter.
2. This engineering scheme design is under the foundation design for the foundation design will be designed in the next.
3. Cutting position refers to C0C4—TC—20—01.



Main electromechanical equip. & parameters

Item	Unit	Type	
Main data			
1 Design head			
2 Discharge			
3 Capacity			
4 Qty			
Main equipments			
1 Turbine			
Type			
Rated head			
Rated output			
Rated discharge			
Rated speed			
2 Generator			
Type			
Rated capacity			
Rated voltage			
Power factor	Lag		
3 Governor			
Type			
4 Crane			
Type			
Lifting capacity			
Span			

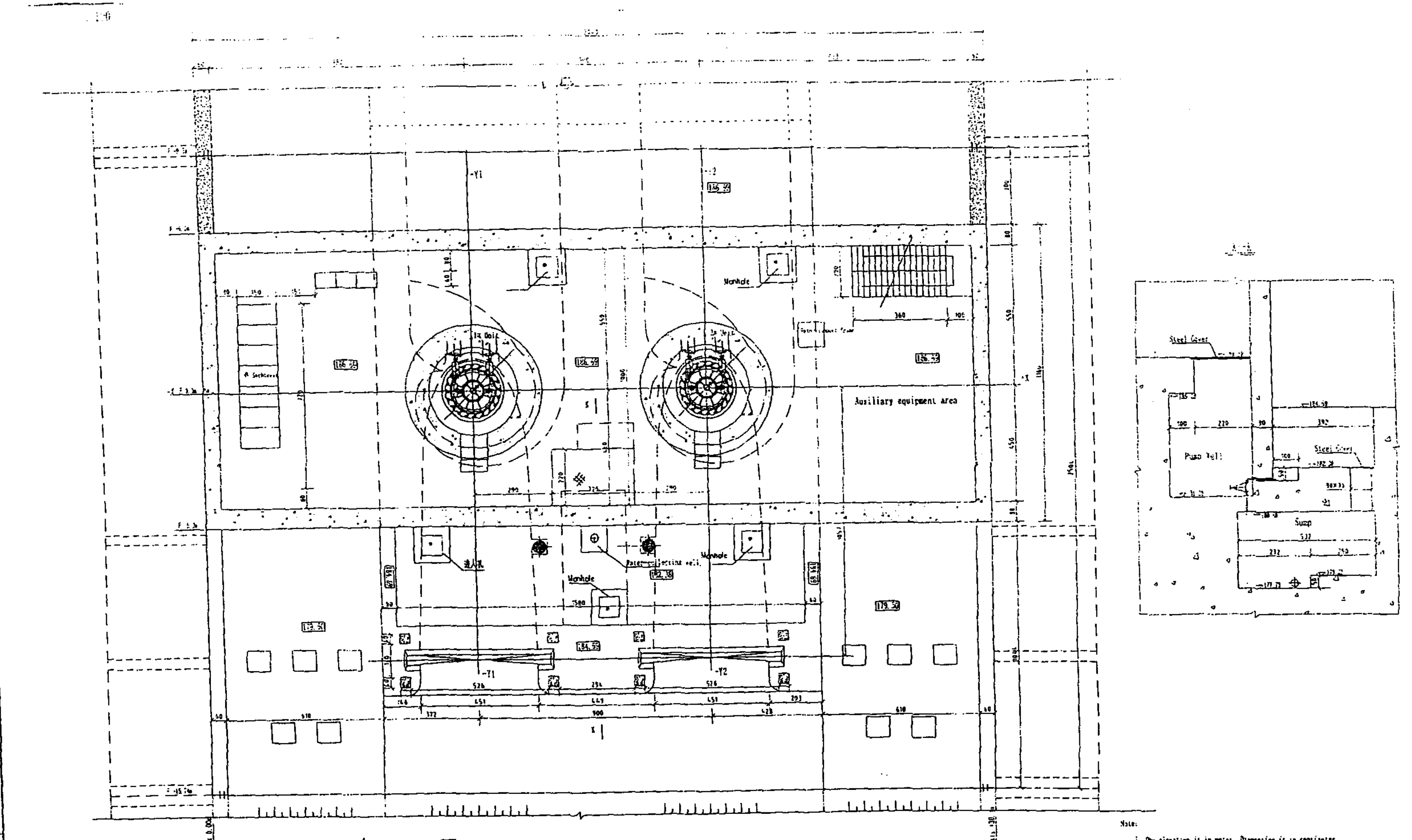
Note:

1. The elevation is in meter. Dimension is in centimeter;
2. This engineering scheme doesn't discuss the foundation design. For the foundation design will be designed by the owner.
3. Cutting position refers to CDCH-TC-PH-04.

Version number	V20160602-1	Unit		Drawing name	Power house diagram(2/1) B-B unit cross-section)	Drawing No.	CDCH-TC-PH-02	Type	
Project name	Foundation Hydel Power Projects (2×2.5 MW)	Contract number		Designed by	Date 2016.06.02	Checked by	Date 2016.06.02	Audit	Date

Website: http://www.csnnet.com

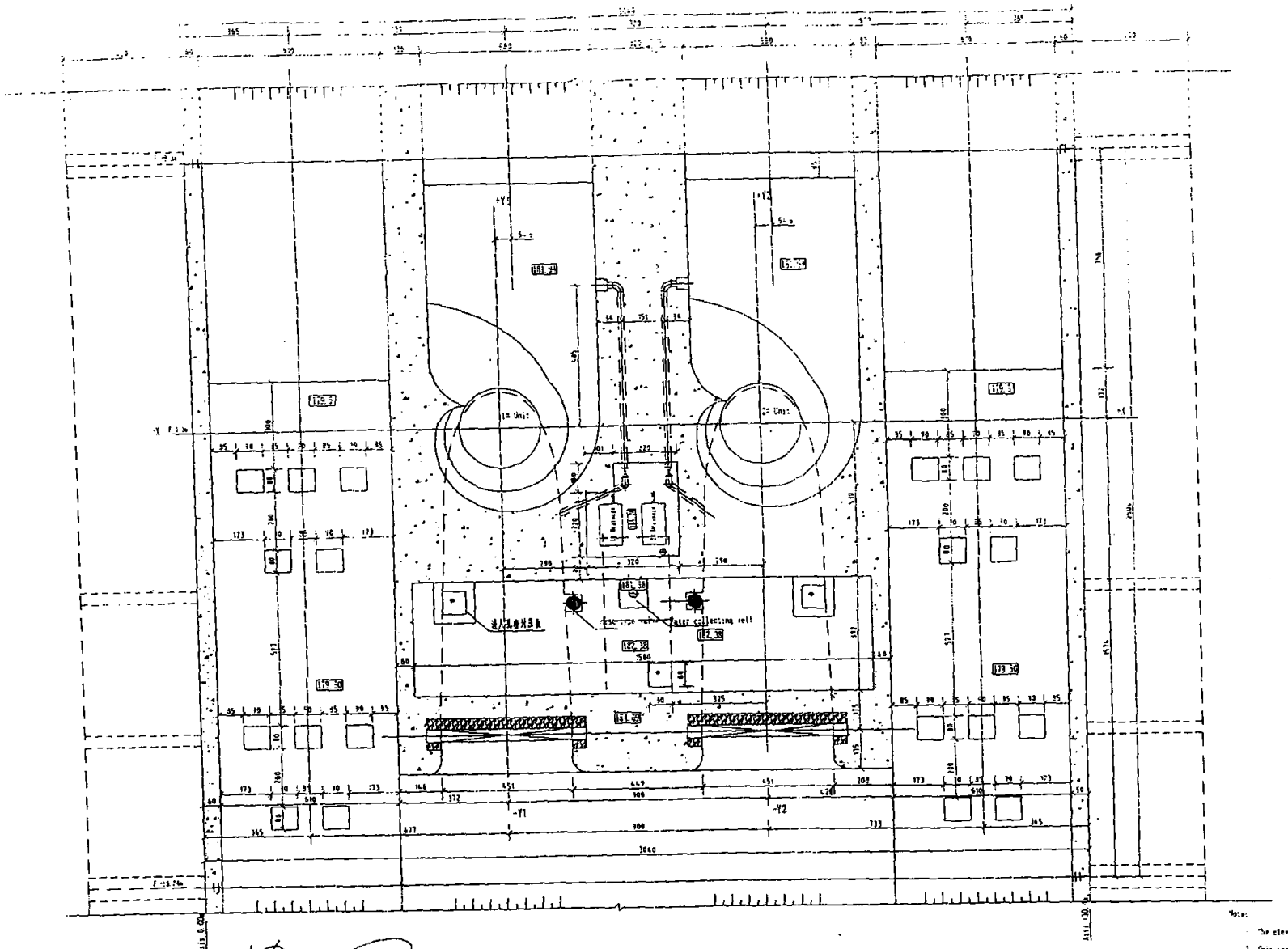
Tel: +86-0731-88738888



Note:

1. The elevation is in meter, Dimension is in centimeter
2. This engineering scheme doesn't study the foundation design for the foundation design will be designed by the owner
3. Cutting position refers to C3C4—TC—PH—02

Version number	V20160402-1	Unit		Drawing name	Power house, [illegible] turbine floor [illegible] arrangement	Drawing No.	C3C4-TC-PH-05
Project Name	Foundation Hydel Power Projects 3/4 (2x2.5 MW)	Contract Number		Designed by / Date	Checked by / Date	Audit / Date	Website: http://www.cshnec.com Tel: [illegible]



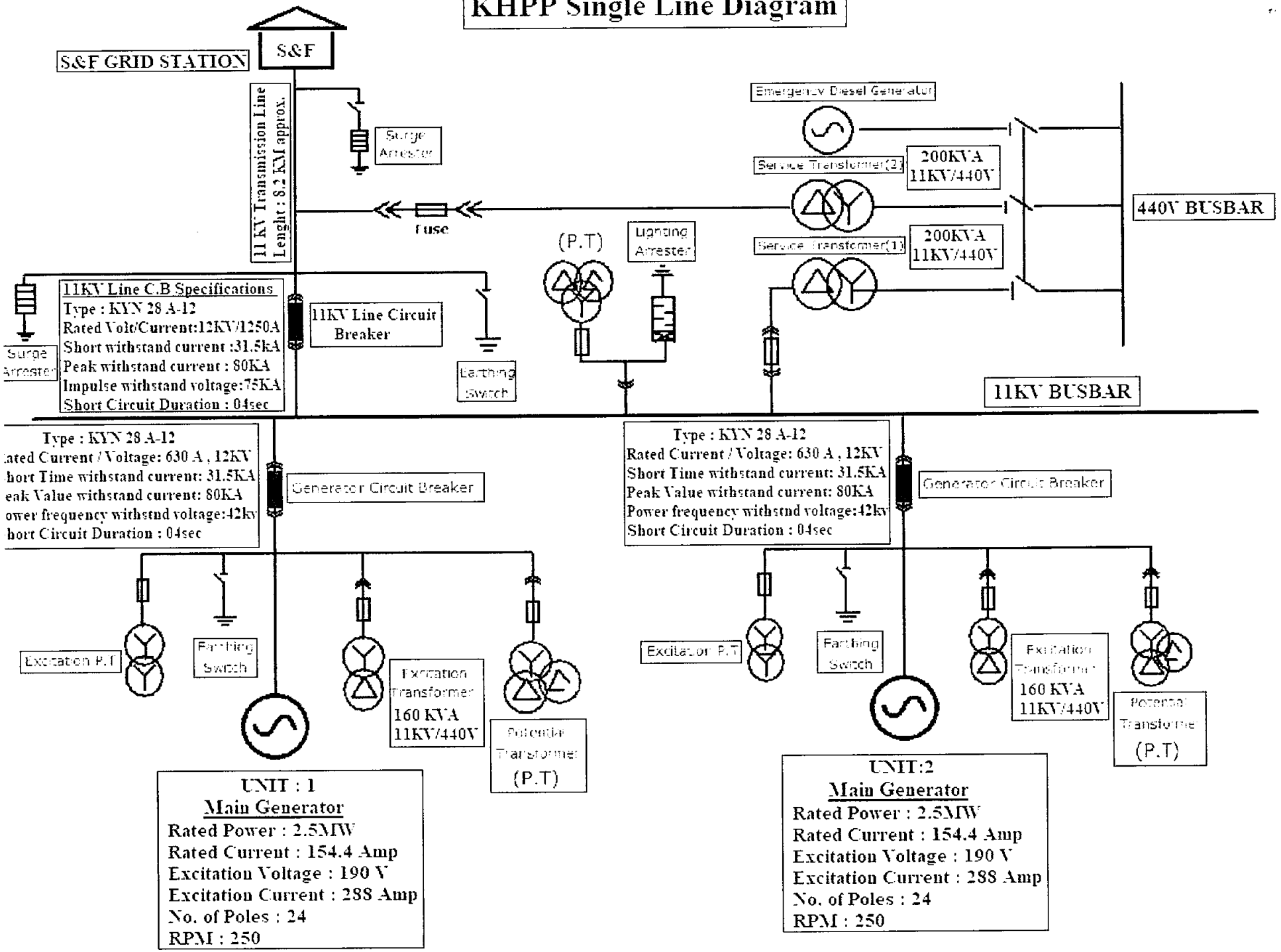
Note:

1. The elevation is in meter, Dimension is in centimeter.
2. This engineering scheme doesn't study the foundation design for the foundation design will be designed by ...power
3. Coiling position refers to ...

Project number	V2014-3402-1	Unit	CM	Drawing name						Drawing No.	Type
Project Name	Foundation Model Power Projects 3/4 (2x75 MW)			Contract number	Designed by	Checked by	Audit	Approved by			
					Date	Date	Date	Date			

Website: http://www.cshec.com
Tel: +86-0731-88230866

KHPP Single Line Diagram



FINANCIAL FEASIBILITY ANALYSIS

PROJECT: KUNDIAN HYDEL POWER PLANT CHASHMA MIANWALI (5MW)

BY

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Contents

1. INTRODUCTION

The objective of this feasibility analysis is to walk around the Plant design, Procurement and construction including civil works of 5 MW Kundian Hydel Power Projects Chashma, Mianwali, Punjab. KUNDIAN HYDEL POWER (PRIVATE) LIMITED, (the "Company"), was incorporated on August 31, 2020 as a private limited Company under the Companies Act 2017, and subsequently work commenced on the project.

The financial viability of the hydropower plant is examined using the integrated appraisal structure (integrated approach uses IRR & NPV appraisal techniques) which analyzes the project and its desirability in different perspective. The project magnetism will be examined from the investor's point of view and bankers' judgment while evaluating the cost of power and energy generated.

Following is analyzed in this chapter:

1. What sources of financing will be used to cover the project's costs?
2. What are the features of this kind of financing?
3. Is there any sufficient working capital in the project?
4. What is the contribution of the project to the investors?
5. What are the risks of the project and how can we mitigate it in order to guarantee the viability and sustainability of the project?
6. Is the project financially viable in terms of enough net cash flows?

2. METHODOLOGY

It is assumed that one EPC Contractor would execute the entire Civil, E&M and Structural Steel works. Single source EPC Contract has many advantages over split scope contracts. The EPC Contractor may, however, engage sub-contractors for specialized jobs that include supply of materials, powerhouse electrification, Transmission Line/Interconnection etc.

The site works shall be executed in accordance with the construction management plan. The construction activities include care and handling of water, bulk excavation and disposal, concrete mixing and placing and structural steel works. For preparation of quality concrete, batching plant shall be used.

Working conditions at the project site are expected to be excellent. Care and handling of water in the excavated area may be a construction hazard for which extra resources would be needed.

3. CONSTRUCTION MEANS

For all works, conventional construction methods shall be applied. Surface excavations require conventional earth moving equipment only. The construction work shall start with the excavation of temporary diversion channel on the left side of the canal. The majority of the work force shall be local, with site laborers and semiskilled labor available from the project area and skilled labor also coming from the region as well as from other parts of the Country. Foreign experts shall be hired for special tasks, especially that associated with installation and testing of major equipment (if necessary).

4. PROJECT COST

The project cost estimate involves preliminary works, complete civil and electromechanical works, installation, testing and commissioning charges of mechanical items, cost of procuring services of engineering & project management consultant and acquisition of land.

A. This work comprises a general description of the specific item of the hydel power plant civil works for all concrete structures element such as.

1. Construction of penstock
2. Construction of intake structure with hoist
3. Construction of spillway with hoist
4. Powerhouse (elbow concrete draft tube, spiral case, wicket gate, concrete around stay ring case, generation pier, surrounding walls, Turbine bed, Power house roof)
5. Construction of tailrace structure with hoist

B. All structure works shall be executed as indicated on the drawings and in conformity with the lines, grade and dimension as specified. The material, equipment, workmanship and construction methods would conform to the best engineering practices and after obtaining due approval of the Engineer.

C. For elevated structure such as hoist of intake and tailrace special care and attention shall be given to the elevation and alignment indicate in the project drawings.

5. MAIN BILL OF QUANTITIES (BOQ'S)

The BOQs of civil works as presented in have been worked out from the proposed project layout plan and quantities furnished after preliminary design of the components of the power plant. All the items are quantified on the basis of early engineering carried out at this stage and are expected to be changed during execution phase. Similarly, the prices of electromechanical works are furnished on the basis of preliminary design.

Civil Works

1. General layout of the site
2. General arrangement of the power house
3. Modification work drawings
4. Longitudinal & section drawing of the power house, auxiliary powerhouse and intake structure at each level showing reinforcement.
5. Earth work and approach means i.e. stair case, handrails and metal works(access road to power house is not included)
6. Diversion of water during construction.
7. Architectural work ,(office kitchen, details of roof ,floor ,windows, doors and finish)
8. Layout of water supply & sewage layout
9. Layout of main pipe for water, oil and air.
10. Pipe arrangement in power house ,generator pit, turbine pit for drainage.
11. Arrangement of embedded pipe & parts
12. Cooling water arrangement

Mechanical drawings

1. Layout of gates, hoisting system.
2. Arrangement of low and high pressure compressed air line.
3. Hydraulic measurement schematic showing location of instruments.
4. Arrangement of track rack, draft tube.
5. General arrangement of E & M equipment.
6. Governor oil bearing & lubrication drawing.

Electrical drawings

1. Single line drawings of power house.
2. Arrangement of grounding & lightening protection.
3. Arrangement of 6.3 kV & 11kV switchboards.
4. Arrangement of 6.3kV & 11kV relay protection , control equipment and measuring instrument.
5. Single line diagram of LV powerhouse.
6. Single line diagram of DC supply system.
7. Arrangement of lightening system including emergency system.

Note: The drawings submitted will include the information specified above and may not have the same numbers and title of the drawings.

The contractor shall submit the documents, drawing and other information before the unit put into the trail operation which shall include but not be limited to the following :

Drawing and descriptions:

1. Schematic layout, protection and control single drawings.
2. Drawings and description of assembling of the turbine, gates, cranes, generator, thrust and guide bearing ,transformers, switchboards, cooling and lubricating system.

Documents brochures and literature:

1. Descriptive literature and brochures on turbines, gates ,crane , generator exciters, transformers, switchboards etc.
2. Descriptive literature on governor and speed governing system.
3. Descriptive literature on the type of excitation system as proposed.
4. Descriptive literature on the unit control and protection system.

The contactor shall submit O and M manual three months before the completion of work.

6. CAPITAL EXPENDITURE BREAKUP

Schedule 1

Sr. No	Description	Origin	QTY	Unit Price	Total (PKR)
1.1	Kaplan Turbines including Inlet Wicket Gates, Governor, Mechanical embedded portions of Spiral case, Draft Tube etc.	China	2e	222,880	445,760
1.2	Overhead Travelling Cranes in Machine Hall and Work shop.	China	1	89,579	89,579
1.3	Auxiliary Mechanical System including Facilities for Compressed Air System, Hydraulic System, Dewatering System, Oil Handing Equipment, Fire Fighting System, Potable, Cooling and Service Water System	China	1	100,028	100,028
1.4	Generator Preferably with 11 kV Generation Including Excitation System Voltage Regulation System, Control and Protection System	China	2	413,189	826,377
1.5	Generator Step-up Transformers (incase of 6.3 kV generation) and Auxiliary System Protection	China			
1.6	200 kVA X 2, 11/.4 kV Station Auxiliary Transformers and other step down transformers	China	Sets	30,125	30,125

1.7	Unit Control System (UCS), Supervisory Control and Data Acquisition (SCADA)	China	Sets	151,137	151,137
1.8	Metering Panel With MHW and MVARH meter, CT's and PT's including Backup Metering Panel	China	Sets	4,016	4,016
1.9	100 kVA Emergency Diesel Generator amd Auto Transfer Switch	China	1	48,069	48,069
1.10	Fire Alarm and Fire Detection and Alarm System	China	1	21,995	21,995
1.11	Cable Medium Voltage 11kV and Low Voltage	China	Sets	107,605	107,605
1.12	Low Voltage AC System including Electrification Light, Wiring and panel boards etc.	China	Sets	30,641	30,641
1.13	Low Voltage DC system including Batteries, charger, wiring and panel board	China	Sets	25,710	25,710
1.14	Earthling and Lightening Protection	China	Sets	10,624	10,624
1.15	Project Instrumentation(Preferably 24v DC)	China	Sets	1,408	1,408
1.16	Mandatory Spare Parts (5 Years)	China	Sets	26,360	26,360
1.17	Gates including Trash Racks with motors and Hoist Mechanism	China	Sets	290,601	290,601
	TOTAL Schedule No. 1				**2,210,035**

Schedule 2

Sr. No	**Description**	Origin	QTY	Unit Price	Total (PKR)
1.11	Fire Alarm and communication Equipment including Fire Detection and Alarm System, Telephone Exchange, with Internal and External Telephone Lines	Pak	Sets	3,046	3,046
1.13	Low Voltage AC System including Electrification Light, Wiring and panel boards etc.	Pak	Sets	21,946	21,946
1.15	Earthing and Lightening Protection	Pak	Sets	16,454	16,454
1.17	Mandatory Spare Parts	Pak	Sets	44,640	44,640
	Total Schedule No. 2				**86,086**
	After 13% Rebate on Schedule 2				**74,895**

Schedule 3

Sr. No	**Description**	Origin	QTY	Unit Price	Total (PKR)
3.1	Detailed Engineering, design services and production of drawings of Civil works	Pak/China		137,786	5,385,766
3.2	Design and Erection Sequence and Production of Drawings for E&M Works	China		137,786	
	Total Schedule No. 3 in Pak Rs and US$				**5,385,766**

SPILL WAY STRUCTURE

This structure shall be constructed as intake structure providing of supporting wall, grooves and slab to the true line, grade and dimension as per drawings. After fixing of slots in the groove when concrete attains enough strength the gate shall be lowered in the groove stat. Construction of hoist shall be carried out as indicated in the drawing and same procedure shall be followed as intake hoist.

INTAKE STRUCTURE

This structure comprises for the supply of water to power plant directly from canal. It controls and functions as top log protects the waste material from entering in the power house through trash rack gate and the main gate function for the supply of water. When plant maintenance is required then the gate shall be closed to stop water entering penstock.

- For the construction of intake structure outer walls and bed shall be provided by the Employer.

POWER HOUSE CONSTRUCTION

It comprises construction of diffusion draft tube, spiral case, wicket gates, concrete around stay ring case ,generator pier, walls, turbine floor and power house roof.

Water from penstock with gravitational force enters in the spiral case through wicket gate where water runs the turbine connected with generator to produce electricity.

The sequence of construction of civil works for power house shall be as under:

1. Bed preparation
2. Construction of draft cone tube
3. Spiral case embedded parts and concrete
4. Wicket gate
5. Turbine Floor
6. Concrete around stay ring case
7. Construction of outer walls
8. Generator pier
9. Power house roof

The staff of electrical/mechanical and civil works together as a team fully cooperating with each other.

Schedule 4

Sr. No	Description	Origin	QTY	Unit Price	Total (PKR)
4.1.1	Water Task 2 Nos for cooling water system (340 cu meter each) with refiling arrangements through appropriate capacity 4 Nos deep well turbine pumps including developments of Bore complete in all respect		2 Sets	16,689,400	33,378,800
4.1.2	Intake Structure		2 Sets	36,314,997	72,629,994

ENVIRONMENTAL IMPACT ASSESSMENT REPORT OF KUNDIAN HYDEL POWER PLANT

Table of Contents

LIST OF ABBREVIATIONS	
KHPP	Kundian Hydel Power Plant
PAEC	Pakistan Atomic Energy Commission
CHASNUPP	Chashma Nuclear Power Plant
CNPGS	Chashma Nuclear Power Generating Station
SSE	Safe Shutdown Earthquake
IAEA	International Atomic Energy Agency
EMP	Environmental Management Plan
EPD	Environmental Protection Department
BOD	Biological Oxygen Demand
COD	chemical oxygen demand
(TSS)	total suspended solids

1. SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

1.1. PROXIMITY TO AN EXISTING KUNDIAN HYDEL POWER PLANT (KHPP)

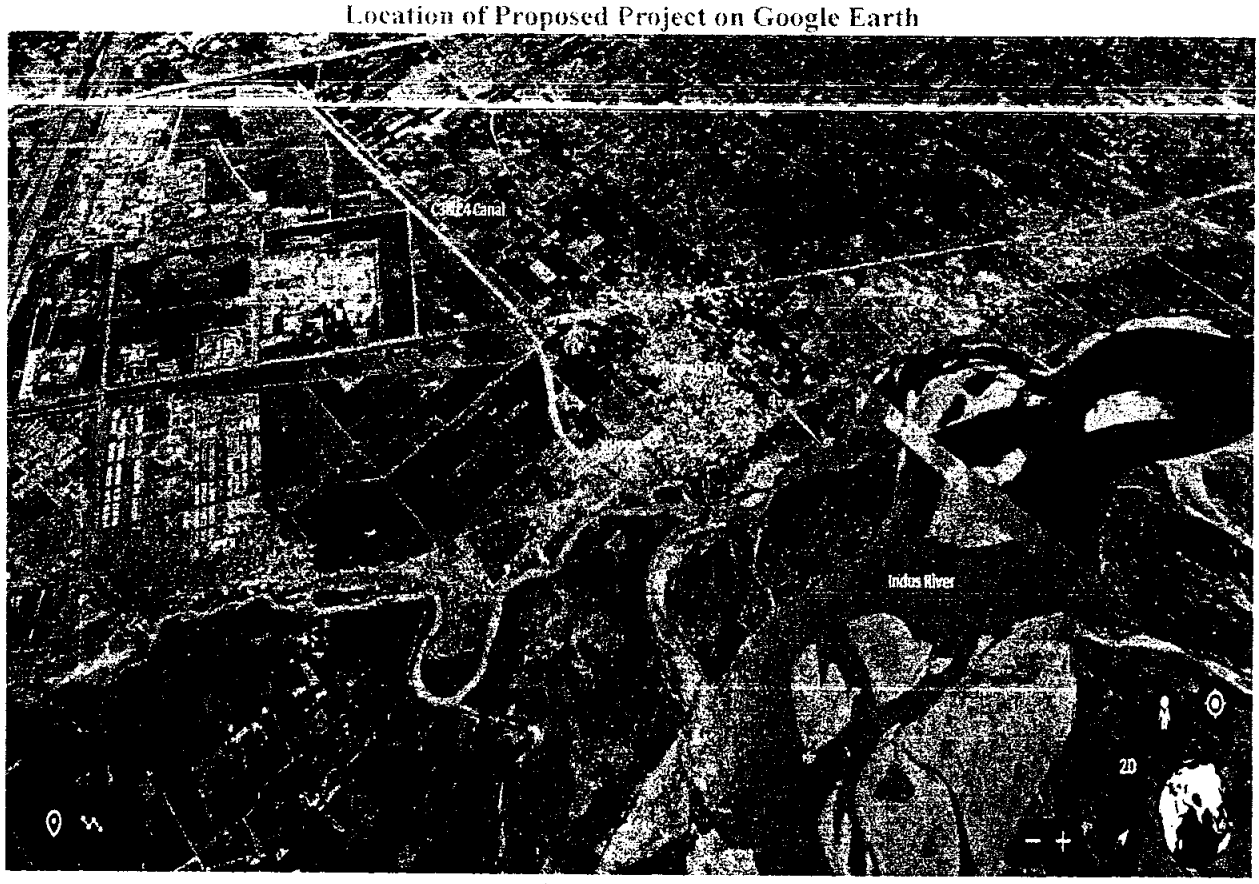
Kundian Hydel Power plant (KHPP) is located on C3 & C4 canal used and purpose built by Chashma Nuclear Power Plants (Chashma NPPs) for cooling of Nuclear Reactors. The cooling water canal is diverted from CJ Link Canal, North of the plant through the intake tunnel. The tunnel will be L shaped, underground structure, trending in north-south direction. The outfall for the discharge of cooling water shall be in south-west direction, it shall be an open channel from Plant to KHPP and then River Indus.

The site is located on the northwest side of the Thal Doab and is bordered on three sides by mountain ranges, the Salt Range to the northeast, the Surghar Range to the north, and the Khisor and Marwat Ranges to the west. The area south of these ranges is the Punjab Plain, the physiographic province in which the site is located.

The analysis of seismic activities shows that most earthquakes occur in Baluchistan arc, Hindu Kush region and Himalayan thrust fault belt mainly related to deformation, and seismic activities that are relatively less related to stable part of Indian subcontinent occur in Punjab Plain, and the location nearby the plant site is a relatively stable area.

Detailed seismic studies have been carried out to evaluate the Safe Shutdown Earthquake (SSE). These studies extend up to 300 km and are based latest IAEA guidelines SSG-9. Regional seism tectonic model in a radial extend of 300 km was developed that comprises of 48 fault sources that were identified by current tectonic conditions and 23 zones of diffused seismicity which were defined as a zone with homogenous seismic and tectonic features. Based upon the seism genic structures/zones/provinces and site geotechnical studies, appropriate weightage to attenuation relationships results in PGA value of 0.26 g caused by the critical source. The value of SSE is conservatively recommended as 0.30 g in the design of safety related buildings.

Location of Proposed Project on Google Earth



Location of Proposed Project on Google Earth

1.2. PROXIMITY TO WELL ESTABLISHED RAIL AND ROAD NETWORK

The KHPP site is linked with other Chashma Sites and as well as to other parts of the country by rail and road network. A railway track passes near the site parallel to the River Indus approximately 1.5 km west of the KHPP. MM road connects the Chashma site which is approximately 10 km from the site.

1.3. NEARBY POPULATION AREA OF KHPP

KHPP energy source is C3 & C4 water canal. Plant uses this source to produce energy. Energy Source is safe and has no harmful effects on nearby population. Alluwali city is located in North side of KHPP on half Km distance. Alluwali is Union Council of Tehsil Piplan, District Mianwali. KHPP is more beneficial for nearby population. Plant uses this water and discharge to Indus River. There is no need to take the protective measures for nearby population.

2. TOPOGRAPHY

2.1. TOPOGRAPHY AND CONTOURING SURVEY

The purpose of the topographic and contouring survey was to determine all the existing structures and salient features, such as hills, nallahs, huts, roads, bridges/culverts, poles and elevations of site area. This was required for installation of proposed Hydel Power Plant.

KEY FINDINGS

Proposed site is located in areas controlled by the PAEC, and the terrain is relatively flat, with the natural terrain average elevation of about 200 m.

2.2. MITIGATION MEASURES

The project design will address aesthetic concerns on visual changes to the landscape, and sensitivity of structures will be protected by established procedures for land stabilization.

2.2.1. LANDSCAPE AND TERRESTRIAL ECOSYSTEM

Buildings and Structures of Hydel Power Plant dominate the landscape of the area. Construction of Hydel Power Plant will add to the characteristic view of the Chashma site. The addition of a number of buildings and structures to the existing set-up would introduce definite signs of prosperity in the area. Landscaping of the surrounding of the new power plant by plantation will be addition to the environmental enhancement efforts.

The land outside the plant boundary is rich with shrubs, trees and plants, which would be the common feeding ground for many terrestrial animals like goats, cows, cats, dogs, birds and small reptiles etc. which are found in abundance in the area.

Due to construction activities at site the movement of these animals may be restricted and they will migrate to the surrounding area due to the disturbance created by construction activities.

MITIGATION MEASURES

- Unnecessary clearing of land will be avoided to minimize disturbance in the ecosystem.
- The project will not directly or indirectly affect ecosystems.

2.2.2.LAND EROSION AND SOIL CONTAMINATION

Change in topography at the site will result in soil erosion and contamination at the proposed site. Soil erosion may affect stability, increase flooding risk because of more rapid and higher levels of runoff caused by natural events such as precipitation, snow melt and bursting of ice or debris dams in the upper reaches of the Indus and its tributaries and reduce land scrape values.

Contamination of soil by oil and grease released from operation of vehicular traffic appears a minor aspect in view of the small number of incoming and outgoing vehicles. No significant impact is predicted during the operation stage.

MITIGATION MEASURES

- Erosion Mitigation will be part of the design by appropriate leveling, retraining the crisscrossing dry streams and small tributaries besides embankment reinforcement and provision of vegetation cover.
- Impacts caused by soil erosion and contamination will be minimized by limiting, as much as possible, the land around the site is mostly comprises of fertile land.
- Proper and complete stone pitching is performed on KHPP side areas and as well as on discharge/tailrace channel side corners to overcome the land erosion.
- Soil contamination by fuel and chemical storages will be minimized by siting these facilities on an impervious base, within an area surrounded by bunds, secured by fencing. The base and walls of the embankment will be impermeable.
- Spoils and surplus materials will be transported using enclosed containers or covered trucks and will be dumped in designated areas. Contractors will prepare a spoils disposal plan prior to commencement of site works.

2.2.3.DISPOSAL OF MATERIAL EXCAVATED FROM LAND

The topsoil will be removed. This will be followed by the building the required access roads in the area. The earthworks carried out on land areas will include mechanical excavation work for the purpose to constructing the water intake structure , spillway structure, tailrace/discharge structure, turbine doom structure and the power plant building pit, as well as the filling and leveling of the plant area and the supporting areas.

MITIGATION MEASURES

- Keep exposed surface areas to a minimum and vegetate exposed areas as soon as practical.
- Use water as a dust suppressant to keep vegetated surfaces and roads damp.
- Use the excavated material soil & sand in the various filling and leveling operations performed in the surrounding areas.

2.2.4.SEISMIC ACTIVITY

The earthquakes in Chashma Region are of quite low magnitude, and some were only reported by the micro seismic monitoring network recently. The largest earthquake reported in the vicinity is a 5.5 magnitude earthquake, of which the epicenter is about 75 km northwest of the area, it is also called the Bhakkar Earthquake occurred on May 1, 1982.

Regional seism tectonic model for Chashma in a radial extend of 300 km has been developed on the basis of geological, geophysical and seismological database that comprises 48 fault sources that were identified by current tectonic conditions and 23 zones of diffused seismicity which were defined as a zone with homogenous seismic and tectonic features. Based on the seismic and tectonic data, seismic hazard was calculated as 0.26 g for a return period of 10,000 years.

There is no Holocene volcanic activity that may affect stability of the site in the site area, or recoverable mineral reserve in the site area and its vicinity, or human history activity, underground works, goaf and cavern that may affect stability of the foundation; there is also no underground cavern, debris flow or other adverse geologic action that may cause such permanent deformation as surface collapse, settlement, upheaval and cracking, and the site is of flat terrain, without potential sliding slope.

MITIGATION MEASURES

All safety related structures would be designed for a safe shut down earthquake of 0.30 g; the value higher than site seismic hazard of 0.26g, while all non-safety buildings would be designed according to Chinese Code corresponding to Building Code of Pakistan Zone 2B.

2.2.5.DISCHARGE OF KHPP WATER DURING NORMAL OPERATION

KHPP water discharged to Indus River after producing energy. KHPP uses water source of C3&C4 canal. C3&C4 use CJ Link Canal water for their systems cooling, during emergency conditions, the heat is transferred through evaporation of water in the cooling tower. The temperature of cooling water in the discharge stream will slightly drop while passing through 6 km long open channel and crossing to KHPP before meeting the River Indus

PHYSICAL EFFECTS

The temperature of the cooling water from the CJ Link Canal varies between 10°C and 32°C depending on the prevailing time and season. The methods of the heat transfer are closed circuit cooling tower heat exchanger, generator coolers, component cooling water heat exchanger, essential chiller, emergency diesel generator and emergency compressor, which raise the temperature of coolant approximately by 7°C. The warm water will be transported to the river via around 6 km long open channel, which will slightly reduce the water temperature. Again this water source rolls the KHPP Turbine by crossing from Penstock structure, and then drains into KHPP discharge channel, further this channel water mix to Indus River. The extent of mixing zone depends on the flow of the Main River and warm water. In summers, when the river flow is very large, the size of mixing zone will be small, where as in winter season when the river flow is relatively low the size of mixing zone will be few hundred meters. The river Indus maintains its temperature downstream of mixing zones, due to relatively large flows in the river. The difference of the warm water joining the main stream of the river Indus after passing through the widened creek remains within Punjab-EPA regulation regarding temperature changes at the edge of resultant mixing zones during different meteorological conditions.

BIOLOGICAL EFFECTS

The released heat may have some effects on the aquatic life in the river Indus. Comparing the volumes of discharged water and river water, the overall effects on the aquatic organisms are not expected to be significant.

The released heat may have some effects on the marine life in the river Indus because of change in fish movement. The fish in the river will swim away from the warm water. Impact on fish population from the mixing zone is negligible as compared to the total fish population in the river.

2.2.6. TRANSPORTATION OF HEAVY EQUIPMENT TO SITE

PAEC has a good experience of handling and transporting of NPP equipment/ materials from Karachi Port to inland destinations including four units of CHASNUPP (C-1 to C-4). Kundian Power Plant will follow the PAEC guideline to mitigate the environmental effects.

MITIGATION MEASURES

- Movement of material and equipment will follow current traffic rules:
- Equipment/material will be properly tied with the vehicle to avoid falling during transportation.
- Fluorescent paint/red cloth will be used on critical places on the transportation material for making it visible to passer-by.
- Transportation will be scheduled considering peak traffic times to mitigate impacts on the local traffic flow.
- Transportation of material will be performed during night or at times when traffic on the roads is thin.

2.3. SCREENING OF POTENTIAL ENVIRONMENTAL IMPACT OF PROJECT ACTIVITIES ON BIOLOGICAL ENVIRONMENT

This section summarizes the impact of construction and operations of the proposed KHPP Site on ecological environment of the project area. Biological environment include **FLORA** and **FAUNA**.

2.3.1. FLORA

Most of the listed FLORA at and around the site area will be removed during the construction work. It results in habitat loss for various birds and small animals in the area. However, such habitat losses are temporary, as animals and birds have greater tendency to adopt new habitats.

MITIGATION MEASURES

- The vegetation will be removed only from areas where needed without disturbing the area.
- Project will ensure tree plantation in the area choosing those species, which have greater potential to grow in the project area.

2.3.2. FAUNA

Removal of shrubs and grasses will affect the temporary habitat of certain reptiles. Lizards will occupy the modified habitat of the project site. New landscape and construction will reduce the population of snakes. There will be negative impact to birds development in the area.

Due to construction activities at site the movement of these animals may be restricted and they will migrate to the surrounding area due to the disturbance created by construction activities.

MITIGATION MEASURES

- Limited disturbance to ecosystem shall be ensured.
- New landscaping of the area will provide many trees and shrubs.
- Animals will adapt to new environment.

3. ENVIRONMENTAL MANAGEMENT PLAN

3.1. INTRODUCTION

This section presents the Environmental Management Plan (EMP) developed for the proposed KHPP The EMP satisfies the requirements of the "Guidelines for Preparation and Review of Environmental Reports" issued by Punjab EPD. Overall responsibility of implementation of this EMP and fulfillment of requirements regarding environmental protection, and public safety shall rest with the management of KHPP.

3.2. OBJECTIVES & SCOPE OF EMP

The objective of the Environmental Management Plan (EMP) is to provide a framework for management and monitoring of the environmental impacts that may arise as the proposed project proceeds. The adequate monitoring of such impacts will ensure that the mitigations measures are carried out accordingly.

3.3. COMPONENTS OF EMP

The EMP consists of the following components:

- Institutional Framework for Environmental Management
- Environmental Management Program

3.3.1.INSTITUTIONAL FRAMEWORK FOR ENVIRONMENTAL MANAGEMEN

Key player in environmental management of the KHPP is PAEC. With respect to management of environmental aspects KHPP follows the guidelines of PAEC. Some key responsibilities/improved monitoring and management practices of KHPP include:

- Maintenance of healthy environment for inhabitants throughout the plant life.
- Monitoring progress of the Project as per planned schedule of activities.
- Monitoring the implementation of environmental mitigation measures by the project staff and contractors (if any).
- Preparation of training materials and maintenance of record.
- Maintaining interfaces with the other departments/stakeholders.
- Developing operational control procedures and manuals, for operation and maintenance of related equipment and activities.
- Maintain and ensure equipment maintenance and calibration periodically.

3.3.2.ENVIRONMENTAL MANAGEMENT PROGRAM

KEY ENVIRONMENTAL AND SOCIAL ASPECTS OF KHPP

The project site is located on the left bank of river Indus in Tehsil Piplan. Installation of the proposed project would require the project proponent to undertake management of following environmental and social issues during the development, construction and operation phases of the project.

- Change in landscape.
- Change in landform, topography and geomorphology.
- Transportation activities; equipment mobilization, transport and storage of construction material.
- Construction waste generation and disposal.
- Emissions during transportation.
- Social impact.

3.4. OPERATION PHASE MONITORING

An operation monitoring program will be followed to monitor sections of the plant processes.

3.4.1.THERMAL IMPACT OF KHPP WATER ON INDUS RIVER

The cooling water travels from condensers of the C3&C4 reactors to KHPP then discharge to KHPP discharge water channel and further mix to river Indus. Studies show that at the confluence point on river Indus, a mixing zone is formed. The extent of the mixing zone depends upon the flow of river and warm water. In summers, when the river flow is very large, the size of mixing zone will be small, where as in winter season when the river flow is relatively low the size of mixing zone will be few hundred meters. The difference of the warm water joining the main stream of the river Indus after passing through the widened creek remains within Punjab-EPA regulations during different meteorological conditions.

3.4.2.SOLID WASTE MONITORING

KHPP has a well prepared plan for solid waste management. Waste consists of plastic & rubber, leaves, wood, bones, animal waste, glass, metal, dust, ashes, stone, bricks.

3.4.3.SANITARY WASTE MONITORING PROGRAMS

The sewage water from the plant will be pumped to sewage treatment plant where the sludge will be removed and the treated water will be mixed with the plant discharge stream to flow to River Indus. The cooling water in the stream will have negligible Biological Oxygen Demand (BOD). The BOD, chemical oxygen demand (COD) and total suspended solids (TSS) values in sanitary waste are anticipated, to be much below the prescribed limits of EPA Punjab.

4. CONCLUSION

On the basis of the overall impact assessment, it is concluded that the proposed KHPP Project is environment friendly and unlikely to cause any significant, lasting impact on the social, physical and biological environment of the area, provided that the proposed activities are carried out in accordance with recommendations of this report, and the mitigation measures are completely and effectively implemented. The proposed KHPP Project is absolutely environmental friendly and is recommended for implementation.